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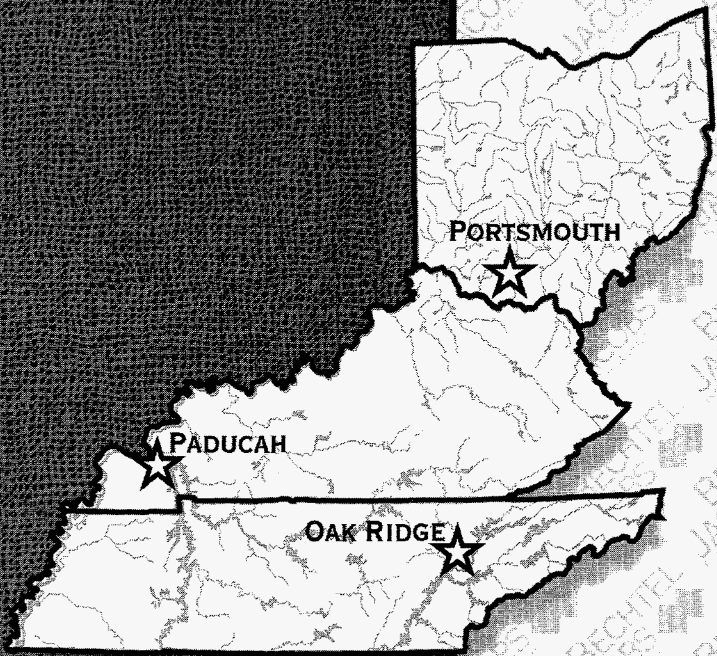
Groundwater Quality Assessment Report for Solid Waste Storage Area 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee

1998



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BECHTEL JACOBS COMPANY LLC
FOR THE UNITED STATES
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Groundwater Quality Assessment Report for Solid Waste Storage Area 6 at Oak Ridge National Laboratory, Oak Ridge, Tennessee

1998

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Prepared by
Lockheed Martin Energy Research
Oak Ridge, Tennessee

Prepared for the
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BECHTEL JACOBS COMPANY LLC
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PREFACE

This document has been prepared as required under Subparts 1200-1-11-.05(5)(f), 1200-1-11-.05(5)(h), and 1200-1-11-.05(6)(e)2 of the "Rules of Tennessee Department of Environmental and Conservation (TDEC) Division of Solid Waste Management Chapter 1200-1-11, Hazardous Waste Management." This work was performed under Work Breakdown Structure 1.4.12.4.1.05.10 (Cost Center Activity Data Sheet 4349). Information provided in this document reflects the results of 1998 sampling of Resource Conservation and Recovery Act monitoring wells at Solid Waste Storage Area 6 at Oak Ridge National Laboratory.

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FIGURES

TABLES

ACRONYMS

bgs	below ground surface
CEI	Compliance Evaluation Investigation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EDT	Explosives Detonation Trench
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
EWB	Emergency Waste Basin
GWQAP	Groundwater Quality Assessment Plan
GWQAR	Groundwater Quality Assessment Report
HDPE	high-density polyethylene
HTF	Hillcut Test Facility
ICM	Interim Corrective Measure
IDL	instrument detection limit
IWQP	Integrated Water Quality Program
LLW	low-level radioactive waste
msl	mean sea level
NPL	National Priority List
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
PCPA	Post-Closure Permit Application
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SWMU	Solid Waste Management Unit
SWSA	Solid Waste Storage Area
TDEC	Tennessee Department of Environment and Conservation
TOC	Total Organic Carbon
TOX	Total Organic Halide
VOC	volatile organic compound
WAG	Waste Area Grouping

1. INTRODUCTION

Solid Waste Storage Area (SWSA) 6, located at the U.S. Department of Energy (DOE) Oak Ridge National Laboratory (ORNL) facility, is a shallow land burial site for low-level radioactive waste (LLW) and other waste types. Wastes were disposed of in unlined trenches and auger holes from 1969 until May 1986, when it was determined that Resource Conservation and Recovery Act (RCRA) regulated wastes were being disposed of there. DOE closed SWSA 6 until changes in operating procedures prevented the disposal of RCRA wastes at SWSA 6. The site, which reopened for waste disposal activities in July 1986, is the only currently operating disposal area for low-level radioactive waste at ORNL.

In addition to SWSA 6, it was determined that hazardous wastes were treated at the Explosives Detonation Trench (EDT). Explosives and shock-sensitive chemicals such as picric acid, phosphorous, and ammonium nitrate were detonated; debris from the explosions was backfilled into the trench.

The Hillcut Test Facility (HTF) is an experimental facility designed to demonstrate a new method of subsurface disposal for solid LLW. In August and September 1986, 27 concrete casks were stacked on a subterranean concrete pad and covered with backfill material. In 1995, an investigation of sources of waste placed in HTF concluded that at least two casks contained lead that was not used as shielding, and that as many as 20 casks could contain RCRA components (lead, solvents, or aerosol cans). A groundwater collection system collects groundwater coming into contact with the casks.

Because of the disposal of RCRA-regulated wastes at SWSA 6 prior to May 1986, treatment of hazardous wastes at the EDT, and now because of the presence of RCRA-regulated waste in the HTF, the facility is considered a RCRA interim status site awaiting final closure. Groundwater quality monitoring at SWSA 6 was initiated in 1988. In 1989, initial data indicated that hazardous waste constituents had entered the groundwater in the eastern portion of the SWSA in the vicinity of Wells 841 and 842. Accordingly, the *Groundwater Quality Assessment Plan* (GWQAP) was developed and submitted to TDEC in December 1989. The first annual Groundwater Quality Assessment Report (GWQAR) was submitted to the Tennessee Department of Environment and Conservation (TDEC) for 1990, *Groundwater Quality Assessment Report for Solid Waste Storage Area at the Oak Ridge National Laboratory* (ORNL 1991). Data from the 1989 monitoring was submitted as part of the *Hazardous Waste Management Annual Report, 1989* (ORNL 1990).

In 1988 and 1989, 8 Interim Corrective Measure (ICM) caps were placed over approximately 10 acres of SWSA 6. The caps were made of 80-mil high density polyethylene (HDPE), and were designed to last for ~ 5 years (BNI 1988).

TDEC never approved the GWQAP, but agreed to proposed monitoring that was recommended in the GWQAR for 1990. The report recommended quarterly sampling of 10 assessment wells at SWSA 6, along with semiannual sampling of 16 perimeter wells. This plan was implemented in 1991 and the results were submitted in the 1991 GWQAR. The 1991 report was never approved by TDEC.

The 1992 monitoring was conducted per recommendations in the 1991 GWQAR and per verbal instruction provided by TDEC during the TDEC Compliance Evaluation Investigation (CEI)

(Burroughs 1992). Based on the CEI, the analytical parameters for the 16 semi-annual monitoring wells were amended to include 10 target SWSA 6 assessment volatile organic compounds (VOCs), rather than Total Organic Halide (TOX) and Total Organic Carbon (TOC). The revisions were initiated in the third quarter of 1992 and continued through 1995.

Since 1992, monitoring has been conducted as part of the CERCLA *Environmental Monitoring Plan For Waste Area Grouping (WAG) 6 (EMP)* (DOE 1995). WAG 6 is composed of the RCRA interim status units plus other radioactive waste disposal units regulated under CERCLA. The EMP was developed to meet the requirements of a letter of agreement signed by the DOE, TDEC, and the U.S. Environmental Protection Agency (EPA) in June 1994. The letter specified that (1) no active source control measures would be implemented at WAG 6 in the near term under CERCLA authority, (2) monitoring would occur to track off-WAG releases, and (3) DOE would develop and demonstrate new environmental restoration technologies that could be used at other sites.

The WAG 6 EMP incorporated compliance monitoring at the RCRA groundwater quality assessment monitoring locations. The CERCLA plan recommended that monitoring be performed in two phases: baseline and routine (DOE 1995). After the baseline monitoring was conducted from October 1994 through September 1995, recommendations were made to reduce the number of RCRA monitoring locations and the frequency of monitoring (DOE 1995). TDEC verbally agreed to the plan, but never formally approved the routine monitoring approach. The routine monitoring approach was implemented beginning in December 1995 and involved monitoring nine downgradient RCRA wells on a semiannual basis, and three upgradient locations on an annual basis. The nine downgradient wells were located based on disposal history and on monitoring results collected since 1989.

Shortly after this, agreements were made to (1) continue RCRA groundwater assessment activities at SWSA 6, deferring closure and post-closure activities until a time when CERCLA remediation activities would be implemented, and (2) discontinue maintenance of the ICM caps.

This report provides the results of the 1998 RCRA groundwater assessment monitoring. The monitoring was performed in accordance with the proposed routine monitoring plan recommended in the 1996 EMP.

Section 2 provides pertinent background on SWSA 6. Section 3 presents the 1998 monitoring results and discusses the results in terms of any significant changes from previous monitoring efforts. Section 4 provides recommendations for changes in monitoring based on the 1998 results. References are provided in Section 5. Appendix A provides the 1998 RCRA Sampling Data and Appendix B provides a summary of 1998 Quality Assurance results.

2. BACKGROUND

2.1 FACILITY DESCRIPTION

WAG 6 is 68-acre LLW disposal facility at the western end of Melton Valley approximately 1.8 miles southwest of the main ORNL plant area (see Figure 2.1). WAG 6 is comprised of five Solid Waste Management Units (SWMUs): SWSA 6, the Emergency Waste Basin (EWB), the Explosives Detonation Trench (EDT), the SWSA 6 Staging Facility (7878), and the SWSA 6 Waste Storage Facility (7842). WAG 6 is bounded by State Highway 95 on the west, White Oak Lake on the south, the West Seep Tributary on the east that separates WAG 6 from WAG 7, and Lagoon Road to the north. Access to the WAG is controlled and monitored and enclosed within an 8-ft chain link security fence topped with barbed wire.

Ground surface elevations within the SWSA range from 745 ft mean sea level (msl) at White Oak Lake along the southern boundary to >850 ft msl along a crest of knobs on the northwest boundary. Maximum topographic relief across the site is 105 ft. Slopes within the SWSA are variable and range from 10 to 57%. The highest topographic relief and steepest slopes occur in the northeastern and eastern site perimeter. The major surface drainages at the WAG are shown on Figure 2.1 and flow from the northern portions of the site to White Oak Lake.

SWSA 6 opened for limited waste disposal operations in 1969 and began full-scale operations in 1973. It has received LLW as well as chemicals, biological wastes, and a variety of other wastes resulting from operations conducted at ORNL (e.g., solvents, scintillation liquids, laboratory glassware and equipment, and protective clothing). The EDT lies within the southern portion of the site (Figure 2.1), where explosives and shock-sensitive chemicals such as picric acid, phosphorous, and ammonium nitrate were detonated with small plastic charges. Debris from the explosives was left in the EDT, which was subsequently backfilled and is no longer in use. The EWB, located in the northeastern corner of the site, received groundwater seepage from several LLW units within the WAG.

Several types of waste disposal techniques were used in SWSA 6, including trenches, auger holes, silos, and above-ground container disposal units. Waste packing varied from complete lack of containerization to plastic bags to stainless steel drums.

Wastes buried before May 1986 were placed in unlined and large-diameter auger holes and concrete-lined disposal casks, quadrex boxes, and greater confinement disposal silos and auger holes. The trenches were generally 50 ft long, 10 ft wide, and 14-18 ft deep, depending on depth to the water table. When the disposal trenches were filled to within 2 ft of ground surface, the trench was backfilled with soils, compacted with heavy equipment, and seeded to retard erosion. LLW was also disposed of in auger holes that were typically 1 to 4 ft in diameter (and were as much as 9 ft in diameter), 18 ft deep, and spaced a minimum of 3 ft apart. Wastes were disposed of in various sized containers up to 55-gallon drums. Following waste disposal, the auger holes were sealed with a concrete plug overlain by 1 to 2 ft of soil cover. Waste inventory records indicate that >85% of the total SWSA 6 chemical and radionuclide activity was disposed of in the 2-acre high activity solvent auger holes in the northeastern portion of the site.

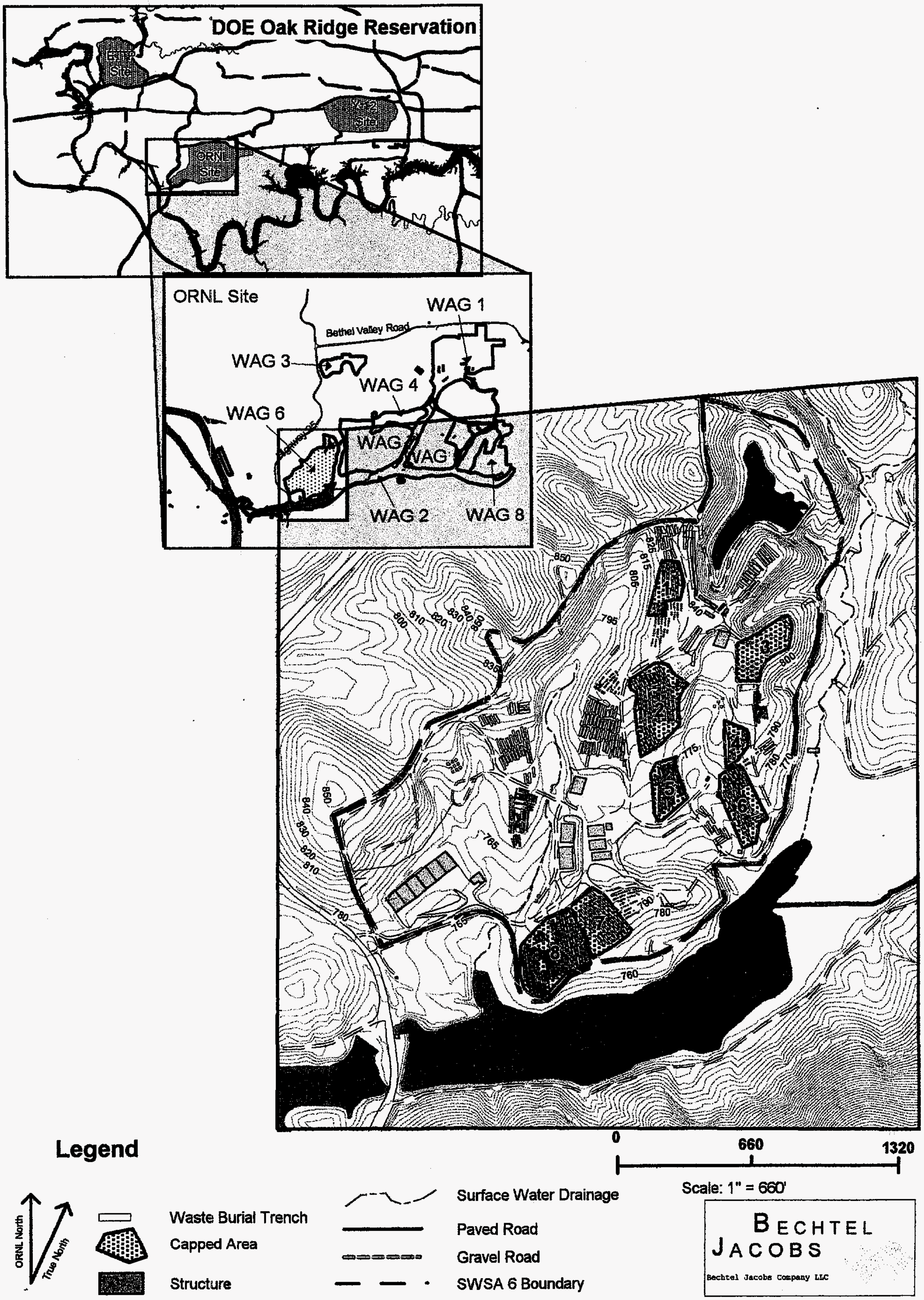

Fig. 2.1. SWSA 6 Site Location

In May 1986, it was determined that about 25% of the landfilled area had received RCRA-regulated wastes. The disposal operations were halted by DOE and later reopened with revised operating procedures and allowed only LLW waste disposal

Greater confinement auger holes and silos were used after May 1986. The silos were concrete lined, 10 ft in diameter and 14 to 20 ft deep. Auger holes were typically 20 ft deep, 20 to 25 inch diameter heavy wall (3-4 inch thick) iron pipe casings and 2-ft concrete seals at the base.

In 1988 and 1989, 8 ICM caps were placed over ~ 10 acres of SWSA 6 (Figure 2.1). The caps were made of 80-ml HDPE and were designed to last for ~ 5 years (BNI 1988).

The HTF is located ~800 ft northwest of White Oak Lake within SWSA 6. In August and September 1986, 27 concrete casks (dimensions 3.5 × 4.5 × 4.5 ft) were stacked on a subterranean concrete pad in a 3 × 3 × 3 arrangement and covered with a multilayer cap. A groundwater collection system was designed to collect groundwater that could come into contact with the casks.

2.2 REGULATORY FRAMEWORK

2.2.1 Regulatory Status

SWSA 6 has been operated under the authority of the Atomic Energy Act of 1954, as amended, and administered under the guidance of the DOE for the purpose of managing LLW. In May 1986, DOE temporarily discontinued disposal of waste at SWSA 6 to address RCRA issues at the site. Although it was found that RCRA-regulated waste had been stored at the SWSA, new disposal procedures were developed to prevent further disposal of RCRA wastes.

SWSA 6 units that received RCRA-regulated wastes after November 8, 1980 are classified as RCRA-regulated units. A RCRA closure plan was submitted to TDEC in August 1988 and approved that September. The plan required that SWSA 6 stop receiving RCRA wastes and the ICM caps be built, and described a series of activities, including a RCRA Facility Investigation (RFI), leading to final closure.

The ICM caps were placed on the RCRA-regulated units and run-on/run-off controls were installed to minimize direct infiltration of precipitation into the RCRA-regulated disposal sites. This interim action allowed time to develop a total comprehensive plan for final RCRA closure.

In December 1989 the Oak Ridge Reservation (ORR), including ORNL, was placed on the National Priority List (NPL) to be remediated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Inclusion into CERCLA meant that final closure also had to comply with CERCLA.

DOE entered into a Federal Facility Agreement with EPA and TDEC, effective January 1, 1992. As a result of this agreement, WAG 6 is regulated under CERCLA. SWSA 6 is also regulated under RCRA as an interim status site.

The RFI/Remedial Investigation (RI) for WAG 6 was completed in 1992. Based on the findings of this and related CERCLA characterization efforts at ORNL, it was determined that the preferred alternative for WAG 6 was to defer action on the site, allowing remediation resources to be applied to other sites at ORNL with more immediate release concerns. As a result of this decision, final RCRA closure has not been completed. The current plan is to complete closure in conjunction with CERCLA actions associated with the remediation of Melton Valley. A revision of the 1988 RCRA Closure Plan was submitted to TDEC in July 1995, which outlined the deferred action approach. The 1995 Closure Plan deferred the groundwater assessment approach to the EMP.

A Post-Closure Permit Application (PCPA) was to have been submitted to TDEC in October 1995, stating that the preferred alternative was deferred action and that monitoring would continue as outlined in the EMP. However, on August 31, 1995, TDEC requested that DOE not submit the PCPA pending the resolution of the impact of draft EPA regulation dealing with issuance of PCPAs at federal facility NPL sites (Burroughs 1992).

2.2.2 RCRA/CERCLA Integration

The TDEC, DOE and EPA agreed that RCRA authority at SWSA 6, EDT, and HTF would be accomplished through future remedial actions under CERCLA. Comprehensive baseline monitoring under the EMP was conducted from October 1994 through September 1995. Twenty-four RCRA wells were monitored, including the 8 wells sampled quarterly and 16 wells sampled semi-annually (Figure 2.2). Results of that sampling were reported in DOE 1995 and both the 1995 and 1996 GWQARs.

Based on the results of the baseline monitoring, a routine monitoring program was proposed (DOE 1995). The RCRA assessment monitoring portion of the EMP routine monitoring covers nine downgradient and three upgradient wells. The routine monitoring was initiated in May 1996.

2.3 HYDROGEOLOGIC FRAMEWORK

A complete summary of the hydrogeologic conditions at SWSA 6 has been presented in several reports (ORNL 1993, BNI 1991; DOE 1995).

2.4 1998 ASSESSMENT MONITORING PROGRAM

2.4.1 Monitoring Network

During 1998, 12 groundwater wells were monitored at SWSA 6. The wells are described in Table 2.1 and shown in Figure 2.2. Three of the wells are upgradient wells: 0858, 0857, and 0846. The remaining nine are located downgradient/along strike of the RCRA-regulated units, as indicated in the table. The wells were sampled in both June and December. Table 2.2 summarizes the key well construction information for the wells. Detailed well construction diagrams and drilling logs for the original 24 RCRA wells are contained in *Monitor Well Data Packages for SWSA 6*, ORNL/RAP-44 (Mortimore and Ebers 1988). Three sets of wells pairs are part of the routine monitoring program: 843/844, 841/842, and 857/858 (upgradient wells). These wells help define the vertical extent of contamination at SWSA 6.

Fig. 2.2. SWSA 6 RCRA sampling locations

Table 2.1. RCRA monitoring well network

Well ID	Rationale
	Downgradient wells
0835	Provides coverage downgradient of RCRA ICM Cap 8
0837	Downgradient of RCRA ICM Cap 7; provides coverage
0841	Historical VOC detections; provides coverage downgradient of RCRA ICM Cap 3/Solvent Auger Holes and along eastern WAG perimeter; deep well of downgradient shallow/deep well pair
0842	Historical VOC detections; provides coverage downgradient of RCRA ICM Cap 3/Solvent Auger Holes and along eastern WAG perimeter; shallow well of downgradient shallow/deep well pair
0843	Historical VOC detections; provides coverage along eastern WAG perimeter; shallow well of downgradient shallow/deep well pair
0844	Historical VOC detections; provides coverage along eastern WAG perimeter; deep well of downgradient shallow/deep well pair
4315	Potentially downgradient, along strike of RCRA ICM Cap 7; recent lead detections; provides coverage of southern WAG perimeter
4316	Downgradient of RCRA ICM Cap 6; potentially downgradient of Cap 4; provides coverage of southern WAG perimeter
4317	Downgradient of RCRA ICM Cap 4
	Upgradient wells
0846	RCRA reference well; most upgradient well at WAG; historically clean of VOCs and radionuclides
0857	RCRA reference wells; help provide full coverage of upgradient perimeter; historically clean; shallow well of upgradient shallow/deep pair
0858	RCRA reference wells deep well of upgradient shallow/deep pair; help provide full coverage of upgradient perimeter and deep zone; historically clean; deep well of upgradient shallow/deep pair

Table 2.2. SWSA 6 well construction information

Well #	ORNL Grid Location		Ground elev.	Total depth	Screen Interval				Interval zone
					Depth		Elevation		
	North	East			T/SCR	B/SCR	T/SCR	B/SCR	
0835	15767.7	23951.8	759.9	27.5	5.5	26.9	754.4	733.0	Regolith
0837	15845.6	24352.6	771.1	31.6	10.0	31.3	761.1	739.8	Regolith
0841	17206.3	25294.8	766.0	56.5	34.0	56.3	732.0	709.7	Shallow bedrock
0842	17216.1	25298.4	767.3	26.8	8.0	23.2	759.3	744.1	Shallow bedrock
0843	17597.1	25221.4	781.0	21.0	3.6	19.3	777.8	762.1	Regolith bedrock
0844	17602.5	25228.6	781.0	52.0	24.6	51.7	756.4	729.3	Shallow bedrock
0846	18030.7	24803.5	861.0	81.0	55.0	81.0	806.0	780.0	Shallow bedrock
0847	17769.9	24790.5	839.6	67.0	45.4	65.8	794.2	773.8	Shallow bedrock
0857	16538.0	23106.3	847.2	70.0	44.7	69.6	802.5	777.6	Shallow bedrock
0858	16542.1	23115.8	847.2	106.4	83.5	106.1	763.7	741.1	Bedrock
4315	15940.8	24690.3	765.0	36.5	19.5	36.3	745.5	728.7	Shallow bedrock
4316	16375.0	25110.0	764.5	27.1	10.0	26.8	754.5	737.7	Regolith bedrock
4317	16720.3	25229.8	767.7	24.8	12.9	24.7	754.8	743.0	Regolith bedrock

T/SCR and B/SCR - Top and Bottom of Screened Section

Under the routine monitoring program, the RCRA wells are sampled less frequently than they were prior to 1995. In 1998, the downgradient RCRA wells were sampled semi-annually, in June and December. The semiannual approach was determined to be the most cost-effective approach of tracking changes in releases at the wells. It also ensured that contaminant concentrations were evaluated for both the wet and dry season.

2.4.2 Sampling and Analysis

During 1998, all 12 RCRA wells were monitored for SW-8240 VOCs, field parameters, radiological parameters, and water levels. Radiological parameters are CERCLA parameters and are reported by the ORR Integrated Water Quality Program (IWQP) and are not discussed as part of the RCRA reporting. The analytical detection limit requirements are presented in the EMP.

Beginning in 1991, a "target compound list" of VOCs was developed for SWSA 6 based on historical sampling results. This list is provided in Table 2.3 along with regulatory levels and detection levels for each chemical. An additional analyte was added to the list as part of developing the EMP. Lead is a target analyte for two monitoring locations, Well 4315 and the HTF. Lead is known to have been stored in the HTF. Historical results from Well 4315 indicate the presence of low levels of lead (~10 to 30 μg/L), and thus lead will continue to be analyzed for in this well. The regulatory level for lead is 15 μg/L.

The groundwater sampling was conducted by the ORR IWQP as part of the reservation-wide monitoring activities. The IWQP was developed to integrate CERCLA and RCRA monitoring efforts across the reservation and across the various monitoring programs within the reservation, to the extent possible. The following standard procedures were followed:

SOP-ESP-302-2	Guideline for Well Purging
SOP-ESP-302-1	Measurement Using a Water Level Indicator
SOP-ESP-302-1	Using a Bladder Pump
SOP-ESP-801	Cleaning and Decontaminating Sample Containers and Sampling Devices
SOP-ESP-307-x	Field Measurement Procedures - (1) Temperature, (2) pH, and (8) Specific Conductance
SOP-ESP-003.012	Use of the Horiba U-10 Water Quality Checker

2.4.3 Quality Assurance/Quality Control

Standard field and laboratory quality control procedures were followed to ensure the analytical quality of the sampling results. Data were validated following the same procedures as used for other IWQP monitoring locations; this level of validation follows CERCLA guidelines and is more extensive than what is routinely required for RCRA monitoring. The procedure called for collecting field blanks, field duplicates, and standard laboratory quality control (QC) procedures, including lab blanks and matrix spikes/matrix spike duplicates.

Table 2.3. SWSA 6 Target compound list, regulatory limits, and detection limits

Target compound	Regulatory limit (μg/L)	Detection limit (μg/L)
1,1-Dichloroethane	-	5
1,2-Dichloroethane	5[a]	5
cis-1,2-Dichloroethene	70[a]	5
trans-1,2-Dichloroethene	100[a]	5
Carbon disulfide	-	5
Carbon tetrachloride	5[a]	5
Chloroform	100[a]	5
Chloromethane	3[b]	5
Tetrachloroethene	5[a]	5
Trichloroethene	5[a]	5
Total xylenes	10,000[a]	5
Lead	15[c]/50[d]	5

[a]40 *CFR* Part 141 - National Primary Drinking Water Regulations, TDEC 1200-5-1
[b]Drinking Water Health Advisory, EPA Office of Water, EPA 822-R-96-001, Feb. 1996.
[c]Technology action level for lead, defined by 40 CFR Part 141.
[d]40CFR264.94 Table 1, Maximum Concentrationof Constituents for Groundwater Protection.

3. GROUNDWATER QUALITY

This chapter presents the 1998 RCRA groundwater assessment monitoring results for SWSA 6, identifies any changes in the nature and extent of VOC contamination, and provides a calculation of the rate of groundwater movement at the WAG. A complete compilation of the 1998 RCRA monitoring results for the 12 RCRA wells is provided in Appendix A of this report.

3.1 GROUNDWATER DATA ASSESSMENT

3.1.1 Data Quality Assessment

This section provides a summary of the 1998 RCRA well sampling results. The 1998 data were collected and analyzed as described in Section 2.4. Trip blanks and field duplicates were collected in the field and matrix spike and matrix spike duplicates were run in the laboratory, as per the QC procedures developed for the IWQP.

A Data Quality Assessment Summary packages is provided in Appendix B. No data quality issues were identified for VOCs. Only three of the wells had VOC detections above detection limits, with the exception of one unqualified detection of acetone (33 μg/L at well 0835 in June) and several low concentration (<5 μg/L) estimated results for 1,1,2-Trichloro-1,2,2-trifluoroethene.

3.1.2 1998 Assessment Results

This section provides summaries of the 1998 results. Summaries of the 1998 results of field parameters are provided in Table 3.1 and analytical results for the SWSA 6 target compounds are included in Tables 3.2 through 3.13.

Outside of a few of the 11 target analytes, no additional VOCs were detected in any of the RCRA wells during either sampling event in 1998. Tables 3.14 and 3.15 provide a summary of positive detections in wells for June and December, respectively, and indicate which detections are greater than the respective regulatory limits.

3.2 NATURE AND EXTENT OF CONTAMINATION

3.2.1 Lateral Extent of Contamination

The 1998 data indicate that the greatest RCRA issue is still associated with releases along the eastern boundary of the site, downgradient of the Solvent Auger Hole area on the adjacent hilltop. These releases are measured in Wells 0841 and 0842, as well as a few detections in Well 0843 located in the opposite downgradient direction of the auger holes. In 1990, the WAG 6 RFI installed four wells in the area of 0842 to determine the extent of the VOC plume in the area (BNI 1991). Wells were located along strike (Well 1244), downgradient (Well 1245), and to the north (Well 1242) and south (Well 1243). All of these wells were placed within 150 ft of each other. VOCs were not detected in the wells (BNI 1991), indicating that groundwater contaminant migration occurs along discreet fractures at SWSA 6 and cannot really be defined as plumes.

Table 3.1. RCRA well field parameters

Well	Measurement date	Conductivity (ms/cm)	Depth to water (ft)	pH (std unit)	Temperature (deg C)
0835	3-Jun-98	0.165	15.61	5.66	17.3
0835	7-Dec-98	0.201	16.80	6.05	17.8
0837	3-Jun-98	0.035	26.53	5.05	17.5
0837	7-Dec-98	0.034	28.50	5.2	16.9
0841	9-Jun-98	0.575	11.82	7.36	15.0
0841	9-Dec-98	0.527	12.49	7.64	13.9
0842	10-Jun-98	0.674	9.23	7.04	14.8
0842	12-Dec-98	0.654	10.96	7.24	15.2
0843	10-Jun-98	0.931	3.66	6.78	14.3
0843	10-Dec-98	0.654	7.54	6.99	13.8
0844	15-Jun-98	0.876	12.01	6.98	15.8
0844	16-Dec-98	0.757	13.48	7.49	13.8
0846	2-Jun-98	0.942	44.85	6.9	16.3
0846	2-Dec-98	0.805	53.1	7.52	15.2
0857	8-Jun-98	0.021	49.76	5.08	15.0
0857	15-Dec-98	0.024	59.59	5.44	13.2
0858	8-Jun-98	0.237	52.33	8.16	16.4
0858	15-Dec-98	0.186	60.05	8.79	13.5
4315	12-Jun-98	0.194	21.72	6.15	15.7
4315	7-Dec-98	0.146	22.92	6.63	16.6
4316	12-Jun-98	0.788	20.6	6.93	18.0
4316	3-Dec-98	0.653	20.52	6.92	17.9
4317	11-Jun-98	0.388	15.53	6.23	18.0
4317	3-Dec-98	0.373	18.5	6.57	17.0

Table 3.2. Target compound monitoring results Well 0835 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01766	1-Jun-98	1,1-Dichloroethane	5	U
W02787	7-Dec-98	1,1-Dichloroethane	1	U
W01766	1-Jun-98	1,2-Dichloroethane	5	U
W02787	7-Dec-98	1,2-Dichloroethane	1	U
W01766	1-Jun-98	1,2-Dichloroethene (total)[b]	5	U
W02787	7-Dec-98	cis-1,2-Dichloroethene	1	U
W02787	7-Dec-98	trans-1,2-Dichloroethene	1	U
W01766	1-Jun-98	Carbon disulfide	5	U
W02787	7-Dec-98	Carbon disulfide	1	U
W01766	1-Jun-98	Carbon tetrachloride	5	U
W02787	7-Dec-98	Carbon tetrachloride	1	U
W01766	1-Jun-98	Chloroform	5	U
W02787	7-Dec-98	Chloroform	1	U
W01766	1-Jun-98	Chloromethane	10	U
W02787	7-Dec-98	Chloromethane	1	U
W01766	1-Jun-98	m,p-Xylene	5	U
W02787	7-Dec-98	m,p-Xylene	1	U
W01766	1-Jun-98	Tetrachloroethene	5	U
W02787	7-Dec-98	Tetrachloroethene	1	U
W01766	1-Jun-98	Trichloroethene	5	U
W02787	7-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.3. Target compound monitoring results Well 0837 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01776	3-Jun-98	1,1-Dichloroethane	5	U
W02792	7-Dec-98	1,1-Dichloroethane	1	U
W01776	3-Jun-98	1,2-Dichloroethane	5	U
W02792	7-Dec-98	1,2-Dichloroethane	1	U
W01776	3-Jun-98	1,2-Dichloroethene (total)[b]	5	U
W02792	7-Dec-98	cis-1,2-Dichloroethene	1	U
W02792	7-Dec-98	trans-1,2-Dichloroethene	1	U
W01776	3-Jun-98	Carbon disulfide	5	U
W02792	7-Dec-98	Carbon disulfide	1	U
W01776	3-Jun-98	Carbon tetrachloride	5	U
W02792	7-Dec-98	Carbon tetrachloride	1	U
W01776	3-Jun-98	Chloroform	5	U
W02792	7-Dec-98	Chloroform	1	U
W01776	3-Jun-98	Chloromethane	10	U
W02792	7-Dec-98	Chloromethane	1	U
W01776	3-Jun-98	m,p-Xylene	5	U
W02792	7-Dec-98	m,p-Xylene	1	U
W01776	3-Jun-98	Tetrachloroethene	5	U
W02792	7-Dec-98	Tetrachloroethene	1	U
W01776	3-Jun-98	Trichloroethene	5	U
W02792	7-Dec-98	Trichloroethene	1	U

[a]"=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.4. Target compound monitoring results Well 0841 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01872	6-Jun-98	1,1-Dichloroethene	5	UJ
W02808	9-Dec-98	1,1-Dichloroethene	1	U
W01872	6-Jun-98	1,1-Dichloroethane	5	UJ
W02808	9-Dec-98	1,1-Dichloroethane	1	U
W01872	6-Jun-98	1,2-Dichloroethene (total)[b]	5	UJ
W02808	9-Dec-98	cis-1,2-Dichloroethene	1	U
W02808	9-Dec-98	trans-1,2-Dichloroethene	1	U
W01872	6-Jun-98	Carbon disulfide	5	UJ
W02808	9-Dec-98	Carbon disulfide	1	U
W01872	6-Jun-98	Carbon tetrachloride	5	UJ
W02808	9-Dec-98	Carbon tetrachloride	1	U
W01872	6-Jun-98	Chloroform	5	UJ
W02808	9-Dec-98	Chloroform	1	U
W01872	6-Jun-98	Chloromethane	10	UJ
W02808	9-Dec-98	Chloromethane	1	B
W01872	6-Jun-98	m,p-Xylene	5	UJ
W02808	9-Dec-98	m,p-Xylene	1	U
W01872	6-Jun-98	Tetrachloroethene	5	UJ
W02808	9-Dec-98	Tetrachloroethene	1	U
W01872	6-Jun-98	Trichloroethene	7	J
W02808	9-Dec-98	Trichloroethene	7	=

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.5. Target compound monitoring results Well 0842 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01707	10-Jun-98	1,1-Dichloroethane	5	U
W02813	10-Dec-98	1,1-Dichloroethane	3	=
W01707	10-Jun-98	1,2-Dichloroethane	7	=
W02813	10-Dec-98	1,2-Dichloroethane	12	=
W01707	10-Jun-98	1,2-Dichloroethene (total)[b]	7	=
W02813	10-Dec-98	cis-1,2-Dichloroethene	15	=
W02813	10-Dec-98	trans-1,2-Dichloroethene	0.8	J
W01707	10-Jun-98	Carbon disulfide	5	U
W02813	10-Dec-98	Carbon disulfide	1	U
W01707	10-Jun-98	Carbon tetrachloride	28	J
W02813	10-Dec-98	Carbon tetrachloride	41	=
W01707	10-Jun-98	Chloroform	29	=
W02813	10-Dec-98	Chloroform	40	=
W01707	10-Jun-98	Chloromethane	10	U
W02813	10-Dec-98	Chloromethane	1	U
W01707	10-Jun-98	m,p-Xylene	5	U
W02813	10-Dec-98	m,p-Xylene	1	U
W01707	10-Jun-98	Tetrachloroethene	5	U
W02813	10-Dec-98	Tetrachloroethene	1.1	=
W01707	10-Jun-98	Trichloroethene	110	=
W02813	10-Dec-98	Trichloroethene	180	D

[a] "=" = detected at reported value; U - not detected; J = estimated value; D=compound identified in an analysis of at a secondary dilution factor

[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.6. Target compound monitoring results Well 0843 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01715	10-Jun-98	1,1-Dichloroethane	5	U
W02818	10-Dec-98	1,1-Dichloroethane	1	U
W01715	10-Jun-98	1,2-Dichloroethane	5	U
W02818	10-Dec-98	1,2-Dichloroethane	1	U
W01715	10-Jun-98	1,2-Dichloroethene (total)[b]	5	U
W02818	10-Dec-98	cis-1,2-Dichloroethene	6	=
W02818	10-Dec-98	trans-1,2-Dichloroethene	1	U
W01715	10-Jun-98	Carbon disulfide	5	U
W02818	10-Dec-98	Carbon disulfide	1	U
W01715	10-Jun-98	Carbon tetrachloride	5	U
W02818	10-Dec-98	Carbon tetrachloride	1	U
W01715	10-Jun-98	Chloroform	5	U
W02818	10-Dec-98	Chloroform	0.7	J
W01715	10-Jun-98	Chloromethane	10	U
W02818	10-Dec-98	Chloromethane	1	U
W01715	10-Jun-98	m,p-Xylene	5	U
W02818	10-Dec-98	m,p-Xylene	1	U
W01715	10-Jun-98	Tetrachloroethene	5	U
W02818	10-Dec-98	Tetrachloroethene	1	U
W01715	10-Jun-98	Trichloroethene	1	J
W02818	10-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.7. Target compound monitoring results Well 0844 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01727	15-Jun-98	1,1-Dichloroethane	5	U
W02832	16-Dec-98	1,1-Dichloroethane	1	U
W01727	15-Jun-98	1,2-Dichloroethane	5	U
W02832	16-Dec-98	1,2-Dichloroethane	1	U
W01727	15-Jun-98	1,2-Dichloroethane (total)[b]	5	U
W02832	16-Dec-98	cis-1,2-Dichloroethane	1	U
W02832	16-Dec-98	trans-1,2-Dichloroethane	1	U
W01727	15-Jun-98	Carbon disulfide	5	U
W02832	16-Dec-98	Carbon disulfide	1	U
W01727	15-Jun-98	Carbon tetrachloride	5	U
W02832	16-Dec-98	Carbon tetrachloride	1	U
W01727	15-Jun-98	Chloroform	5	U
W02832	16-Dec-98	Chloroform	1	U
W01727	15-Jun-98	Chloromethane	10	U
W02832	16-Dec-98	Chloromethane	1	U
W01727	15-Jun-98	m,p-Xylene	5	U
W02832	16-Dec-98	m,p-Xylene	1	U
W01727	15-Jun-98	Tetrachloroethene	5	U
W02832	16-Dec-98	Tetrachloroethene	1	U
W01727	15-Jun-98	Trichloroethene	5	U
W02832	16-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.8. Target compound monitoring results Well 0846 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01732	2-Jun-98	1,1-Dichloroethane	5	U
W02840	2-Dec-98	1,1-Dichloroethane	1	U
W01732	2-Jun-98	1,2-Dichloroethane	5	U
W02840	2-Dec-98	1,2-Dichloroethane	1	U
W01732	2-Jun-98	1,2-Dichloroethene (total)[b]	5	U
W02840	2-Dec-98	cis-1,2-Dichloroethene	1	U
W02840	2-Dec-98	trans-1,2-Dichloroethene	1	U
W01732	2-Jun-98	Carbon disulfide	5	U
W02840	2-Dec-98	Carbon disulfide	1	U
W01732	2-Jun-98	Carbon tetrachloride	5	U
W02840	2-Dec-98	Carbon tetrachloride	1	U
W01732	2-Jun-98	Chloroform	5	U
W02840	2-Dec-98	Chloroform	1	U
W01732	2-Jun-98	Chloromethane	10	U
W02840	2-Dec-98	Chloromethane	1	U
W01732	2-Jun-98	m,p-Xylene	5	U
W02840	2-Dec-98	m,p-Xylene	1	U
W01732	2-Jun-98	Tetrachloroethene	5	U
W02840	2-Dec-98	Tetrachloroethene	1	U
W01732	2-Jun-98	Trichloroethene	5	U
W02840	2-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.9. Target compound monitoring results Well 0857 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01737	8-Jun-98	1,1-Dichloroethane	5	UJ
W02844	15-Dec-98	1,1-Dichloroethane	1	U
W01737	8-Jun-98	1,2-Dichloroethane	5	UJ
W02844	15-Dec-98	1,2-Dichloroethane	1	U
W01737	8-Jun-98	1,2-Dichloroethene (total)[b]	5	UJ
W02844	15-Dec-98	cis-1,2-Dichloroethene	1	U
W02844	15-Dec-98	trans-1,2-Dichloroethene	1	U
W01737	8-Jun-98	Carbon disulfide	5	UJ
W02844	15-Dec-98	Carbon disulfide	1	U
W01737	8-Jun-98	Carbon tetrachloride	5	UJ
W02844	15-Dec-98	Carbon tetrachloride	1	U
W01737	8-Jun-98	Chloroform	5	UJ
W02844	15-Dec-98	Chloroform	1	U
W01737	8-Jun-98	Chloromethane	10	UJ
W02844	15-Dec-98	Chloromethane	1	U
W01737	8-Jun-98	m,p-Xylene	5	UJ
W02844	15-Dec-98	m,p-Xylene	1	U
W01737	8-Jun-98	Tetrachloroethene	5	UJ
W02844	15-Dec-98	Tetrachloroethene	1	U
W01737	8-Jun-98	Trichloroethene	5	UJ
W02844	15-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.10. Target compound monitoring results Well 0858 - 1998

Sample ID	Sample date	Target compound	Results (µg/L)	Data qualifier[a]
W01742	8-Jun-98	1,1-Dichloroethane	5	UJ
W02849	15-Dec-98	1,1-Dichloroethane	1	U
W01742	8-Jun-98	1,2-Dichloroethane	5	UJ
W02849	15-Dec-98	1,2-Dichloroethane	1	U
W01742	8-Jun-98	1,2-Dichloroethene (total)[b]	5	UJ
W02849	15-Dec-98	cis-1,2-Dichloroethene	1	U
W02849	15-Dec-98	trans-1,2-Dichloroethene	1	U
W01742	8-Jun-98	Carbon disulfide	5	UJ
W02849	15-Dec-98	Carbon disulfide	1	U
W01742	8-Jun-98	Carbon tetrachloride	5	UJ
W02849	15-Dec-98	Carbon tetrachloride	1	U
W01742	8-Jun-98	Chloroform	5	UJ
W02849	15-Dec-98	Chloroform	1	U
W01742	8-Jun-98	Chloromethane	10	UJ
M01225	15-Dec-98	Chloromethane	1	U
W01742	8-Jun-98	m,p-Xylene	5	UJ
W02849	15-Dec-98	m,p-Xylene	1	U
W01742	8-Jun-98	Tetrachloroethene	5	UJ
W02849	15-Dec-98	Tetrachloroethene	1	U
W01742	8-Jun-98	Trichloroethene	5	UJ
W02849	15-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.11. Target compound monitoring results Well 4315 - 1998

Sample ID	Sample date	Target compound	Results ($\mu g/L$)	Data qualifier[a]
W01748	6-Jun-98	1,1-Dichloroethane	5	UJ
W02856	7-Dec-98	1,1-Dichloroethane	1	U
W01748	6-Jun-98	1,2-Dichloroethane	5	UJ
W02856	7-Dec-98	1,2-Dichloroethane	1	U
W01748	6-Jun-98	1,2-Dichloroethene (total)[b]	5	UJ
W02856	7-Dec-98	cis-1,2-Dichloroethene	1	U
W02856	7-Dec-98	trans-1,2-Dichloroethene	1	U
W01748	6-Jun-98	Carbon disulfide	5	UJ
W02856	7-Dec-98	Carbon disulfide	1	U
W01748	6-Jun-98	Carbon tetrachloride	5	UJ
W02856	7-Dec-98	Carbon tetrachloride	1	U
W01748	6-Jun-98	Chloroform	5	UJ
W02856	7-Dec-98	Chloroform	1	U
W01748	6-Jun-98	Chloromethane	10	UJ
W02856	7-Dec-98	Chloromethane	1	U
W01750	6-Jun-98	Lead	18.3	=
W02856	7-Dec-98	Lead	14.7	=
W01748	6-Jun-98	m,p-Xylene	5	UJ
W02856	7-Dec-98	m,p-Xylene	1	U
W01748	6-Jun-98	Tetrachloroethene	5	UJ
W02856	7-Dec-98	Tetrachloroethene	1	U
W01748	6-Jun-98	Trichloroethene	5	UJ
W02856	7-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.12. Target compound monitoring results Well 4316 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01755	12-Jun-98	1,1-Dichloroethane	5	UJ
W02863	3-Dec-98	1,1-Dichloroethane	1	U
W01755	12-Jun-98	1,2-Dichloroethane	5	UJ
W02863	3-Dec-98	1,2-Dichloroethane	1	U
W01755	12-Jun-98	1,2-Dichloroethene (total)[b]	5	UJ
W02863	3-Dec-98	cis-1,2-Dichloroethene	1	U
W02863	3-Dec-98	trans-1,2-Dichloroethene	1	U
W01755	12-Jun-98	Carbon disulfide	5	UJ
W02863	3-Dec-98	Carbon disulfide	1	U
W01755	12-Jun-98	Carbon tetrachloride	5	UJ
W02863	3-Dec-98	Carbon tetrachloride	1	U
W01755	12-Jun-98	Chloroform	5	UJ
W02863	3-Dec-98	Chloroform	1	U
W01755	12-Jun-98	Chloromethane	10	UJ
W02863	3-Dec-98	Chloromethane	1	U
W01755	12-Jun-98	m,p-Xylene	5	UJ
W02863	3-Dec-98	m,p-Xylene	1	U
W01755	12-Jun-98	Tetrachloroethene	5	UJ
W02863	3-Dec-98	Tetrachloroethene	1	U
W01755	12-Jun-98	Trichloroethene	5	UJ
W02863	3-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value

[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.13. Target compound monitoring results Well 4317 - 1998

Sample ID	Sample date	Target compound	Results (μg/L)	Data qualifier[a]
W01761	11-Jun-98	1,1-Dichloroethane	5	U
W02868	3-Dec-98	1,1-Dichloroethane	1	U
W01761	11-Jun-98	1,2-Dichloroethane	5	U
W02868	3-Dec-98	1,2-Dichloroethane	1	U
W01761	11-Jun-98	1,2-Dichloroethene (total)[b]	5	U
W02868	3-Dec-98	cis-1,2-Dichloroethene	1	U
W02868	3-Dec-98	trans-1,2-Dichloroethene	1	U
W01761	11-Jun-98	Carbon disulfide	5	U
W02868	3-Dec-98	Carbon disulfide	1	U
W01761	11-Jun-98	Carbon tetrachloride	5	U
W02868	3-Dec-98	Carbon tetrachloride	1	U
W01761	11-Jun-98	Chloroform	5	U
W02868	3-Dec-98	Chloroform	1	U
W01761	11-Jun-98	Chloromethane	10	U
W02868	3-Dec-98	Chloromethane	1	U
W01761	11-Jun-98	m,p-Xylene	5	U
W02868	3-Dec-98	m,p-Xylene	1	U
W01761	11-Jun-98	Tetrachloroethene	5	U
W02868	3-Dec-98	Tetrachloroethene	1	U
W01761	11-Jun-98	Trichloroethene	5	U
W02868	3-Dec-98	Trichloroethene	1	U

[a] "=" = detected at reported value; U - not detected; J = estimated value
[b] Laboratory results include only 1,2-dichloroethene (total)

Table 3.14. Comparison of detected VOC concentrations to action levels, June 1998 (underline represents detections above the regulatory level)

Analyte	Regulatory level (μg/L)	Detections (μg/L)/Well number 0841	0842	0843	4315
1,1-Dichloroethane	-				
1,2-Dichloroethane	5		7		
1,2-Dichloroethene (total)	-		7	8	
cis-1,2-Dichloroethene	70				
trans-1,2-Dichloroethene	100				
Carbon disulfide	-				
Carbon tetrachloride	5		28		
Chloroform	100	1J	29		
Chloromethane	3				
Tetrachloroethene	5				
Trichloroethene	5	7J	110	1J	
Total xylenes	10,000				
Lead	15^a - 50^b				18.3

[a] 40 CFR 141 National Primary Drinking Water Standard concentration for lead is 15 μg/L.

[b] 40 CFR 264.94 Table 1, Maximum Concentration for Groundwater Protection (lead = 50 μg/L).

J = estimated value

Table 3.15. Comparison of detected VOC concentrations to action levels, December 1998 (underline represents hits above the regulatory level)

Analyte	Regulatory level (μg/L)	Detections (μg/L)/Well number 0841	0842	0843	4315
1,1-Dichloroethane	-		3		
1,2-Dichloroethane	5	0.6(J)	12		
1,2-Dichloroethene (total)	-				
cis-1,2-Dichloroethene	70	0.6(J)	15	6	
trans-1,2-Dichloroethene	100		0.8(J)		
Carbon Disulfide	-				
Carbon tetrachloride	5		41		
Chloroform	100	0.8(J)	40		
Chloromethane	3				
Tetrachloroethene	5		1.1		
Trichloroethene	5	7	180		
Total xylenes	10,000				
Lead	15[a] - 50[b]				14.7

[a] 40 CFR 141 National Primary Drinking Water Standard concentration for lead is 15 μg/L.
[b] 40 CFR 264.94 Table 1, Maximum Concentration for Groundwater Protection (lead = 50 μg/L).
J = estimated value

Figures 3.1 and 3.2 present a summary of the VOC concentrations in Wells 0841 and 0842 over time. Historical concentrations of trichloroethylene in Well 0842 have been as high as 550 μg/L in 1988. However, they have decreased over time with short term increases observed in years of above average rainfall during the spring season. In 1994 and 1998 spring rainfall amounts were above average and VOC concentrations measured during the fall sampling event and the subsequent samples increased temporarily.

3.2.2 Vertical Extent of Contamination

Much has been reported about the groundwater flow patterns in the Melton Valley. In general, hydraulic conductivity and fracture density decrease with depth in the Nolichucky Shale and Maryville Limestone. It is estimated that >90% of infiltrated rainwater flows along the shallow water table and emerges in nearby surface waters (DOE 1995).

Wells 0842 and 0841 are a shallow/intermediate well pair that can be used to assess the vertical extent of VOC contamination. Well 0842 is screened from 8 to 23.2 ft below ground surface (bgs) and well 0841 is screened from 34 to 56.3 ft bgs. VOC concentrations in Well 0842 are significantly higher than in 0841, 110 to 180 μg/L in 842 as opposed to 7 μg/L in 0841. TCE is the highest concentration VOC in a suite of 6 detected VOCs in Well 0842 while it is the only detected VOC in Well 0841. The two wells sample different zones vertically with no overlap in screened zone elevations. Therefore, although there is an indication that a small amount of TCE is migrates in the fractures deeper than about 25 feet bgs, it is apparent that the bulk of the VOCs at this well pair migrate in the shallow zone. In 1994-1995, as part of the EMP baseline monitoring, seeps along the West Seep Tributary, downgradient of wells 0841/0842, were monitored and analyzed for VOCs. No target compounds were detected in the seeps.

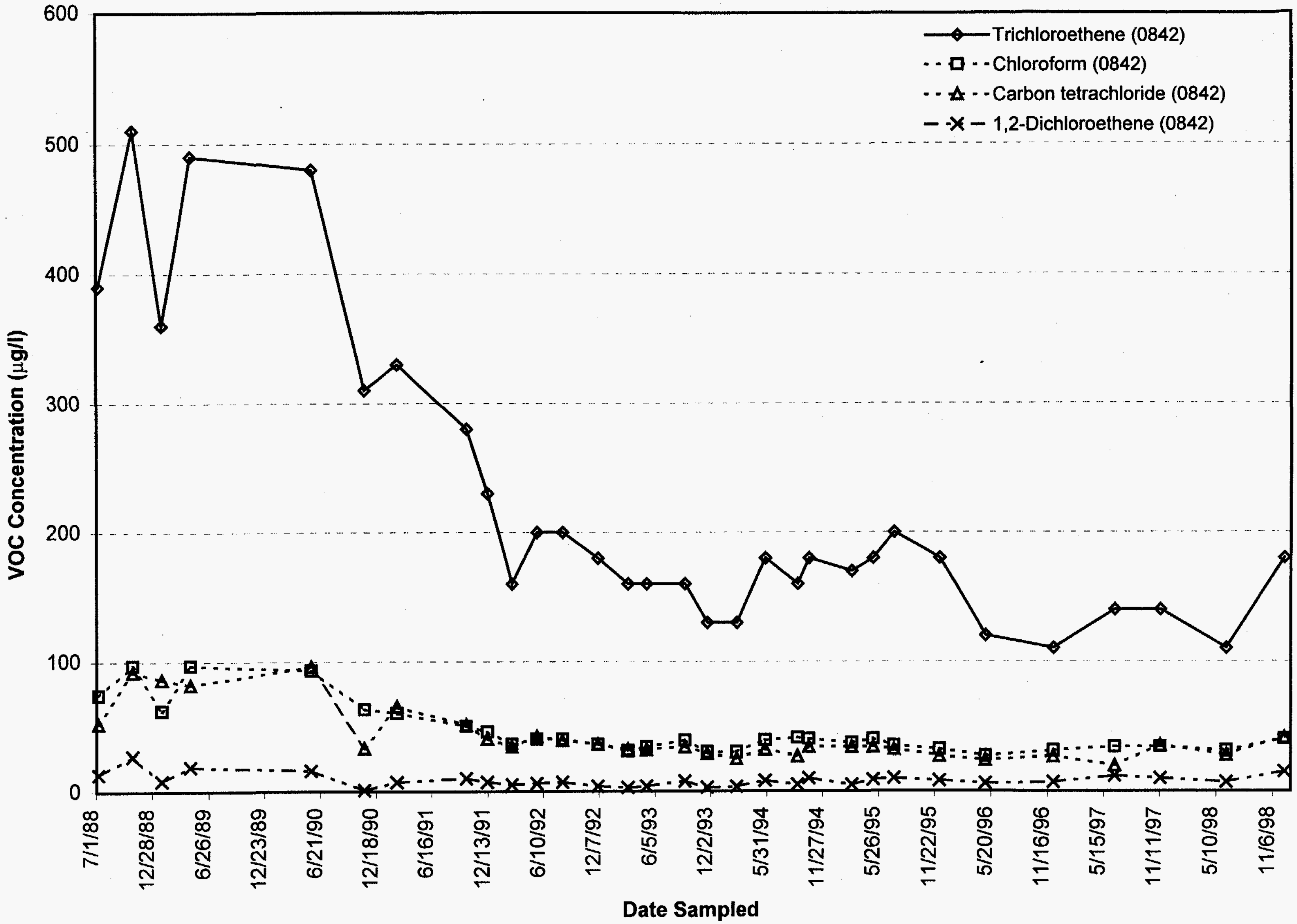

Fig. 3.1. VOC concentrations, Well 0842

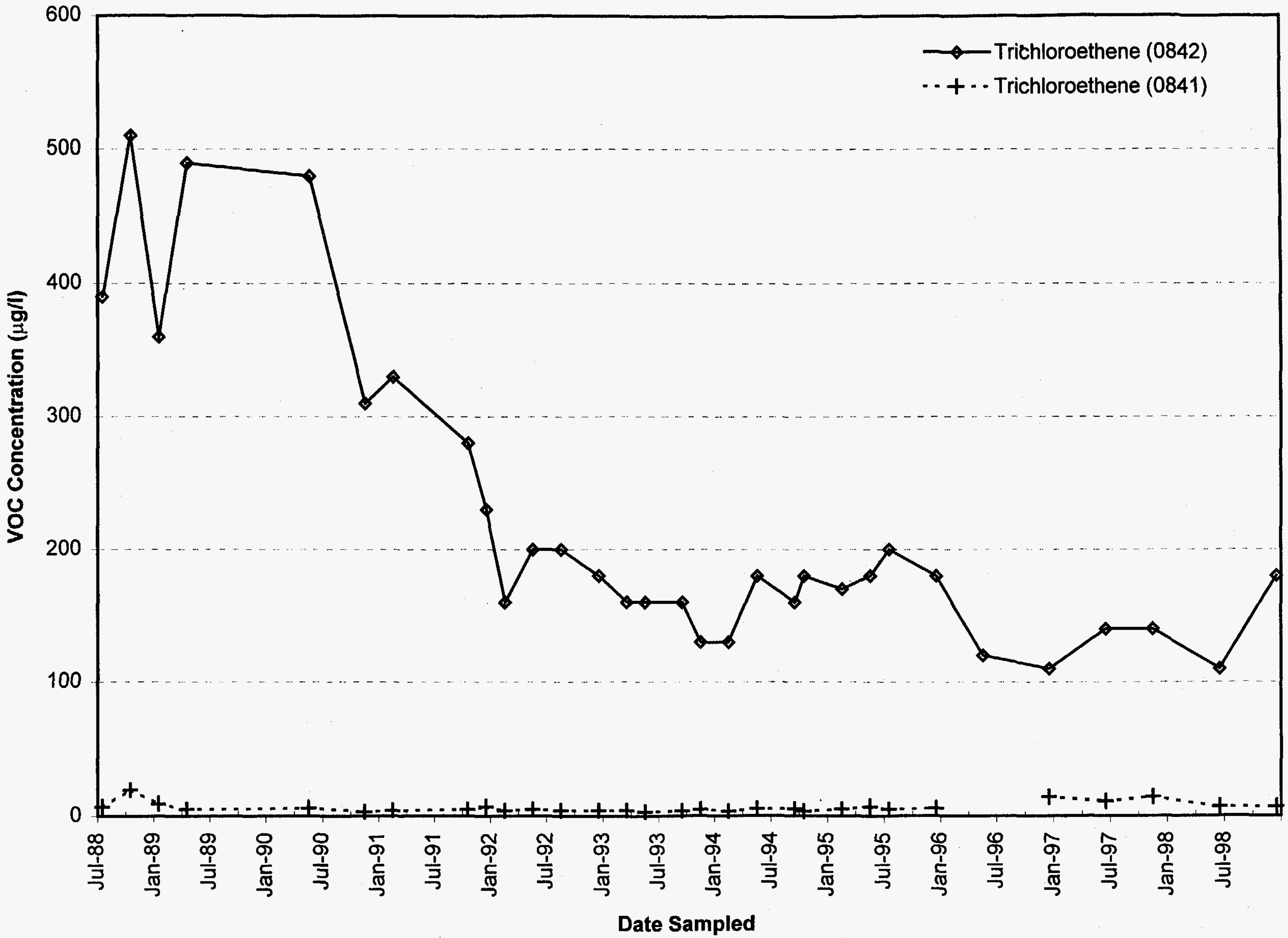

Fig. 3.2. TCE concentrations in wells 0841 and 0842

3.3 CONTAMINANT MIGRATION

No new studies were performed in 1998 to better define and quantify contaminant migration characteristics at SWSA 6. Several past studies have been performed, including the RFI, the 1994 and 1996 WAG 6 Annual Reports (DOE 1995; DOE 1995), and several valley groundwater modeling efforts. Information from these past studies, and from the 1996 GWQAR, is provided to help define contaminant migration pathways and rates for SWSA 6.

Figure 3.3 shows the shallow water table for WAG 6 as reported in the 1996 WAG 6 Annual Report. The water table and water flow direction does not change from the wet to the dry season (DOE 1995). Most of the water that infiltrates the ground surface exits the WAG at two surface water monitoring stations, MS1 and MS3. Storm flow is the primary mechanism of flow in the unsaturated zone to these discharge points. Flow velocities can vary greatly in storm vs non-storm conditions. Much of the water flux leaving the WAG occurs during a few heavy storm events per year.

In general, the majority of groundwater flow at SWSA 6 occurs through fractures, particularly in the bedrock. A small amount of matrix diffusion into the rock can occur in cases where contaminant concentration gradients exit between water in fractures and water in the rock matrix. Diffusion out of the rock matrix is slow, primarily because of the mechanisms of sorption, degradation, and chemical precipitation.

Although much of the flow occurs through fractures, average velocities can be estimated using the standard equation for estimating groundwater flow velocity in porous media:

$$V=\frac{(K)(i)}{n}$$

where

v = the average linear seepage velocity,
K = the hydraulic conductivity,
i = the hydraulic gradient,
n = the effective porosity of the aquifer media.

Values for each of the parameters as well as flow velocities were provided in the 1996 GWQAR. Velocities for the regolith range from 0.55 to 1.37 ft /d and for the bedrock from 13.32 to 64 ft /d (ORNL 1997).

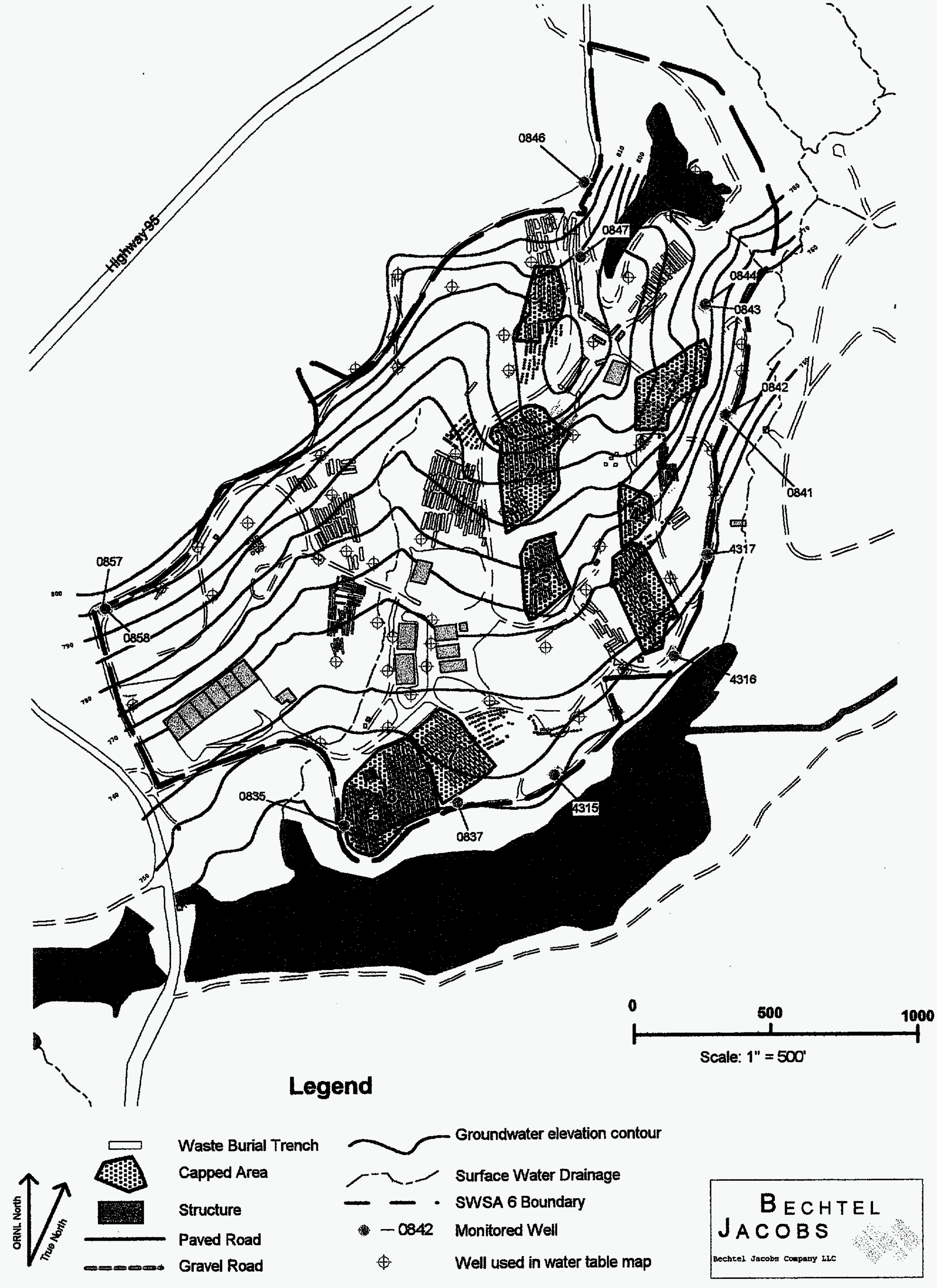

Fig.3.3. SWSA 6 groundwater levels

4. RECOMMENDATIONS

The following recommendations are made based on 1998 monitoring of SWSA 6:

- Groundwater data obtained during 1998 indicate that continued monitoring of the existing well network is appropriate. Collection of samples semiannually in December and June are appropriate based on seasonal groundwater and surface water discharge patterns.

- Change the well purging technique from a three-volume purge to a micropurge technique. Based on results of micropurge testing reported in the 1997 GWQAR it is apparent that the micropurge technique provides more representative samples for VOC analysis. This change will also bring the SWSA 6 RCRA protocol in line with RCRA sampling at the Y-12 Plant[1] and with the purge technique being used for all of the CERCLA groundwater sampling at ORNL.

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[1]Modifications to RCRA Post-Closure Permits for the Bear Creek Hydrogeological Regime (TN HW-087), Chestnut Ridge Hydrogeological Regime (TN HW-0088), and Upper East Fork Poplar Creek Hydrogeological Regime (TN HW-089) issued on 7/28/98, 7/22/97, and 6/25/97, respectively.

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APPENDIX A

1998 SWSA 6 GROUNDWATER DATA

Volatile Organic Compound Analytical Results - June 1998

Station	Reporting Unit	Well 0835	Well 0837	Well 0841	Well 0842	Well 0843	Well 0844	Well 0846	Well 0857	Well 0858	Well 4315	Well 4316	Well 4317
Sample Id		W01766	W01776	W01872	W01707	W01715	W01727	W01732	W01737	W01742	W01748	W01755	W01761
Date Sampled		6/1/98	6/3/98	6/9/98	6/10/98	6/10/98	6/15/98	6/2/98	6/8/98	6/8/98	6/12/98	6/12/98	6/11/98
1,1,1-Trichloroethane	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
1,1,2,2-Tetrachloroethane	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/L	10 U	10 U	10 UJ	5J	10 U	10 U	10 U	2 J	2 J	10 UJ	10 UJ	2 J
1,1,2-Trichloroethane	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
1,1-Dichloroethane	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
1,1-Dichloroethene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
1,2-Dichloroethane	µg/L	5 U	5 U	5 UJ	7 =	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
1,2-Dichloroethene	µg/L	5 U	5 U	5 UJ	7 =	8 =	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
1,2-Dichloropropane	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
2-Butanone	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
2-Hexanone	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
4-Methyl-2-pentanone	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
Acetone	µg/L	33 =	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
Benzene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Bromodichloromethane	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Bromoform	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Bromomethane	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
Carbon disulfide	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Carbon tetrachloride	µg/L	5 U	5 U	5 UJ	28 J	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Chlorobenzene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Chloroethane	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
Chloroform	µg/L	5 U	5 U	1 J	29 =	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Chloromethane	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
cis-1,3-Dichloropropene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Dibromochloromethane	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Ethylbenzene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
m,p-Xylene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Methylene chloride	µg/L	5 U	5 U	6 UJ	5 U	5 U	9 U	5 U	5 UJ	5 UJ	9 UJ	8 UJ	5 U
Styrene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Tetrachloroethene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Toluene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
trans-1,3-Dichloropropene	µg/L	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Trichloroethene	µg/L	5 U	5 U	7 J	110 =	1 J	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 U
Vinyl acetate	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
Vinyl chloride	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
Lead	µg/L										18.3 =		

U = undetected

J = estimated value

Volatile Organic Compound Analytical Results - December 1998

Station		Well 0835	Well 0837	Well 0841	Well 0842	Well 0843	Well 0844	Well 0846	Well 0857	Well 0858	Well 4315	Well 4316	Well 4317
Sample Id		W02787	W02792	W02808	W02813	W02818	W02832	W02840	W02844	W02849	W02856	W02863	W02868
Date Sampled	Reporting Unit	12/7/98	12/7/98	12/9/98	12/10/98	12/10/98	12/16/98	12/2/98	12/15/98	12/15/98	12/7/98	12/3/98	12/3/98
1,1,1-Trichloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ
1,1,2-Trichloroethane	µg/L	1 U	1 U	1 U	0.8 J	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	µg/L	1 U	1 U	1 U	3 =	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	1 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ
1,2-Dibromo-3-chloropropane	µg/L	1 U	1 R	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ
1,2-Dibromoethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	µg/L	1 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ
1,2-Dichloroethane	µg/L	1 U	1 U	0.6 J	12 =	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	1 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ
1,4-Dichlorobenzene	µg/L	1 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 UJ
2-Butanone	µg/L	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R
2-Hexanone	µg/L	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R
4-Methyl-2-pentanone	µg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R	5 R
Benzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	1 U	1 U	1 U	41 =	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	1 U	1 U	0.8 J	40 =	0.7 J	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Chloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	1 U	1 U	0.6 J	15 =	6 =	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
m,p-Xylene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Methylene chloride	µg/L	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 U	2 UJ	2 U	2 U	2 UJ	2 UJ	2 UJ
Styrene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	1 U	1 U	1 U	1.1 =	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	1 U	1 U	1 U	0.8 J	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	1 U	1 U	7 =	180 =	1 =	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Vinyl acetate	µg/L	1 R	1 U	1 R	4 J	1 R	1 U	1 R	1 U	1 U	1 R	1 R	1 R
Vinyl chloride	µg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Lead	µg/L										14.7 =		

U = undetected

J = estimated value

R = unusable data (GC/MS mass assignment error)

APPENDIX B

DATA QUALITY ASSESSMENT

IWQP - ORNL WASTE AREA GROUP 6 (WAG6)

Project: **ORNL Data Validation Task, WAG6, Oak Ridge National Laboratory, Oak Ridge, Tennessee**

Analysis: **Volatile Organic Compounds (VOC)**

DRG Nos.: 9806164, 9806319, and 9806369

No. of Samples: 23 Matrix: Water

Sample Nos.: W01766, W01732, W01877, W01776, W01972, W01737, W01878, W01742, W01879, W01872, W01715, W01874, W01699, W01707, W01873, W01761, W01882, W01748, W01883, W01884, W01755, W01727, and W01876

The data were validated following the criteria stated in or referred to in the Statement of Work and the EPA data validation functional guidelines.

The following QC criteria were considered in the validation process:

QC Criteria

- Holding Time
- GC/MS Tuning
- Calibration
- Blanks
- Surrogate Recovery
- Matrix Spike/Matrix Spike Duplicate
- Laboratory Control Samples
- Internal Standards Performance
- Case Narrative

Volatile Organic Compounds

A total of 23 water samples at ORNL Waste Area Group 6 (WAG6) were collected on 6/1/98, 6/2/98, 6/3/98, 6/8/98, 6/9/98, 6/10/98, 6/11/98, 6/12/98, and 6/15/98. All samples were analyzed by EPA CLP OLM03.1 methodology for volatile organic compounds (VOC) and represented 805 analyses (i.e. data points). The analytical laboratory was RCRA LabNet of Lionville, Pennsylvania.

The project produced valid results for 100% of the VOC data. There were no rejected data. It is determined that estimated data are useable for project objectives. Positive VOC results were observed in 10 samples (44% of the samples) and represented 3% of the total data points. Results for chloroform in W01699, freon in W01707, W01737, W01742, and W01761; trichloroethene and chloroform in W01872; 1,1-dichloroethane and freon in W01873; and 1,2-dichloroethene(total) in W01874 were reported as estimated (J) because the observed values were between the detection levels and the laboratory reporting levels. Positive VOC results that were greater than the laboratory reporting levels included acetone in W01732; trichloroethene in W01699; 1,2-dichloroethene(total), chloroform, 1,2-dichloroethane, carbon tetrachloride, and trichloroethene in W01707; 1,2-dichloroethene(total) in W01715, trichloroethene in W01872; and 1,2-dichloroethene(total), 1,2-dichloroethane, chloroform, carbon tetrachloride, and trichloroethene in W01873. The highest analyte levels observed were trichloroethene at 110 ug/L in W01707 and trichloroethene at 150 ug/L in W01873. All other positive VOC analytes were detected at levels slightly above the reporting level but less than 35 ug/L.

Based on VOC method blank levels, results for methylene chloride in all 23 samples, acetone in 6 samples, 2-butanone in 6 samples, chloromethane in 1 sample, and freon in 7 samples were qualified as not detected (U) and the Contract Required Quantitation Levels (CRQL) were reported or elevated as required. These qualifications are not uncommon since these analytes occur as frequent laboratory contaminants and represented 5.3% of the overall VOC data. Due to VOC continuing calibration %D deviations, positive results for carbon tetrachloride in W01707 and W01873 were qualified as estimated (J) and represented only 0.25% of the total data points. A total of 12 samples (52% of the samples) were analyzed a few days outside the 14 day (from collection) holding time limit which resulted in the estimation (J/UJ) of all results for these samples and represented 420 data points or 52% of all VOC data. These samples included: W01737, W01742, W01872, W01873, W01874, W01878, W01879, W01882, W01748, W01755, W01883, and W01884. No other deviations were observed that required any further qualifications of the VOC data.

Data, as presented, have been qualified as useable, but estimated when necessary. Data which have been estimated provide indications of either precision, accuracy, or sensitivity being less than desired but adequate for interpretation. Estimated data are useable for project objectives and the VOC data are considered acceptable for unlimited use.

IWQP - ORNL WASTE AREA GROUP 6 (WAG6)

Project: **ORNL Data Validation Task, WAG6, Oak Ridge National Laboratory, Oak Ridge, Tennessee**

Analysis: **Volatile Organic Compounds (VOC) and Inorganics (Lead)**

DRG Nos.: 9812584, 9812633, 9812671, and 9812732

No. of Samples: 17 Matrix: Water

Sample Nos.: W02840, W02863, W02868, W02787, W02792, W02793, W02856, W02798, W02799, W02860, W02808, W02813, W02818, W02819, W02832, W02844, and W02849

The data were validated following the criteria stated in or referred to in the Statement of Work and the EPA data validation functional guidelines.

The following QC criteria were considered in the validation process:

QC Criteria

- Holding Time
- GC/MS Tuning
- Calibration
- Blanks
- Surrogate Recovery
- Matrix Spike/Matrix Spike Duplicate
- Laboratory Control Samples
- Internal Standards Performance
- Case Narrative

Volatile Organic Compounds

A total of 17 water samples at ORNL Waste Area Group 6 (WAG6) were collected on 12/2/98, 12/3/98, 12/7/98, 12/9/98, 12/10/98, 12/15/98, and 12/16/98. Fourteen samples were analyzed by EPA CLP OLM02 methodology for volatile organic compounds (VOC) and 3 samples were analyzed by EPA CLP ILM04.0 methodology for Lead and represented a total of 591 analyses (i.e. data points). The analytical laboratory was RCRA LabNet of Lionville, Pennsylvania.

The project produced valid results for 91.4% of the combined VOC and Lead data. Rejected data were limited to the VOC analyses and represented 8.6% of all data. It is determined that estimated data are useable for project objectives. Positive VOC results were observed in 4 VOC samples (24% of the samples) and represented 3.4% of the total data points. Results for cis-1,2-dichloroethene, chloroform, and 1,2-dichloroethane in W02808; chloroform in W02818; and trichloroethene and chloroform in W02819 were reported as estimated (J) because the observed values were between the detection levels and the laboratory reporting levels. Positive VOC results that were greater than the laboratory reporting levels included trichloroethene in W02808; 1,1-dichloroethane, cis-1,2-dichloroethene, chloroform, 1,2-dichloroethane, carbon tetrachloride, vinyl acetate, trichloroethene, and tetrachloroethene in W02813; cis-1,2-dichloroethene and trichloroethene in W02818; and cis-1,2-dichloroethene in W02819. The highest analyte levels observed were trichloroethene at 180 ug/L, chloroform at 40 ug/L, and carbon tetrachloride at 41 ug/L all in sample W02813. All other positive VOC analytes were detected at levels slightly above the reporting level but less than 20 ug/L.

Based on VOC method blank levels, results for methylene chloride in 11 samples were qualified as not detected (U) and the Contract Required Quantitation Level (CRQL) was reported. This qualification is not uncommon since methylene chloride occurs as a frequent laboratory contaminant and represented 1.9% of the overall data. Due to VOC initial or continuing calibration %RSD or %D deviations, results for methylene chloride in 11 samples were qualified as not detected, associated value uncertain (UJ), and vinyl acetate in W02813 was qualified as estimated (J) and represented 2% of all data points. Based on low initial and continuing calibration relative response factors (RRF) less than 0.05, non-detect results for acetone, 2-butanone, 2-hexanone in all VOC samples, vinyl acetate in 13 samples, and 1,2-dibromo-3-chloropropane in 2 samples were rejected (R) and represented 8.6% of all data. Positive vinyl acetate in W02813 was estimated (J) due to low RRF value. VOC sample W02840 was analyzed a few days outside the 14 day (from collection) holding time limit which resulted in the estimation (UJ) of all results for this sample. Due to low 1,4-dichlorobenzene-d4 internal standard area counts in VOC samples W02868 and W02808, the 6 analytes using this internal standard for quantitation were qualified as not detected, associated values uncertain (UJ) and represented 2% of all data. Sample W02808 was reanalyzed due to low internal standard area. The reanalysis of this sample also exhibited low area counts along with poor surrogate recoveries and served to verify matrix interferences to be the cause. VOC sample W02813 required a 1:10 dilution to bring the target analyte trichloroethene within the linear range of the instrument. No other deviations were observed that required any further qualifications of the VOC data.

Inorganics (Lead)

The 3 samples analyzed for lead included W02798, W02799, and W02860. No deviations from the validation criteria required any qualifications of the lead sample data. Positive result for lead was observed in W02860 above the laboratory reporting level at 14.7 ug/L. The project produced valid results for 100% of the lead sample data.

Data, as presented, have been qualified as useable, but estimated when necessary. Data which have been estimated provide indications of either precision, accuracy, or sensitivity being less than desired but adequate for interpretation. Rejected VOC data should be viewed with caution since sensitivity requirements were not acceptable. Estimated data are useable for project objectives and are considered acceptable for use.

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