LMS/SAL/S09886

Post-Closure Inspection, Sampling, and Maintenance Report for the Salmon, Mississippi, Site Calendar Year 2012

March 2013

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Abbreviations

DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet (foot)
LM	Office of Legacy Management
MCL	maximum contaminant level set by the U.S. Environmental Protection Agency
MDC	minimum detectable concentration
pCi/L	picocuries per liter of water (about 1/27 radioactive disintegrations per second per liter)
TCE	trichloroethene
TRG	target remediation goal set by the State of Mississippi
VOC	volatile organic compound

1.0 Introduction

This report summarizes the 2012 annual inspection, sampling, measurement, and maintenance activities performed at the Salmon, Mississippi, Site (Salmon site[1]). The draft *Long-Term Surveillance and Maintenance Plan for the Salmon Site, Lamar County, Mississippi* (DOE 2007) specifies the submittal of an annual report of site activities with the results of sample analyses. A revised plan is in preparation. The *Long-Term Surveillance Plan for the Salmon, Mississippi, Site* is intended for release in 2013.

The Salmon site consists of 1,470 acres. The site is located in Lamar County, Mississippi, approximately 10 miles west of Purvis, Mississippi, and about 21 miles southwest of Hattiesburg, Mississippi (Figure 1).

The State of Mississippi owns the surface real estate[2] subject to certain restrictions related to subsurface penetration. The State is the surface operator; the Mississippi Forestry Commission is its agent. The federal government owns the subsurface real estate (including minerals and some surface features[3]), shares right-of-entry easements with the State, and retains rights related to subsurface monitoring. The U.S. Department of Energy (DOE) Office of Legacy Management (LM), a successor agency to the U.S. Atomic Energy Commission, is responsible for the long-term surveillance of the subsurface real estate.

The Atomic Energy Commission conducted Projects Dribble and Miracle Play to study seismic signatures from explosions in the Tatum Salt Dome beneath the site. Figure 2 shows an outline of the salt dome at about 2,500 feet below the surface. Two nuclear tests (code name Dribble) and two gas-explosive tests (code name Miracle Play) were conducted well within the Tatum Salt Dome between 1964 and 1970. The first nuclear test—Salmon (detonated 22 October 1964)—created a cavity 2,710 feet below ground surface. The second test—Sterling (3 December 1966)—and the two subsequent gas explosions, Diode Tube (2 February 1969) and Humid Water (19 April 1970), were conducted within the cavity created by the Salmon test. No radioactivity was released to the surface during the four tests. Residual radioactivity from Project Dribble is contained within the cavity walls and the cavity itself. The properties of the salt—plasticity and impermeability—provide geologic isolation from the surroundings.

Radioactive liquid waste derived from drill-back operations was injected into Aquifer 5 from March to July 1965. Since 1950, the oil industry had used Aquifer 5 for brine injection (the Baxterville field is 6 miles southwest of the dome). The injection well, located in the southwest corner of the site, was plugged during site cleanup operations.

The site was cleaned up and decommissioned in 1972. During the cleanup, most of the soil and drilling-mud contamination from drill-back operations were slurried and injected into the cavity. All test boreholes for emplacement, drill-back, and injection, and other wells were plugged and abandoned in accordance with the requirements of the State of Mississippi.

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[1] The Salmon site is locally known as the Tatum Salt Dome Test Site.

[2] The site in now designated as the "Jamie Whitten Forest Management Area."

[3] The groundwater monitoring wells, the protective bollards, concrete pads around each well, three survey bench marks, and the monument at ground zero.

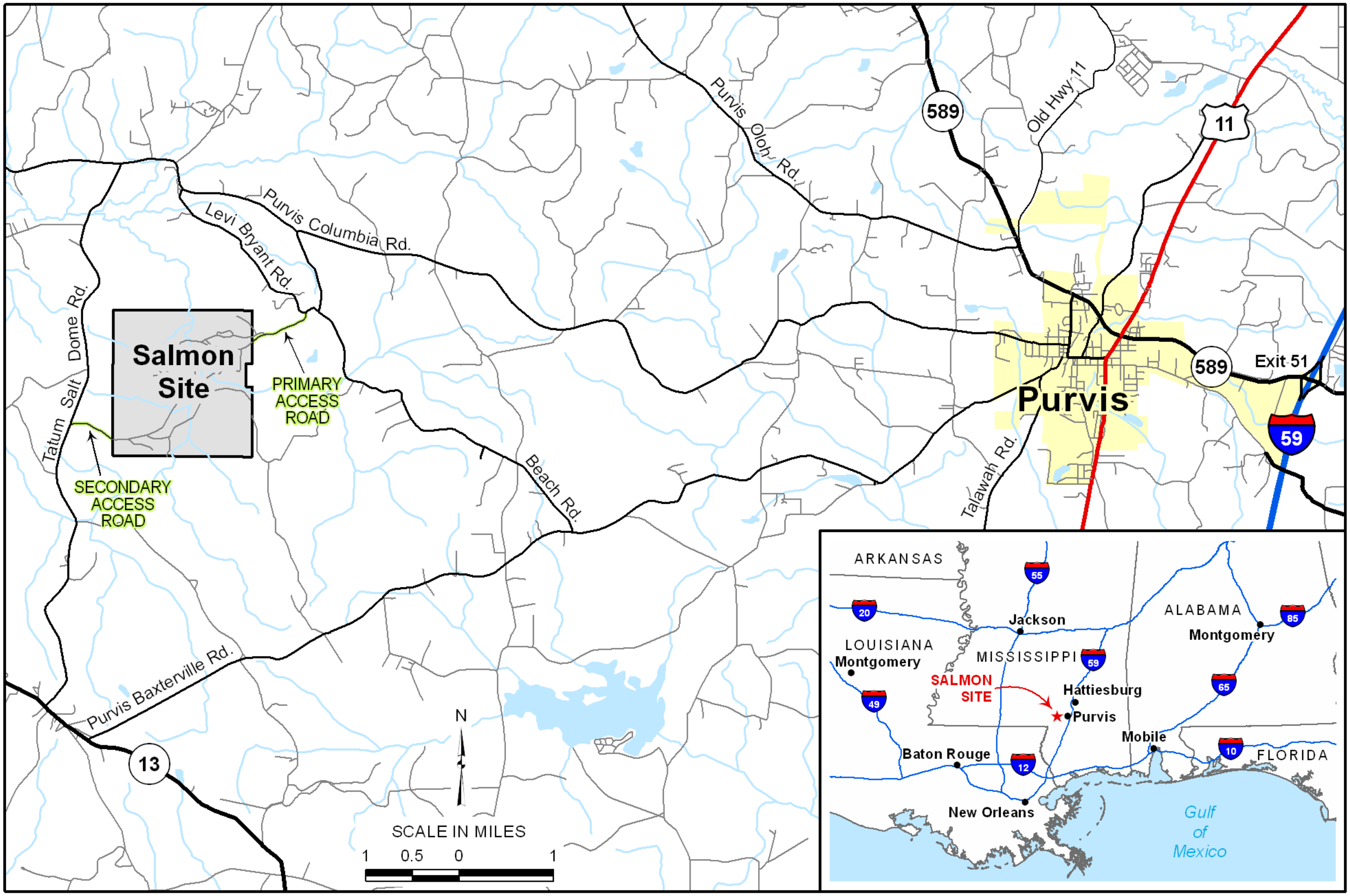

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Figure 1. Salmon Site and Surrounding Region

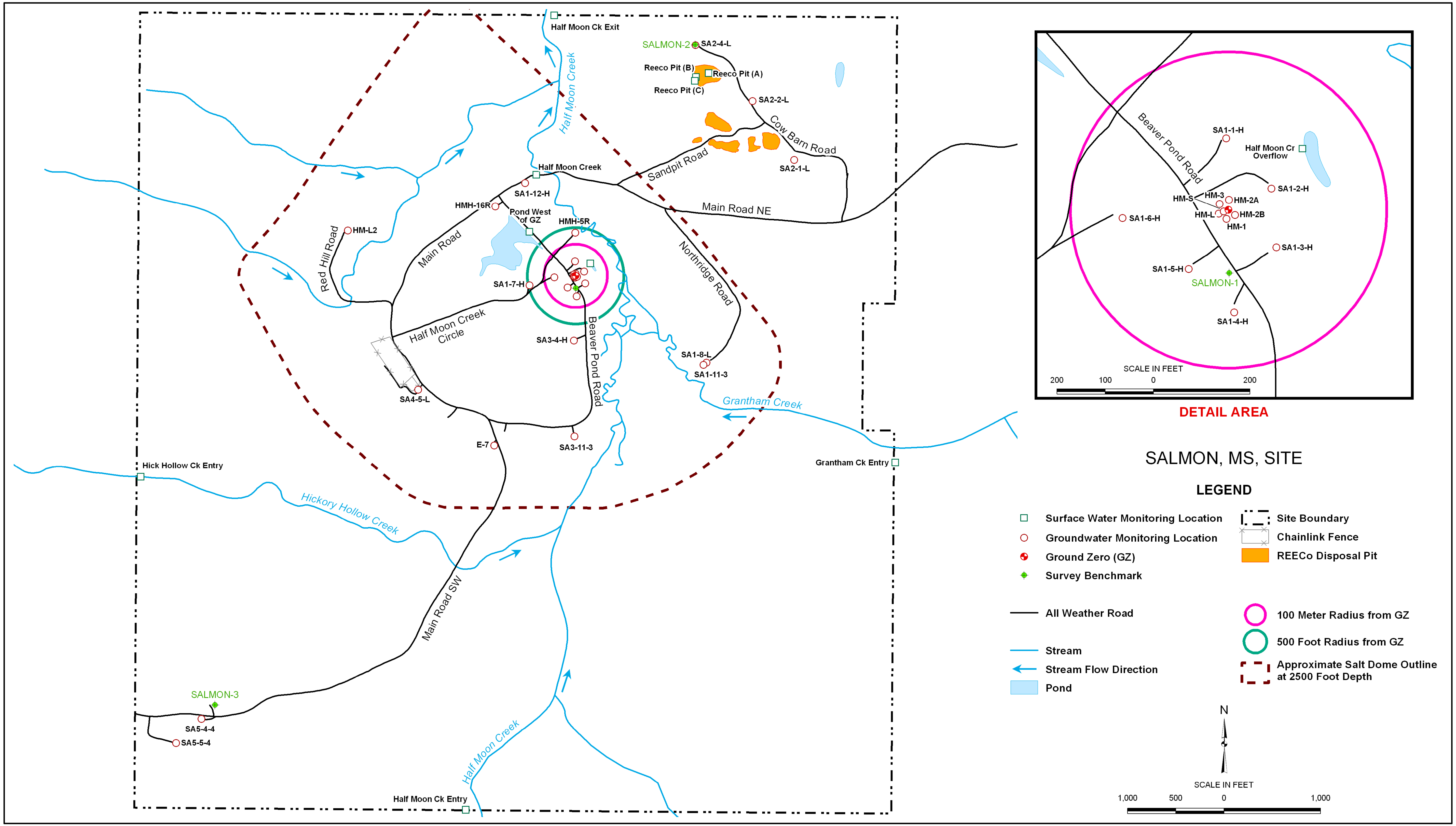

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Figure 2. Sampling Locations within the Salmon Site

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Shallow contamination at two ground-zero-area locations could not be completely removed due to the high water table. The remaining contamination was left in place and covered with local, uncontaminated, soil. These two locations are known as the Mouse Hole (used for vertical storage of drill pipe) and Post Shot No. 1 Slush Pit, which contained drilling mud. The contamination in the pit consisted of tritium, metals, and volatile organic compounds (VOCs). The Mouse Hole is located beneath concrete that supports the concrete base of the monument at ground zero[4]. The mud pit is located nearby and is covered with clean fill (centered at about 178 feet at S16.5°E from ground zero).

Tritium brought to the surface during the drill-back operations has been detected in shallow groundwater samples collected by the U.S. Environmental Protection Agency (EPA) between 1972 and 2007, and subsequently by LM. In the monitoring wells where tritium has been detected, its concentration is attenuating faster than the rate predicted by the law of radioactive decay. No radioactivity from the detonations has been detected in the deep wells that monitor the plugged emplacement wells at ground zero or in the two deep wells that monitor Aquifer 5 where liquid radioactive material was injected. Figure 2 shows current surface-water sample points and monitoring well locations.

The potential source locations of residual contamination at the site are:

- The Mouse Hole and Slush Pit, both within 30 feet of the surface.
- The cavity and the now-plugged ground-zero boreholes used during the tests.
- The wastes injected into Aquifer 5 and the borehole used to inject the wastes.

LM regularly monitors the locations associated with these sources (DOE 2007).

The contaminants of concern (COCs), determined from laboratory analytical results, are those with concentrations that exceed either the drinking water maximum contaminant level (MCL) (EPA 2011) or the Mississippi target remediation goal (TRG) (MDEQ 2002). Table 1 lists the COCs detected in water samples collected since 2004.

Table 1. Contaminants of Concern Detected Above the MCL or TRG Since 2004

Radioactivity	Metals	Volatile Organic Compounds
Tritium	Arsenic[a]	Trichloroethene[a]
	Barium[a]	*cis*-1,2-Dichloroethene
	Chromium[a]	Vinyl chloride
	Lead	

[a] Detected in groundwater above its MCL in 2012.

Tritium is listed as a COC because it is more mobile in groundwater than the other radioactive products resulting from a nuclear explosion. Since 2002, tritium has not been detected above its MCL (20,000 picocuries/liter [pCi/L]). The source of the arsenic is unknown and is unrelated to DOE activities.

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[4] Ground zero is the surface point directly above the common center of the subsurface detonations.

Some compounds are deliberately left off the list of COCs in Table 1. The history of reported analytic results indicates that methylene chloride (dichloromethane or DCM) has been detected in the method blanks associated with the analysis process. This suggests that DCM is probably a laboratory contaminant and not a contaminant in site water. Naphthalene has been detected once in each of three wells since volatile organic analysis of Salmon water samples began in the 1990s. One of the wells is over 900-feet deep. There is no pattern or operations history to suggest that Napthalene is a site contaminant. Therefore, these compounds are judged not to be due to test activities.

The surveillance and inspection objectives, shown in Table 2, are used as guidance for regular inspections, institutional controls, water sample collection, water-level measurements, maintenance, and recordkeeping.

Table 2. Long-Term Surveillance and Inspection Objectives for the Salmon, Mississippi, Site

Surveillance and Inspection Objective	Strategies to Achieve Objective
Control exposure to contaminated groundwater and cavity	• Maintain existing institutional controls • Modify existing or add new institutional controls, as necessary • Inspect for threats to the integrity of the institutional controls • Provide a grant for extension of the local potable-water infrastructure (complete)
Monitor onsite surface waters and groundwater	• Regularly monitor water for tritium and gamma-emitting radionuclides • Monitor concentration trends • Plan and coordinate response if detected concentrations exceed screening or action levels • Monitor natural attenuation of metals and VOCs in water
Physical maintenance	• Conduct regular inspections of monitor wells and access to them • Perform needed maintenance on or improvements to monitoring systems • Maintain access to monitoring systems, as necessary
Promote and preserve knowledge base	• Comply with DOE requirements of mandatory surveillance program • Regularly and frequently communicate with regulators and stakeholders • Maintain and make available the database of geospatial site information • Maintain electronic and hard copies of site documents available to the public • Comply with National Archives and Records Administration records management requirements

Summary of 2012 Site Activities

Water samples were collected from 11 surface locations and 28 wells along with depth-to-water-level measurements. Maintenance was performed on the ground zero monument and in some of the wells. Institutional controls and the Lamar County Public Library’s Salmon document collection were inspected. Site work was observed by visitors and recorded by a television film crew for later broadcast.

Appendix A shows selected images of fieldwork. Analytical results from sample analyses are summarized in Appendix B. Appendix C shows trend plots of COCs through 2012. Appendix D tabulates the water-level elevations by quarter and shows hydrographs for three aquifers since September 2007.

2.0 Inspection and Maintenance Activities

2.1 Institutional, Engineering, and Physical Controls

2.1.1 Deed restrictions, Zoning, and the Ground-Zero Monument

The original bronze plaque on the ground-zero monument was removed (Appendix A, Image A-1) and replaced with a new plaque (Appendix A, Image A-2) inscribed with the following text:

> NO EXCAVATION, DRILLING, AND/OR REMOVAL OF MATERIALS IS PERMITTED WITHOUT U.S. GOVERNMENT PERMISSION TO PENETRATE INTO THE SUBSURFACE BELOW THE 1470 ACRE TRACT SITUATED WITHIN SECTIONS 11, 12, 13, AND 14, T2N, R16W, ST. STEPHENS MERIDIAN, MISSISSIPPI.

The deed restriction filed with the Lamar County Chancery Clerk (page 212, Book 18-A, 25 August 2005 and the quitclaim transfer deed filed on page 239, Book 21-M, 20 December 2010) prohibits surface penetration without government permission. The original plaque prohibited penetration below mean sea level without government permission. At ground zero, sea level is about 240 feet below the surface of the monument.

The State has agreed not to conduct logging operations within 500 feet of ground zero (see Figure 3).

Currently, the site and surrounding lands are not zoned. The deed restriction specifies that DOE is to be notified “prior to any change in zoning.” An inspector inquired at the Lamar County Planning Department on 20 April 2012 and was informed that no zoning change is planned for the site and surrounding lands.

2.1.2 Fences

The site perimeter fence is nonfunctional. Dense vegetation hinders access along most of the perimeter.

2.1.3 Gates and Locks

There are two gates to the site; one at the main site entry on Main Road NE and the other on Main Road SW (see Figure 3). Both gates and the locks on them are in good condition.

2.1.4 Signs

The DOE “No Trespassing” signs are still posted at the gates and at some perimeter locations.

2.2 Physical Site Conditions

The site roads to the wells were inspected before sample-collection began. The roads were in good condition and safe for vehicles carrying sampling equipment; a few road ruts are beginning to develop.

The Mississippi Forestry Commission has cleared an abandoned road in the southwest quadrant in preparation for logging operations. Trees have been marked for harvest.

2.3 Monitoring Wells

There are 28 wells on the Salmon site dedicated to the collection of groundwater samples from aquifers below the site. Dedicated bladder pumps are installed in 26 of the 28 wells. Dedicated submersible Gundfos electric pumps are installed in the two deep wells positioned in Aquifer 4.

The aquifers above the salt dome at ground zero, listed from deepest to shallowest, are Caprock Aquifer, Aquifer 3, Aquifer 2B, Aquifer 2A, Aquifer 1, Local Aquifer, and Alluvial Aquifer.

Six wells at ground zero are positioned in six of the seven aquifers above the dome (except the Caprock Aquifer). Their purpose is to monitor the integrity of the test cavity and plugged emplacement test wells into the cavity.

Within 1,100 feet of ground zero, twelve wells are positioned in the Alluvial Aquifer. One of these wells also monitors the plugged test wells at ground zero.

Seven wells are positioned in the Local Aquifer. One of these wells is used to monitor the plugged test wells at ground zero. The Local Aquifer is a minor source of drinking water offsite.

Two wells at ground zero are positioned in Aquifer 2: one well is screened in Aquifer 2A and the other is screened in Aquifer 2B. Their purpose is to monitor the plugged test wells at ground zero.

Three wells are positioned in Aquifer 3. One of these wells is used to monitor the plugged test wells at ground zero. Aquifer 3 is a major source of municipal water offsite.

One well is positioned in the top of the calcite, the Caprock Aquifer formation. This well may be in contact with Aquifer 3 and not the Caprock Aquifer.

Two deep wells in the southwest corner of the site are positioned in Aquifer 4 to monitor leakage from Aquifer 5. These wells are off the salt dome.

Groundwater samples are collected according to a procedure based on accepted standards for low-flow sampling (ASTM 2007). In summary, the first step is to make a depth-to-water-level measurement; next, the sample lines in the well are purged. The sample is collected (Appendix A, Image A–3); the analytical laboratory specifies the minimum volume. Finally, field measurements are made on a duplicate sample (Appendix A, Image A–4) and the last depth-to-water-level measurement recorded. The process is similar but not identical for the two deep wells with electric pumps.

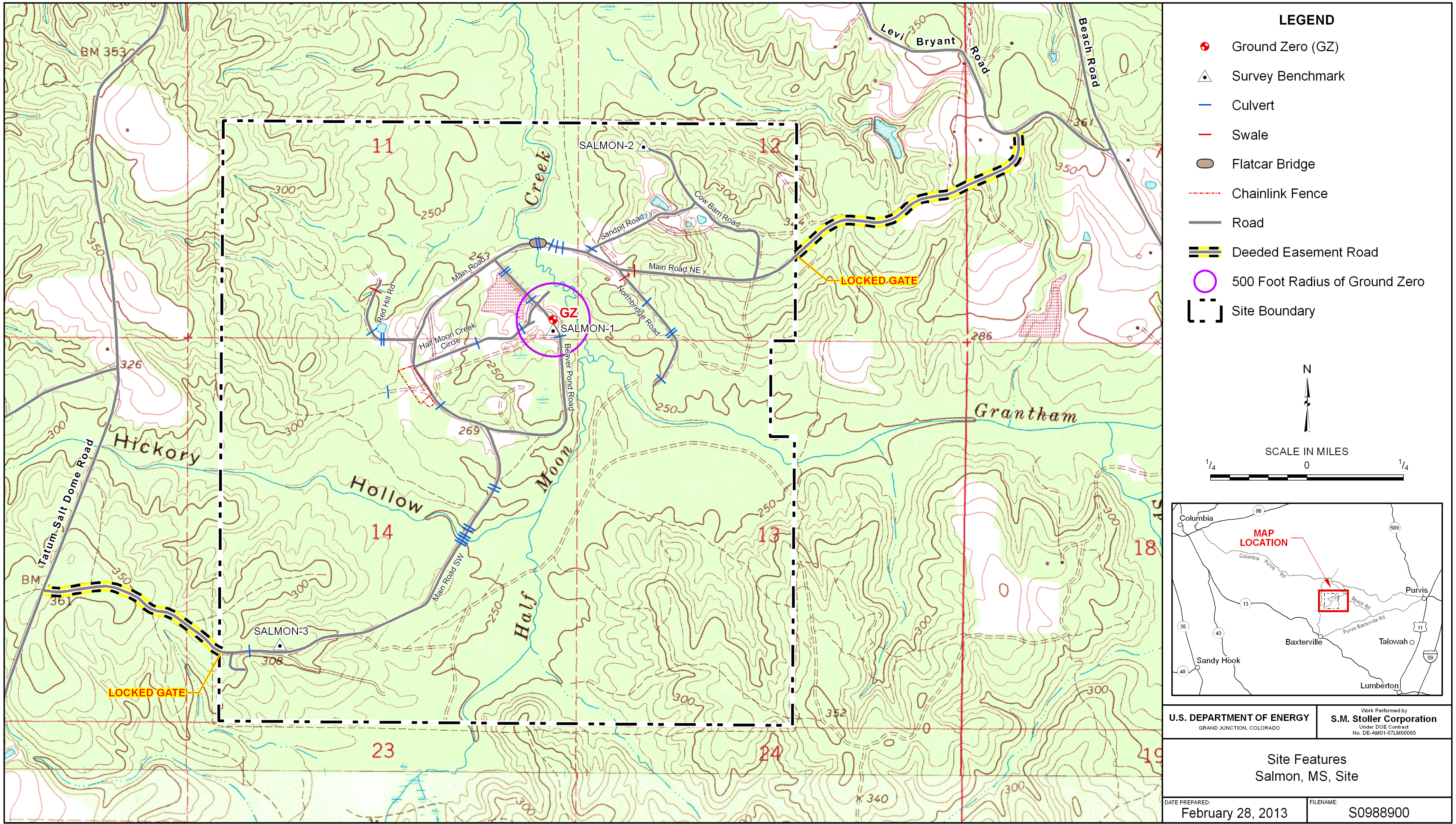

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Figure 3. Topographic Map of the Salmon Site with Road Features

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Historically, purge water collected from some alluvial wells near ground zero contain contaminants in concentrations above MCL. The number of these wells varies from year to year. The 2011 annual report (DOE 2012b) identified these wells and the contaminants in concentrations above MCL. In 2012, the purge water from five wells[5]—about 1 gallon per well—was containerized, blended, and discarded. The blending dilutes the composite purge water and reduces the composite concentrations to levels below the respective MCL. However, purge water from well HMH-5R contains trichloroethene (TCE), which must be treated separately due to its concentration level. This purge water (about 1 gallon) was treated in the field by sparging for 1.7 hours to reduce the TCE concentration to a level below its MCL. A sample was collected for TCE analysis. The laboratory reported no TCE in the sample. The MCL for TCE is 5.0 micrograms per liter (µg/L).

Diluted or treated purge water is not regulated under any waste regulations except that it cannot be placed back into the aquifer, discharged to state surface waters, or discharged to the ground if contaminant levels are known to exceed state TRGs or MCLs.

A typical monitoring well is surrounded by a protective white metal casing with a locked metal cover. At the base is a rectangular concrete pad. At each corner of the pad stands a 4-foot-high bollard[6] painted bright “safety orange.” A three-bollard set surrounds each of the three surveyor benchmarks. The protective well casings, covers, concrete pads, and bollards were in good condition. The bollards protecting the benchmarks were in good condition.

A flex-flow well cap assembly supports each bladder pump by a pair of 0.25-inch-diameter polyethylene tubes: one tube is for pressurized air to operate the pump, and the other is for the water sample from the pump. The assembly was replaced in wells where the brass coupling in the air-supply side of the flex-flow adaptor well cap was cracked. The old assemblies were returned to Grand Junction for salvage.

The cables supporting the water level data loggers in wells SA5-4-4 and SA5-5-4 were shortened by about 12 and 18 feet, respectively.

2.4 Surface Sample Locations

There are 10 surface-water sample locations onsite and one backup location offsite (west of the site at Hickory Hollow Creek and Tatum Salt Dome Road). Three surface-water sample locations are within 1,200 feet of ground zero, three locations are at seeps in REEco pit number 5, and four locations are at site perimeter locations where the three creeks enter and Half Moon Creek exits to the north.

Surface water sampling consists of sample collection by container immersion and field measurements (Appendix A, Image A-4).

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[5] Wells SA1-1-H, SA1-3-H, SA1-7-H, SA4-5-L, and HM-3.

[6] A bollard is a concrete-filled pipe, here 4-inches in diameter, set in concrete below ground.

2.5 Site Ecology

The gopher tortoise is a federally listed threatened species and is listed as endangered by the State of Mississippi. No active tortoise burrows were observed in the vicinity of the 28 monitoring wells, the three benchmarks, or the monument at ground zero.

No beaver or beaver activities were observed. In past years, beavers have undermined an access road to the wells.

2.6 Public Information Access

The *Post-Closure Inspection, Sampling, and Maintenance Report for the Salmon, Mississippi, Site Calendar Year 2011* (DOE 2012b) and the Data Validation Package (DOE 2012a) were posted on the LM webpage (http://www.lm.doe.gov/salmon/Sites.aspx). The Data Validation Package contains all the results from analyses of the water samples that were collected during April 2012. This report provides a summary of the analytical results.

A WDAM-TV news crew (from Hattiesburg, Mississippi) visited the site on Wednesday, 18 April, to film the site and the sample collection activities and to conduct interviews (Appendix A, Images A-5 and A-6). Visitors onsite during the filming represented Auburn University, DOE, Mississippi Department of Health Radiologic Health Division, Mississippi Forestry Commission, S.M. Stoller Corporation, University of Southern Mississippi, and Wildlife Mississippi.

The Salmon document collection at the Purvis Public Library was inspected in April 2012. In May 2012, the LM Support contractor prepared special binders and sent them to the library to aid organization of annual reports prepared by the DOE Office of Environmental Management, LM, and the State.

3.0 Analytical Results

Groundwater samples were collected from each of the 28 active onsite wells. Surface water samples were collected from 10 onsite locations (Appendix A, Image A–7) and one offsite location.

The 39 water samples were analyzed for tritium. Selected surface water and groundwater samples were analyzed for VOCs, metals, gamma-emitting radionuclides, or some combination of these analytes or methods. Tabulated laboratory results are given in Appendix B.

Temperature, pH, and specific conductance were measured in the field on a replicate sample at the time of sample collection. Turbidity was also measured in groundwater duplicate samples. Depth to water was measured before and after groundwater sample collection (Appendix A, Image A–8).

Radiochemistry analyses—tritium, enriched tritium, and gamma spectrometry—were performed by GEL Laboratories (Charleston, South Carolina). Metals[7] and VOCs were analyzed by ALS Group Laboratory (Fort Collins, Colorado).

This is the first time LM has contracted with a commercial laboratory for radiochemistry analyses of Salmon water samples. The EPA Radiation and Indoor Environments National Laboratory (Las Vegas, Nevada) no longer performs enriched tritium analysis. Twenty-five percent of the collected water samples are specified for analysis by the more-sensitive enriched tritium method.

Tritium was detected in three groundwater samples at quantitative concentrations (i.e., above the minimum detectable concentration [MDC]; see Appendix B, Table B–1, the samples without a "J" qualification[8]). In 2011, quantitative tritium concentrations were detected in three samples.

No tritium was detected above the MDC in the 11 surface water samples.

Three gamma-emitting isotopes were detected above the MDC by gamma spectrometry in 2012: cesium-137, lead-212, and potassium-40 (Appendix B, table B–4). Data validation classified the lead-212 result as nonquantitative[9] and J-qualified the other two reported results.

Analytical results are tabulated in Appendix B. Tritium concentrations above the laboratory-determined MDC in groundwater samples are tabulated in Table B–1. VOCs and metals above the laboratory-determined detection limits in groundwater are tabulated in Table B−2. Metals above detection limits in surface waters are tabulated in Table B−3. Gamma-emitting isotopes above the MDC are tabulated in Table B–4.

3.1 2012 Sample Results Greater than Standards

Thirty-seven groundwater, 11 surface water, and 6 duplicate samples were submitted to two laboratories for radiochemistry, VOCs, and metals analyses. The laboratories returned 265 analytical results, including duplicates. Excluding the duplicate results, 239 concentration results were returned above the laboratory-determined MDC: 11 tritium, 3 gamma emitters, 24 VOC, and 120/81 metals in groundwater/surface water, respectively. Five groundwater samples from five locations had a VOC or metal concentration that exceeded an MCL or TRG. The results and relevant standards are tabulated in Table 3, listed by location and date sampled.

Table 3. 2012 Analytical Results of Groundwater Exceeding the MCL or TRG

Location	Date Sampled	Analyte	Result (mg/L)	MCL or TRG (mg/L)
SA1-3-H	18 April 2012	Arsenic	0.015	0.010
SA1-7-H	18 April 2012	Arsenic	0.014	0.010
SA4-5-L	16 April 2012	Barium	2.600	2.000
HM-3	16 April 2012	Chromium	0.110	0.100
HMH-5R	18 April 2012	Trichloroethene (TCE)	0.051	0.005

mg/L = milligrams per liter (1×10^{-3} gram per liter)

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[7] Resource Conservation and Recovery Act metals—arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury—plus antimony, beryllium, nickel, and zinc

[8] J-qualified means the result is between one- and three-times MDC.

[9] Data Validation assigns a "U" qualification when the result is less than three times the total propagated uncertainty.

The analytes listed in Table 3 were also present in concentrations above detection limits at the same five locations in 2011.

3.2 Contaminant Concentration Trends

Selected concentration trends through 2012 are plotted in Appendix C.

Tritium concentrations in groundwater are plotted in Figures C–1 through C–6. Tritium concentrations in surface waters are plotted in Figures C–7 through C–9.

The plots of tritium concentration in groundwater are grouped by location. Figure C–1 is a plot of tritium-concentration trends for the six of the seven aquifers above the salt dome at ground zero. Tritium-concentration trends in Alluvial Aquifer wells "near" and "far" from ground zero are plotted in Figures C–2 and C–3, respectively. The tritium-concentration trends in the Local Aquifer, Aquifer 3, and Aquifer 4 are displayed in Figures C–4 through C–6, respectively.

The tritium concentration trends in surface-water locations near ground zero, the REECo pit number 5 area, and boundary locations where creeks exit and enter are plotted in Figures C–7 through C–9, respectively.

Tritium detected in shallow well SA1-1-H is the largest tritium concentration above the MDC in 2012 (Appendix C, Figure C–2). The tritium concentration reported in 2012 is 30 percent less than the concentration reported in 2011.

Overall, the tritium concentration trends in groundwater and surface water are decreasing or at low concentrations.

The reported gamma-spectrometry results above MDCs may be the result of a more sensitive analysis by GEL Laboratories. Previously, no cesium-137 concentration has been reported in Salmon water samples.

Figures C–10 through C–16 show concentration trends of VOCs or metals that exceed the respective standards in 2012 or have exceeded the standards in the past.

Five groundwater samples contained concentrations of TCE or metals above MCLs in 2012 compared to six in 2011. In 2012, the TCE concentration in well SA1-1-H groundwater decreased to less than the MCL. TCE in well HMH-5R groundwater was 51 percent of the 100 µg/L reported in 2011. Concentrations of dichloroethene isomers, decreased in 2012. Previously, their concentrations were trending linearly toward the respective MCL, The trends are plotted in Figure C–17.

3.3 2011 Water-Level Measurements

Depth-to-water level in the onsite wells are measured quarterly. The Mississippi Department of Health, Division of Radiologic Health measures depth-to-water levels during the first, third, and fourth quarters. LM measures depth-to-water levels during the second quarter (Appendix A, Image A–8).

Quarterly water-level elevations (above mean sea level) for each well are tabulated in Appendix D, Table D–1 along with hydrographs for the Alluvial Aquifer, Local Aquifer, and Aquifer 3.

4.0 Recommendations

Review the sample analyses plan for 2013.

5.0 References

ASTM (American Society for Testing and Materials), 2007. “Standard Guide for Sampling Ground-Water Monitoring Wells,” D 4448–01, October.

DOE (U.S. Department of Energy), 2007. *Long-Term Surveillance and Maintenance Plan for the Salmon Site, Lamar County, Mississippi*, Draft, DOE-LM/1447-2007, Office of Legacy Management, Grand Junction, Colorado, April.

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Appendix A

Selected 2012 Images

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Image A–1. Removing the original bronze plaque from the ground-zero monument.

Image A–2. Installing the new bronze plaque on the monument.

Image A–3. Sealing a sample container of water collected from well HM-3. In the background, the technician is working on sample chain-of-custody paperwork for the analytical laboratory. Clean gloves are worn so as not to contaminate the sample.

Image A–4. Recording field measurements (pH, specific conductance, and temperature) made on a surface-water sample collected from Half Moon Creek where it enters the site from the south.

Image A–5. A videocamera is set up for filming interviews by WDAM-TV, Hattiesburg, Mississippi. Left to right are Mon Musfiett (cameraman, WDAM-TV), Ashley Surlea (reporter, WDAM-TV), and Karl Barber (Mississippi Department of Health Radiologic Health Division).

Image A–6. Ashley Surlea interviews Art Kleinrath (DOE Office of Legacy Management) on camera.

Image A–7. A surface-water sample is collected from a seep in REECo Pit #5.

Image A–8. A depth-to-water-level measurement is made in well SA5-4-4.

Appendix B

2012 Analytical Laboratory Results

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Table B–1. Reported Tritium Concentrations Greater Than the Minimum Detectable Concentration (MDC) in Water Samples Collected during April 2012

Location	Date	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers
SA5-4-4	16-Apr-12	Enriched Tritium	2.48	pCi/L		J
SA1-2-H	16-Apr-12	Tritium	281	pCi/L		FJ
SA1-5-H	16-Apr-12	Enriched Tritium	110	pCi/L		F
SA1-1-H	16-Apr-12	Tritium	3240	pCi/L		F
HM-S	17-Apr-12	Tritium	294	pCi/L		FJ
HM-1	17-Apr-12	Enriched Tritium	5.83	pCi/L		FJ
HM-L	17-Apr-12	Tritium	606	pCi/L		FJ
HMH-5R	18-Apr-12	Tritium	847	pCi/L		F
HMH-16R	18-Apr-12	Enriched Tritium	14.3	pCi/L		FQ
SA1-7-H	18-Apr-12	Enriched Tritium	7.42	pCi/L		FJ
SA1-3-H	18-Apr-12	Tritium	301	pCi/L		FJ

Twenty-five percent of the samples submitted for tritium analysis are also analyzed by the enriched method.
The drinking water maximum contaminant level (MCL) is 20,000 pCi/L

Abbreviations:

pCi/L	picocurie per liter
F	Field sample collected by the low-flow method
J	Estimated value— the result is between one- and three- times the MDC
Q	Qualitative result due to well characteristics and/or sample collection conditions

Statistics:

11	Number of results greater than the MDC
0	Number of duplicates
11	Number of unique results
7	Number of qualified results (J)
1	Number of qualitative results (Q)
3	Number of quantitative results
10	Number of samples collected by the low-flow method (F)
1	Number of samples collected by a dedicated submersible pump

Table B–2. Reported VOC and Metal Concentrations Greater than Detection Limits in Groundwater Samples Collected during April 2012. Results greater than the MCL or TRG are in Bold.

Location	Date Sampled	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers	MCL or TRG
HM-3	4/16/2012	Antimony	0.000071	mg/L		F	
HM-L2	4/16/2012	Antimony	0.000093	mg/L		F	
SA1-2-H	4/16/2012	Antimony	0.000069	mg/L		F	
SA1-5-H	4/16/2012	Antimony	0.000026	mg/L	B	F	
SA4-5-L	4/16/2012	Antimony	0.00018	mg/L		FQ	
HM-L	4/17/2012	Antimony	0.000037	mg/L		F	
SA1-8-L	4/17/2012	Antimony	0.000013	mg/L	B	F	
SA2-2-L	4/17/2012	Antimony	0.00027	mg/L		FQ	
SA2-4-L	4/17/2012	Antimony	0.00005	mg/L		F	
HMH-16R	4/18/2012	Antimony	0.000014	mg/L	B	FQ	
HMH-5R (dup)	4/18/2012	Antimony	0.000014	mg/L	B	F	
HMH-5R	4/18/2012	Antimony	0.000063	mg/L		F	
SA1-3-H	4/18/2012	Antimony	0.000036	mg/L		F	
SA1-6-H	4/18/2012	Antimony	0.000088	mg/L		F	
SA1-7-H	4/18/2012	Antimony	0.000018	mg/L	B	F	
SA2-1-L	4/18/2012	Antimony	0.00017	mg/L		F	
HM-3	4/16/2012	Arsenic	0.00072	mg/L		F	
HM-L2	4/16/2012	Arsenic	0.000085	mg/L	B	UF	
SA1-1-H (dup)	4/16/2012	Arsenic	0.0044	mg/L		F	
SA1-1-H	4/16/2012	Arsenic	0.0045	mg/L		F	
SA1-2-H	4/16/2012	Arsenic	0.0016	mg/L		F	
SA1-5-H	4/16/2012	Arsenic	0.00053	mg/L		F	
SA4-5-L	4/16/2012	Arsenic	0.00021	mg/L		JFQ	
HM-L	4/17/2012	Arsenic	0.0012	mg/L		F	
HM-S	4/17/2012	Arsenic	0.00015	mg/L		JF	
SA1-8-L	4/17/2012	Arsenic	0.0032	mg/L		F	
SA2-2-L	4/17/2012	Arsenic	0.00037	mg/L		FQ	
SA2-4-L	4/17/2012	Arsenic	0.0099	mg/L		F	
HMH-16R	4/18/2012	Arsenic	0.00024	mg/L		JFQ	
HMH-5R (dup)	4/18/2012	Arsenic	0.004	mg/L		F	
HMH-5R	4/18/2012	Arsenic	0.004	mg/L		F	
SA1-12-H	4/18/2012	Arsenic	0.0002	mg/L		JF	
SA1-3-H	**4/18/2012**	**Arsenic**	**0.015**	**mg/L**		**F**	**0.01**
SA1-4-H	4/18/2012	Arsenic	0.00042	mg/L		F	
SA1-6-H	4/18/2012	Arsenic	0.000063	mg/L	B	UF	
SA1-7-H	**4/18/2012**	**Arsenic**	**0.014**	**mg/L**		**F**	**0.01**
SA2-1-L	4/18/2012	Arsenic	0.0088	mg/L		F	
SA3-4-H	4/18/2012	Arsenic	0.000075	mg/L	B	JF	
SA3-4-H (dup)	4/18/2012	Arsenic	0.000093	mg/L	B	UF	

Table B–2 (continued). Reported VOC and Metal Concentrations Greater than Detection Limits in Groundwater Samples Collected during April 2012. Results greater than the MCL or TRG are in Bold.

Location	Date Sampled	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers	MCL or TRG
HM-3	4/16/2012	Barium	0.15	mg/L		F	
HM-L2	4/16/2012	Barium	0.064	mg/L		F	
SA1-1-H (dup)	4/16/2012	Barium	0.32	mg/L		F	
SA1-1-H	4/16/2012	Barium	0.32	mg/L		F	
SA1-2-H	4/16/2012	Barium	0.085	mg/L		F	
SA1-5-H	4/16/2012	Barium	0.021	mg/L		F	
SA4-5-L	**4/16/2012**	**Barium**	**2.6**	**mg/L**		**FQ**	**2**
HM-L	4/17/2012	Barium	0.46	mg/L		F	
HM-S	4/17/2012	Barium	0.034	mg/L		F	
SA1-8-L	4/17/2012	Barium	0.21	mg/L		F	
SA2-2-L	4/17/2012	Barium	0.87	mg/L		FQ	
SA2-4-L	4/17/2012	Barium	0.1	mg/L		F	
HMH-16R	4/18/2012	Barium	0.39	mg/L		FQ	
HMH-5R	4/18/2012	Barium	0.12	mg/L		F	
HMH-5R (dup)	4/18/2012	Barium	0.13	mg/L		F	
SA1-12-H	4/18/2012	Barium	0.32	mg/L		F	
SA1-3-H	4/18/2012	Barium	0.077	mg/L		F	
SA1-4-H	4/18/2012	Barium	0.26	mg/L		F	
SA1-6-H	4/18/2012	Barium	0.016	mg/L	BE	JF	
SA1-7-H	4/18/2012	Barium	0.3	mg/L		F	
SA2-1-L	4/18/2012	Barium	0.056	mg/L		F	
SA3-4-H (dup)	4/18/2012	Barium	0.27	mg/L		F	
SA3-4-H	4/18/2012	Barium	0.27	mg/L		F	
SA1-2-H	4/16/2012	Benzene	0.31	µg/L	J	F	
HM-S	4/17/2012	Benzene	0.47	µg/L	J	F	
SA1-3-H	4/18/2012	Benzene	0.96	µg/L	J	F	
SA1-1-H	4/16/2012	Beryllium	0.00038	mg/L	B	F	
SA1-2-H	4/16/2012	Beryllium	0.00027	mg/L	B	F	
SA1-3-H	4/18/2012	Beryllium	0.00035	mg/L	B	F	
SA1-4-H	4/18/2012	Beryllium	0.0002	mg/L	B	F	
SA1-2-H	4/16/2012	Cadmium	0.000066	mg/L		F	
SA4-5-L	4/16/2012	Cadmium	0.000039	mg/L		FQ	
HM-L	4/17/2012	Cadmium	0.000015	mg/L	B	F	
HMH-16R	4/18/2012	Cadmium	0.00002	mg/L	B	FQ	
SA1-12-H	4/18/2012	Cadmium	0.000022	mg/L	B	F	
SA1-4-H	4/18/2012	Cadmium	0.00002	mg/L	B	F	
SA3-4-H	4/18/2012	Cadmium	0.000024	mg/L	B	F	
SA3-4-H (dup)	4/18/2012	Cadmium	0.000033	mg/L		F	
HM-3	**4/16/2012**	**Chromium**	**0.11**	**mg/L**		**F**	**0.1**
SA4-5-L	4/16/2012	Chromium	0.049	mg/L		FQ	

Table B–2 (continued). Reported VOC and Metal Concentrations Greater than Detection Limits in Groundwater Samples Collected during April 2012. Results greater than the MCL or TRG are in Bold.

Location	Date Sampled	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers	MCL or TRG
HM-L	4/17/2012	Chromium	0.0012	mg/L	B	F	
SA2-2-L	4/17/2012	Chromium	0.013	mg/L		FQ	
SA1-3-H	4/18/2012	Chromium	0.0029	mg/L	B	F	
HM-3	4/16/2012	Lead	0.00079	mg/L		F	
HM-L2	4/16/2012	Lead	0.00041	mg/L		F	
SA1-1-H	4/16/2012	Lead	0.000085	mg/L		JF	
SA1-1-H (dup)	4/16/2012	Lead	0.00024	mg/L		JF	
SA1-2-H	4/16/2012	Lead	0.000018	mg/L	B	UF	
SA1-5-H	4/16/2012	Lead	0.000097	mg/L		F	
SA4-5-L	4/16/2012	Lead	0.0051	mg/L		FQ	
HM-L	4/17/2012	Lead	0.000021	mg/L	B	UF	
HM-S	4/17/2012	Lead	0.000043	mg/L	B	F	
SA1-8-L	4/17/2012	Lead	0.000038	mg/L	B	F	
SA2-2-L	4/17/2012	Lead	0.0056	mg/L		FQ	
SA2-4-L	4/17/2012	Lead	0.000082	mg/L		F	
HMH-16R	4/18/2012	Lead	0.000012	mg/L	B	FQ	
HMH-5R (dup)	4/18/2012	Lead	0.000038	mg/L	B	UF	
HMH-5R	4/18/2012	Lead	0.00018	mg/L		F	
SA1-12-H	4/18/2012	Lead	0.000021	mg/L	B	UF	
SA1-3-H	4/18/2012	Lead	0.000039	mg/L	B	UF	
SA1-4-H	4/18/2012	Lead	0.000059	mg/L		UF	
SA1-6-H	4/18/2012	Lead	0.000053	mg/L		UF	
SA1-7-H	4/18/2012	Lead	0.000038	mg/L	B	UF	
SA2-1-L	4/18/2012	Lead	0.000061	mg/L		F	
SA3-4-H (dup)	4/18/2012	Lead	0.000024	mg/L	B	F	
HM-3	4/16/2012	Mercury	0.000012	mg/L	B	UF	
HM-L2	4/16/2012	Mercury	6.1E-06	mg/L	B	UF	
SA1-1-H (dup)	4/16/2012	Mercury	5.6E-06	mg/L	B	UF	
SA4-5-L	4/16/2012	Mercury	7.5E-06	mg/L	B	UFQ	
HM-L	4/17/2012	Mercury	0.000011	mg/L	B	UF	
HM-S	4/17/2012	Mercury	8.1E-06	mg/L	B	UF	
SA2-2-L	4/17/2012	Mercury	0.000014	mg/L	B	UFQ	
SA2-4-L	4/17/2012	Mercury	0.000011	mg/L	B	UF	
HMH-16R	4/18/2012	Mercury	0.000011	mg/L	B	UFQ	
HMH-5R (dup)	4/18/2012	Mercury	4.6E-06	mg/L	B	UF	
SA2-1-L	4/18/2012	Mercury	0.000014	mg/L	B	UF	
SA3-4-H	4/18/2012	Mercury	3.9E-06	mg/L	B	UF	
SA1-12-H	4/18/2012	Nickel	0.00099	mg/L	B	F	
HM-L2	4/16/2012	Selenium	0.000033	mg/L	B	F	
SA1-1-H (dup)	4/16/2012	Selenium	0.000066	mg/L	B	F	

Table B–2 (continued). Reported VOC and Metal Concentrations Greater than Detection Limits in Groundwater Samples Collected during April 2012. Results greater than the MCL or TRG are in Bold.

Location	Date Sampled	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers	MCL or TRG
SA1-1-H	4/16/2012	Selenium	0.000091	mg/L	B	F	
SA1-2-H	4/16/2012	Selenium	0.0001	mg/L	B	F	
SA1-5-H	4/16/2012	Selenium	0.00017	mg/L		F	
SA4-5-L	4/16/2012	Selenium	0.0002	mg/L		FQ	
HM-S	4/17/2012	Selenium	0.000074	mg/L	B	F	
SA2-2-L	4/17/2012	Selenium	0.00028	mg/L		FQ	
HMH-5R	4/18/2012	Selenium	0.000035	mg/L	B	F	
HMH-5R (dup)	4/18/2012	Selenium	0.000061	mg/L	B	F	
SA1-3-H	4/18/2012	Selenium	0.0002	mg/L		F	
SA1-7-H	4/18/2012	Selenium	0.00091	mg/L		F	
SA2-1-L	4/18/2012	Selenium	0.00013	mg/L		F	
SA3-4-H	4/18/2012	Selenium	0.000053	mg/L	B	F	
SA1-2-H (dup)	4/16/2012	Tetrachloroethene	0.21	µg/L	J	F	
SA1-2-H	4/16/2012	Tetrachloroethene	0.23	µg/L	J	F	
E-7	4/16/2012	Toluene	0.49	µg/L	J	F	
SA1-1-H (dup)	4/16/2012	Trichloroethene	2.1	µg/L		F	
SA1-1-H	4/16/2012	Trichloroethene	2.2	µg/L		F	
SA1-2-H (dup)	4/16/2012	Trichloroethene	1.3	µg/L		F	
SA1-2-H	4/16/2012	Trichloroethene	1.5	µg/L		F	
HM-S	4/17/2012	Trichloroethene	2.2	µg/L		F	
HMH-5R	**4/18/2012**	**Trichloroethene**	**51**	**µg/L**		**F**	**5**
HMH-5R (dup)	**4/18/2012**	**Trichloroethene**	**52**	**µg/L**		**F**	**5**
SA1-3-H	4/18/2012	Trichloroethene	1.9	µg/L		F	
SA1-3-H	4/18/2012	Vinyl chloride	1.1	µg/L		F	
HM-3	4/16/2012	Zinc	0.0016	mg/L	B	JF	
SA1-1-H (dup)	4/16/2012	Zinc	0.0013	mg/L	B	JF	
SA1-1-H	4/16/2012	Zinc	0.0038	mg/L	B	F	
SA1-5-H	4/16/2012	Zinc	0.0018	mg/L	B	JF	
SA4-5-L	4/16/2012	Zinc	0.19	mg/L		FQ	
SA1-8-L	4/17/2012	Zinc	0.04	mg/L		F	
SA2-2-L	4/17/2012	Zinc	0.0086	mg/L	B	FQ	
HMH-5R	4/18/2012	Zinc	0.0028	mg/L	B	JF	
SA1-1-H (dup)	4/16/2012	*cis*-1,2-Dichloroethene	6.7	µg/L		F	
SA1-1-H	4/16/2012	*cis*-1,2-Dichloroethene	7.2	µg/L		F	
SA1-2-H (dup)	4/16/2012	*cis*-1,2-Dichloroethene	6.7	µg/L		F	
SA1-2-H	4/16/2012	*cis*-1,2-Dichloroethene	6.9	µg/L		F	
SA1-5-H	4/16/2012	*cis*-1,2-Dichloroethene	8.1	µg/L		F	
HM-S	4/17/2012	*cis*-1,2-Dichloroethene	8.7	µg/L		F	
HMH-5R (dup)	4/18/2012	*cis*-1,2-Dichloroethene	29	µg/L		F	
HMH-5R	4/18/2012	*cis*-1,2-Dichloroethene	29	µg/L		F	

Table B–2 (continued). Reported VOC and Metal Concentrations Greater than Detection Limits in Groundwater Samples Collected during April 2012. Results greater than the MCL or TRG are in Bold.

Location	Date Sampled	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers	MCL or TRG
SA1-3-H	4/18/2012	*cis*-1,2-Dichloroethene	62	µg/L		F	
SA1-7-H	4/18/2012	*cis*-1,2-Dichloroethene	0.59	µg/L	J	F	
SA1-1-H (dup)	4/16/2012	*trans*-1,2-Dichloroethene	2.2	µg/L		F	
SA1-1-H	4/16/2012	*trans*-1,2-Dichloroethene	2.3	ug/Lµg/L		F	
SA1-2-H (dup)	4/16/2012	*trans*-1,2-Dichloroethene	1.8	µg/L		F	
SA1-2-H	4/16/2012	*trans*-1,2-Dichloroethene	2	µg/L		F	
SA1-5-H	4/16/2012	*trans*-1,2-Dichloroethene	2.1	µg/L		F	
HM-S	4/17/2012	*trans*-1,2-Dichloroethene	1.3	µg/L		F	
HMH-5R	4/18/2012	*trans*-1,2-Dichloroethene	3.4	µg/L		F	
HMH-5R (dup)	4/18/2012	*trans*-1,2-Dichloroethene	3.5	µg/L		F	
SA1-3-H	4/18/2012	*trans*-1,2-Dichloroethene	26	µg/L		F	

Results shown are greater than the detection limit of 5 times the reported concentration in the method blank

Abbreviations

dup	duplicate sample result
mg/L	milligrams per liter
µg/L	micrograms per liter
MCL:	maximum contaminant level set by the U.S. Environmental Protection Agency
TRG:	target remediation goal set by the State of Mississippi

Lab Qualifiers

B:	Inorganics analysis: Result is between the detection limit and contract required detection limit Organics analysis: Analyte was found in the method blank
E:	Estimated value due to interference
J:	Estimated value

Data Validation Qualifiers

F:	Field sample collected by the low-flow method
J:	Estimated value—the qualified result is less than 5-times the practical quantitation limit
Q:	Qualitative value due to the well characteristics and/or sample collection conditions
U:	Nonquantitative value — the result is less than three times the total propagated uncertainty

Statistics

170	Number of results greater than the detection limit
<u>26</u>	Number of duplicate results
144	Number of unique results greater than the detection limit
34	Number of VOC results greater than the detection limit

Table B–2 (continued). Reported VOC and Metal Concentrations Greater than Detection Limits in Groundwater Samples Collected during April 2012. Results greater than the MCL or TRG are in Bold.

10	Number of duplicate VOC results
24	Number of unique VOC results greater than the detection limit
136	Number of metal results greater than the detection limit
16	Number of duplicate metal results
120	Number of unique metal results greater than the detection limit
5	Number of results greater than the MCL or TRG
5	Number of locations with results greater than the detection limit
4	Number of analytes greater than the MCL or TRG

Table B-3. Reported Metal Concentrations Greater Than the Detection Limit in Surface-Water Samples Collected during April 2012

Location	Date Sampled	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers	MCL or TRG
Half Moon Ck Entry	4/17/2012	Antimony	0.000022	mg/L	B		
Half Moon Ck Exit	4/17/2012	Antimony	0.000027	mg/L	B		
Reeco Pit (A)	4/17/2012	Antimony	0.000091	mg/L			
Reeco Pit (B)	4/17/2012	Antimony	0.000043	mg/L			
Reeco Pit (C)	4/17/2012	Antimony	0.00005	mg/L			
Grantham Ck Entry	4/18/2012	Antimony	0.000016	mg/L	B		
HALFMOON CREEK	4/18/2012	Antimony	0.000022	mg/L	B		
HALFMOONCRKOVERFLOW	4/18/2012	Antimony	0.000068	mg/L			
Hick Hollow Ck Entry	4/18/2012	Antimony	0.000017	mg/L	B		
HickHCrTSD-East	4/18/2012	Antimony	0.000016	mg/L	B		
Pond West of GZ	4/18/2012	Antimony	0.000091	mg/L			
Half Moon Ck Entry	4/17/2012	Arsenic	0.00036	mg/L			
Half Moon Ck Exit	4/17/2012	Arsenic	0.00035	mg/L			
Reeco Pit (A)	4/17/2012	Arsenic	0.00069	mg/L			
Reeco Pit (B)	4/17/2012	Arsenic	0.00086	mg/L			
Reeco Pit (C)	4/17/2012	Arsenic	0.00066	mg/L			
Grantham Ck Entry	4/18/2012	Arsenic	0.00041	mg/L			
HALFMOON CREEK	4/18/2012	Arsenic	0.00041	mg/L			
HALFMOONCRKOVERFLOW	4/18/2012	Arsenic	0.0014	mg/L			
Hick Hollow Ck Entry	4/18/2012	Arsenic	0.00024	mg/L			
HickHCrTSD-East	4/18/2012	Arsenic	0.00019	mg/L			
Pond West of GZ	4/18/2012	Arsenic	0.005	mg/L			
Half Moon Ck Entry	4/17/2012	Barium	0.048	mg/L			
Half Moon Ck Exit	4/17/2012	Barium	0.046	mg/L			
Reeco Pit (A)	4/17/2012	Barium	0.04	mg/L			
Reeco Pit (B)	4/17/2012	Barium	0.031	mg/L			
Reeco Pit (C)	4/17/2012	Barium	0.028	mg/L			
Grantham Ck Entry	4/18/2012	Barium	0.034	mg/L			
HALFMOON CREEK	4/18/2012	Barium	0.042	mg/L			
HALFMOONCRKOVERFLOW	4/18/2012	Barium	0.096	mg/L			
Hick Hollow Ck Entry	4/18/2012	Barium	0.026	mg/L			
HickHCrTSD-East	4/18/2012	Barium	0.028	mg/L			
Pond West of GZ	4/18/2012	Barium	0.075	mg/L			
Half Moon Ck Entry	4/17/2012	Cadmium	0.000025	mg/L	B		
Half Moon Ck Exit	4/17/2012	Cadmium	0.000017	mg/L	B		
Reeco Pit (A)	4/17/2012	Cadmium	0.000038	mg/L			
Reeco Pit (B)	4/17/2012	Cadmium	0.000029	mg/L	B		
Reeco Pit (C)	4/17/2012	Cadmium	0.000029	mg/L	B		
HALFMOON CREEK	4/18/2012	Cadmium	0.000027	mg/L	B		

Table B-3 (continued). Reported Metal Concentrations Greater Than the Detection Limit in Surface-Water Samples Collected during April 2012

Location	Date Sampled	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers	MCL or TRG
HALFMOONCRKOVERFLOW	4/18/2012	Cadmium	0.000034	mg/L			
Hick Hollow Ck Entry	4/18/2012	Cadmium	0.000013	mg/L	B		
Pond West of GZ	4/18/2012	Cadmium	0.000032	mg/L			
Half Moon Ck Entry	4/17/2012	Chromium	0.00061	mg/L	B		
Reeco Pit (A)	4/17/2012	Chromium	0.00073	mg/L	B		
Reeco Pit (B)	4/17/2012	Chromium	0.0019	mg/L	B	J	
Reeco Pit (C)	4/17/2012	Chromium	0.0017	mg/L	B	J	
HALFMOONCRKOVERFLOW	4/18/2012	Chromium	0.0034	mg/L	B		
Pond West of GZ	4/18/2012	Chromium	0.0035	mg/L	B		
Half Moon Ck Entry	4/17/2012	Lead	0.00052	mg/L			
Half Moon Ck Exit	4/17/2012	Lead	0.0005	mg/L			
Reeco Pit (A)	4/17/2012	Lead	0.00027	mg/L			
Reeco Pit (B)	4/17/2012	Lead	0.00054	mg/L			
Reeco Pit (C)	4/17/2012	Lead	0.00052	mg/L			
Grantham Ck Entry	4/18/2012	Lead	0.00028	mg/L			
HALFMOON CREEK	4/18/2012	Lead	0.00039	mg/L			
HALFMOONCRKOVERFLOW	4/18/2012	Lead	0.00042	mg/L			
Hick Hollow Ck Entry	4/18/2012	Lead	0.0001	mg/L			
HickHCrTSD-East	4/18/2012	Lead	0.00015	mg/L			
Pond West of GZ	4/18/2012	Lead	0.0012	mg/L			
HALFMOON CREEK	4/18/2012	Mercury	0.000018	mg/L	B		
Pond West of GZ	4/18/2012	Mercury	8.2E-06	mg/L	B		
Half Moon Ck Entry	4/17/2012	Selenium	0.00016	mg/L			
Half Moon Ck Exit	4/17/2012	Selenium	0.00012	mg/L			
Reeco Pit (A)	4/17/2012	Selenium	0.00012	mg/L			
Reeco Pit (B)	4/17/2012	Selenium	0.00013	mg/L			
Reeco Pit (C)	4/17/2012	Selenium	0.00013	mg/L			
Grantham Ck Entry	4/18/2012	Selenium	0.00013	mg/L			
HALFMOON CREEK	4/18/2012	Selenium	0.00013	mg/L			
HALFMOONCRKOVERFLOW	4/18/2012	Selenium	0.00022	mg/L			
Hick Hollow Ck Entry	4/18/2012	Selenium	0.000086	mg/L	B		
HickHCrTSD-East	4/18/2012	Selenium	0.000053	mg/L	B		
Pond West of GZ	4/18/2012	Selenium	0.00036	mg/L			
Half Moon Ck Entry	4/17/2012	Zinc	0.0024	mg/L	B	J	
Half Moon Ck Exit	4/17/2012	Zinc	0.0015	mg/L	B	J	
Reeco Pit (A)	4/17/2012	Zinc	0.0059	mg/L	B		
Reeco Pit (B)	4/17/2012	Zinc	0.0035	mg/L	B	J	
Reeco Pit (C)	4/17/2012	Zinc	0.0018	mg/L	B	J	
HALFMOON CREEK	4/18/2012	Zinc	0.0011	mg/L	B	J	
HALFMOONCRKOVERFLOW	4/18/2012	Zinc	0.0024	mg/L	B	J	

Table B-3 (continued). Reported Metal Concentrations Greater Than the Detection Limit in Surface-Water Samples Collected during April 2012

Location	Date Sampled	Analyte	Result	Units	Lab Qualifiers	Data Validation Qualifiers	MCL or TRG
HickHCrTSD-East	4/18/2012	Zinc	0.0011	mg/L	B	J	
Pond West of GZ	4/18/2012	Zinc	0.004	mg/L	B		

Abbreviations

mg/L	milligrams per liter

Lab Qualifiers

B:	The result is between the inorganic detection limit and contract required detection limit

Data Validation Qualifiers

J:	Estimated value----the qualified result is less than five-times the practical quantitation limit

Statistics

81	Number of metal results greater than the detection limit
0	Number of duplicate results
81	Number of unique metal results greater than the detection limit
0	Number of results greater than the MCL or TRG

Table B–4. Gamma-Emitting Isotopes Greater Than the MDC as Reported by Gamma Spectroscopy of Water Samples Collected during April 2012.

Location	Date Sampled	Analyte	Result	One Standard Deviation	Minimum Detectable Concentration	Units	Lab Qualifiers	Data Validation Qualifiers
HM-3	4/16/2012	Lead-212	7.42	3.00	5.33	pCi/L		UF
SA4-5-L	4/16/2012	Potassium-40	61.1	18.45	31.3	pCi/L		FQJ
SA2-4-L	4/17/2012	Cesium-137	4.43	1.36	3.82	pCi/L		FJ

Abbreviations

pCi/L	picocuries per liter

Data Validation Qualifiers

F:	Field sample collected by the low-flow method
J:	Qualified value—the qualified result is between one- and 3-times the MDC
Q:	Qualitative value due to the well characteristics and/or sample collection conditions
U:	Nonquantitative value—the result is less than 3 times the total propagated uncertainty

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Appendix C

Concentration Trend Plots

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Preface

Inspection of radioactivity trends in Salmon site surface water and groundwater begins with the application of standard statistical and best-practice principles to sort the reported results that are meaningful—quantitative results—from those that are not.

The analytical laboratory determines a minimum detectable concentration (MDC) for each radiometric concentration reported. If the reported concentration is less than the laboratory-calculated MDC, the laboratory assigns "U" to the concentration result, which signifies the concentration is not a quantifiable result. LM conducts a data validation process that re-examines the laboratory's assignment for qualifying conditions. The data validation process assigns "U" to the reported concentration when the value is determined to be less than three times the reported total propagated uncertainty (even though the laboratory may not have assigned "U" to the result). If the reported concentration is between one and three times the MDC, data validation assigns a "J" to signify a qualified quantitative-concentration result.

The tritium-concentration trend plots in this appendix are based on the laboratory's assignment. A hollow symbol indicates a nonquantitative result, and a solid symbol signifies a concentration greater than the MDC unless otherwise noted. Negative tritium concentrations are reported by the laboratory: these results are not physical. Only positive concentrations are plotted. This is why some data appear to be missing from the tritium trend plots.

The tritium concentration trends are plotted on a vertical logarithmic scale (concentration) versus a horizontal linear scale (time). Plotted this way, the concentration decay with time is a straight line with a characteristic slope unique to the decay half-life of tritium, 12.32 years. A calculated tritium decay example is plotted as a solid line for comparison. If the slope of the trend is steeper than the solid line, the tritium is decaying faster than the law of radioactive decay predicts. A steeper trend slope is likely due to a dilution contribution to the radioactive decay.

Tritium in fallout from atmospheric nuclear testing conducted during the cold war (Brown 1995) is plotted on the trend plots for comparison. Atmospheric nuclear testing ended with the signing of the limited Test Ban Treaty in 1963. The treaty was the catalyst for Project Dribble.

The method detection limit (MDL) is reported for each metal and volatile organic compound concentration analyzed: the uncertainty is not reported. Similar to the MDC process, the laboratory's classification process is to assign "U" if the reported result is less than the MDL. If between one and five times the MDL, the laboratory may add a qualifier for laboratory process reasons.

The concentration trends for metals and volatile organic compounds are displayed when a result has exceeded the MCL[10] at any time in past. If the result exceeded its MCL in 2012, a line is drawn thorough all the results for that sample point.

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[10] MCL is the maximum contaminant level established by EPA (EPA 2011) for drinking water.

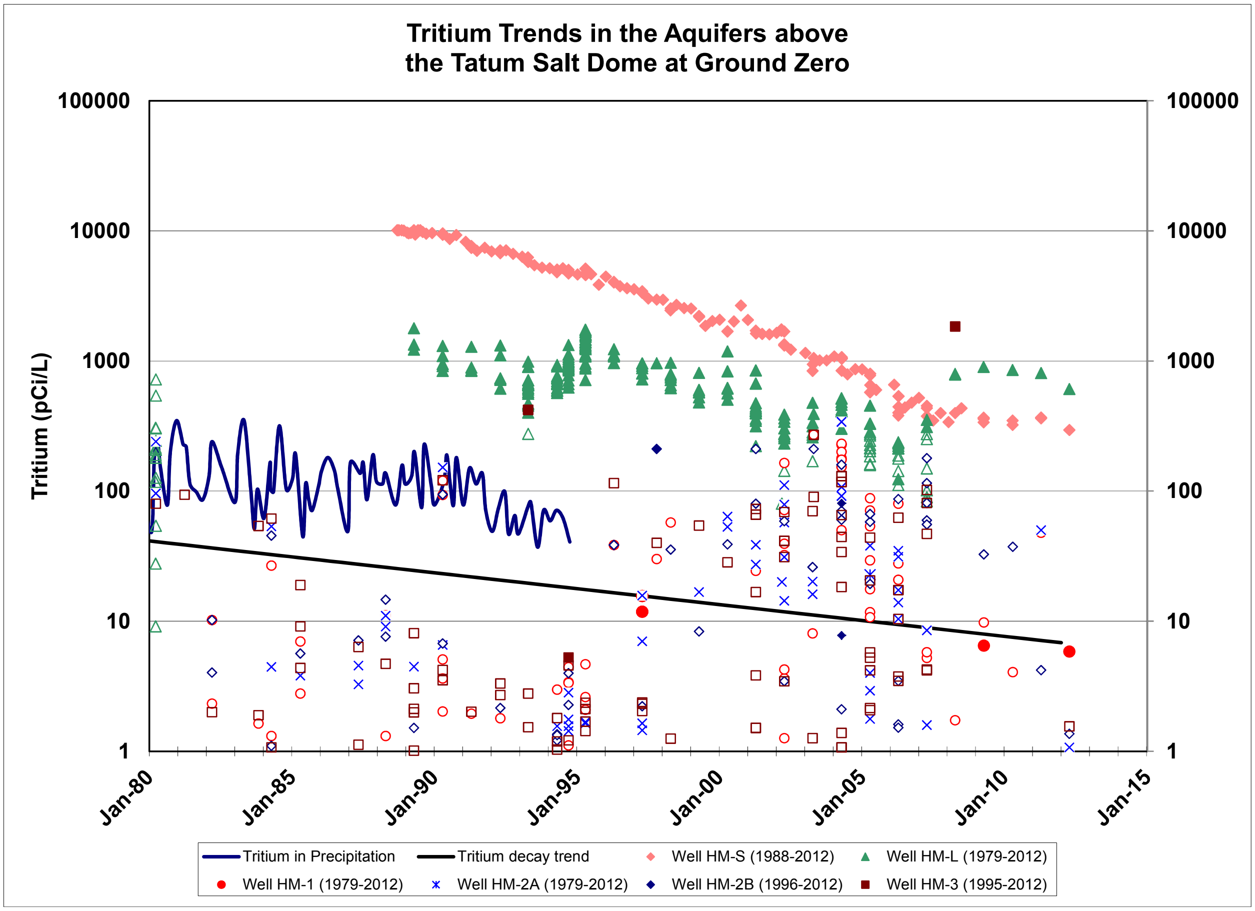

Figure C–1. Tritium concentration trends through 2012 in the aquifers above the Tatum Salt Dome are displayed. The legend lists wells by increasing depth below the surface (left-to-right, by row) starting with the Alluvial Aquifer, the shallowest aquifer. For well HM-2A, "x" represents a nonquantitative value, and "+" superimposed on "x" is a quantitative concentration. The April 2008 tritium concentrations reported for wells HM-3 and HM-2B (obscured) are outliers.

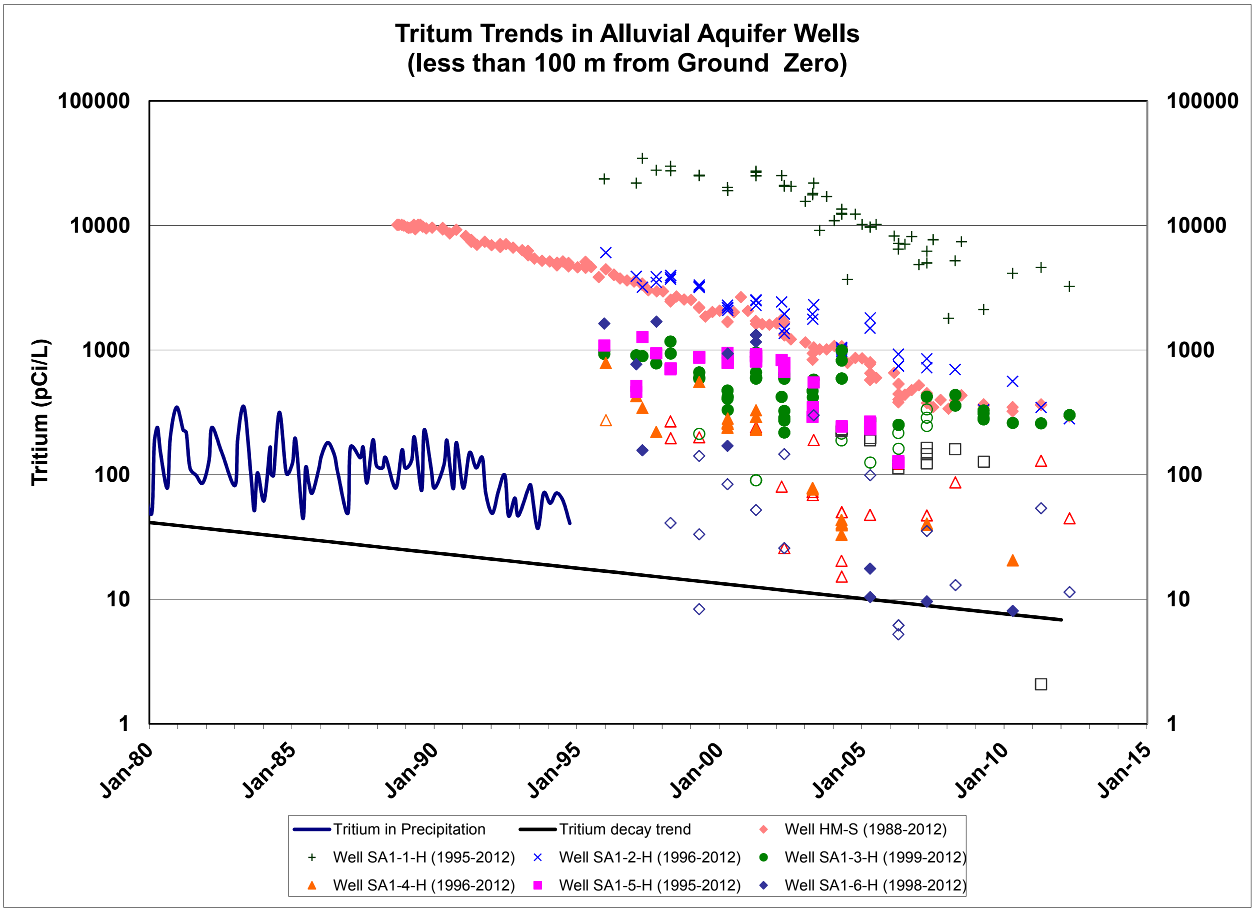

Figure C–2. Tritium concentration trends through 2012 in seven groundwater wells in the Alluvial Aquifer are displayed. The wells are within 100 m of ground zero. All tritium concentrations detected in wells SA1-1-H and SA1-2-H are quantitative and designated by point symbols, "+" and "x", respectively.

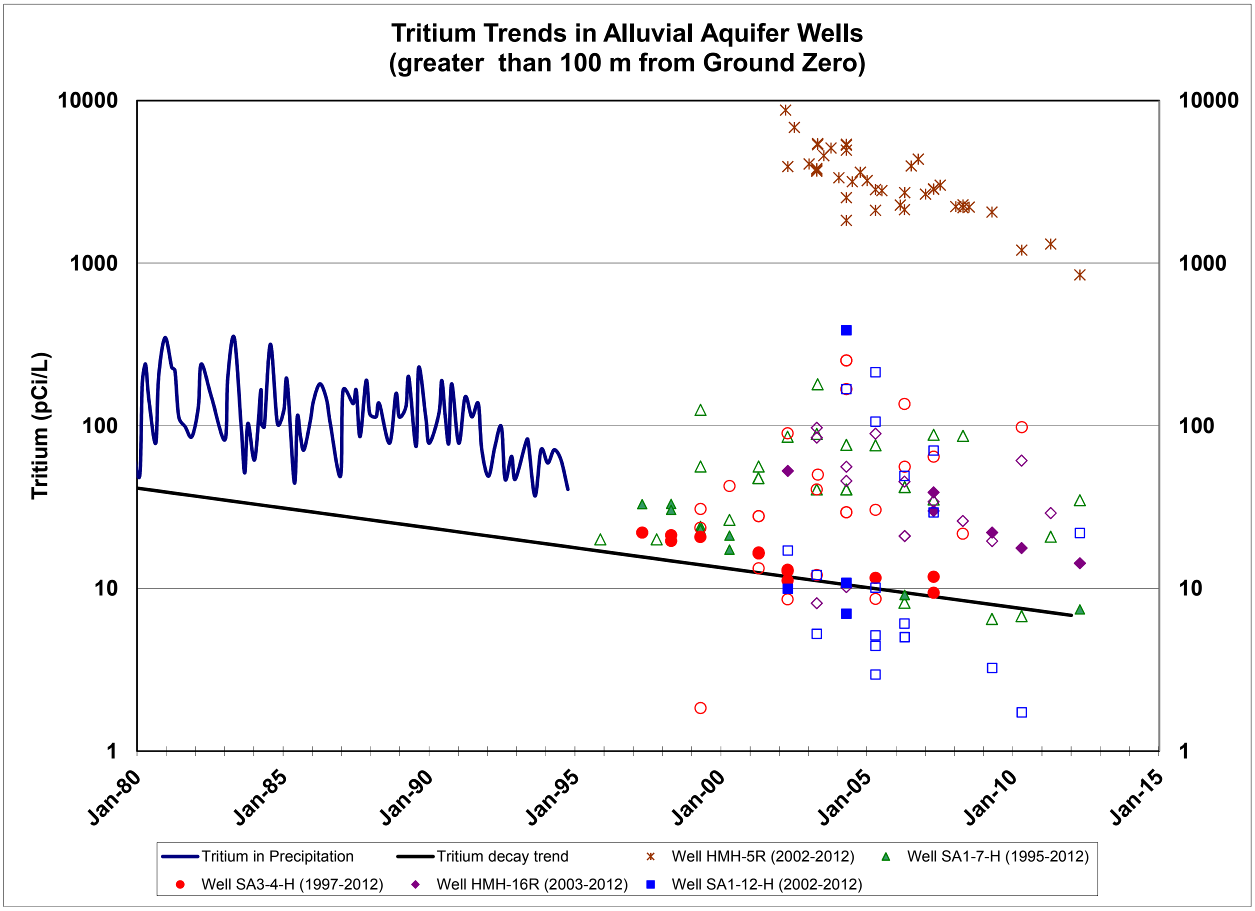

Figure C–3. Tritium concentration trends through 2012 in Alluvial Aquifer wells are displayed. The wells, greater than 100 meters from ground zero are ordered (left-to-right, by row) in the legend by increasing distance from ground zero. All tritium results reported for well HMH-5R groundwater are quantitative.

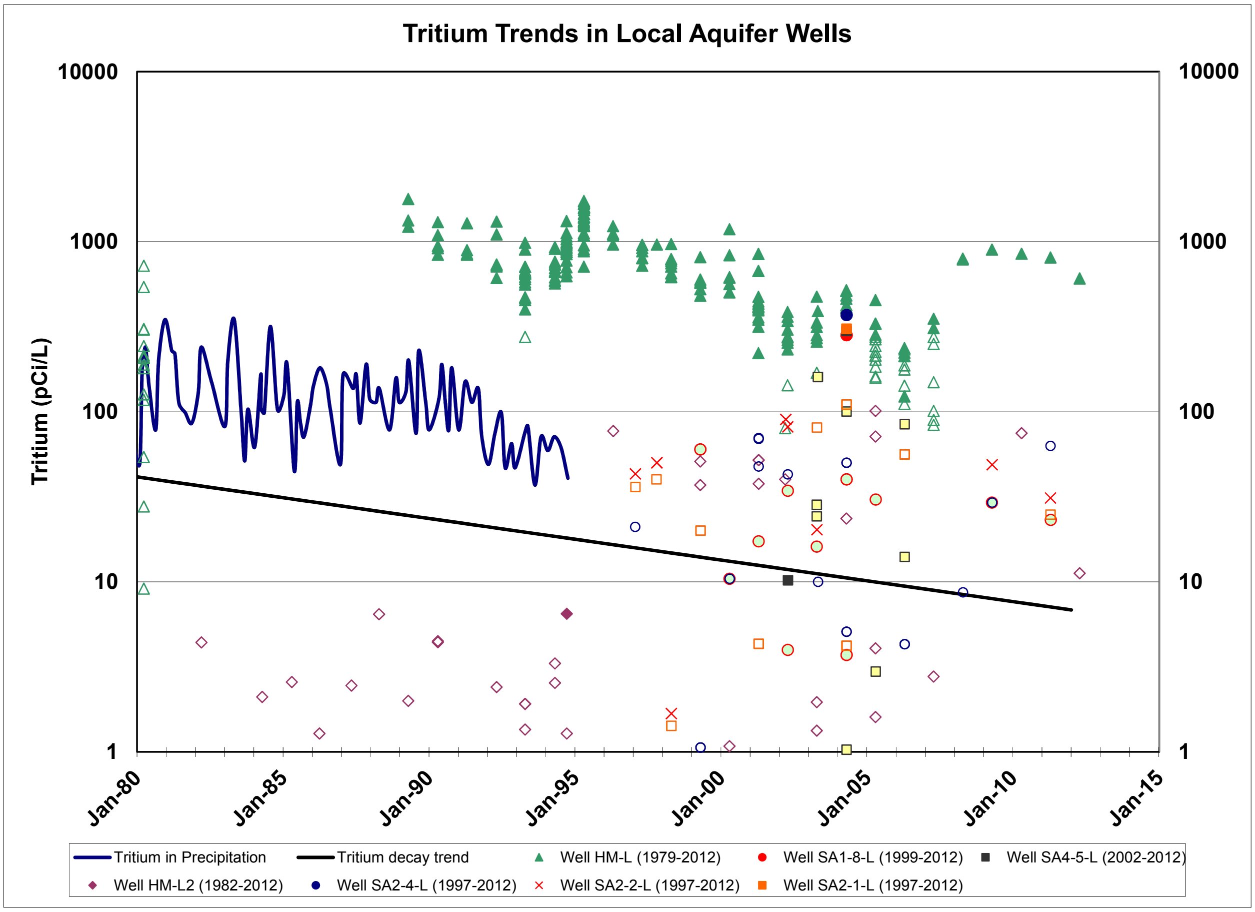

Figure C–4. Tritium concentration trends through 2012 in the seven wells that monitor the Local Aquifer are displayed. No result reported for well SA2-2-L is quantitative: all results are plotted with the "x" symbol.

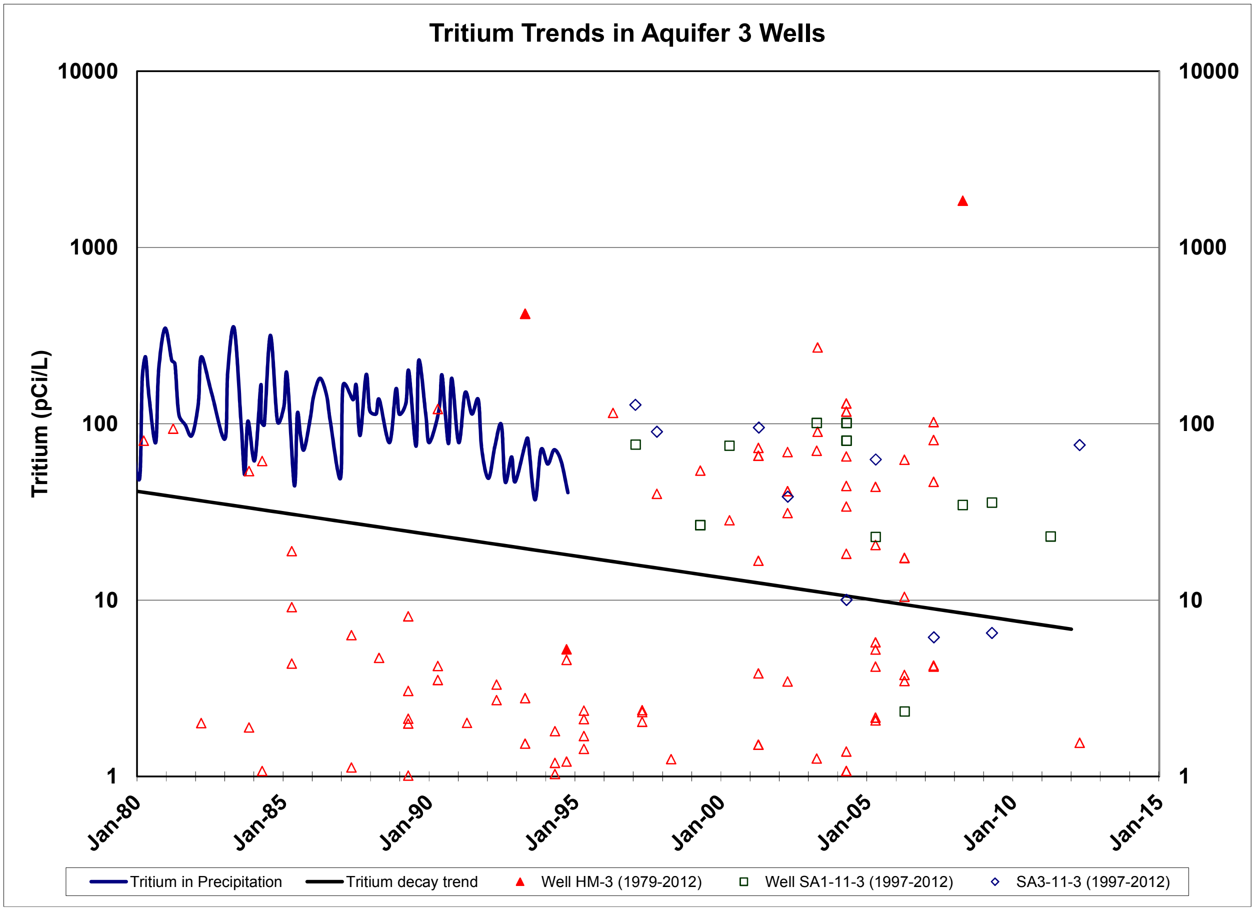

Figure C–5. Tritium concentration trends through 2012 in the three wells that monitor Aquifer 3 are displayed. Results in Aquifer 3 are not quantitative except for three concentrations reported for well HM-3 (in 1993, 1994, and 2008).

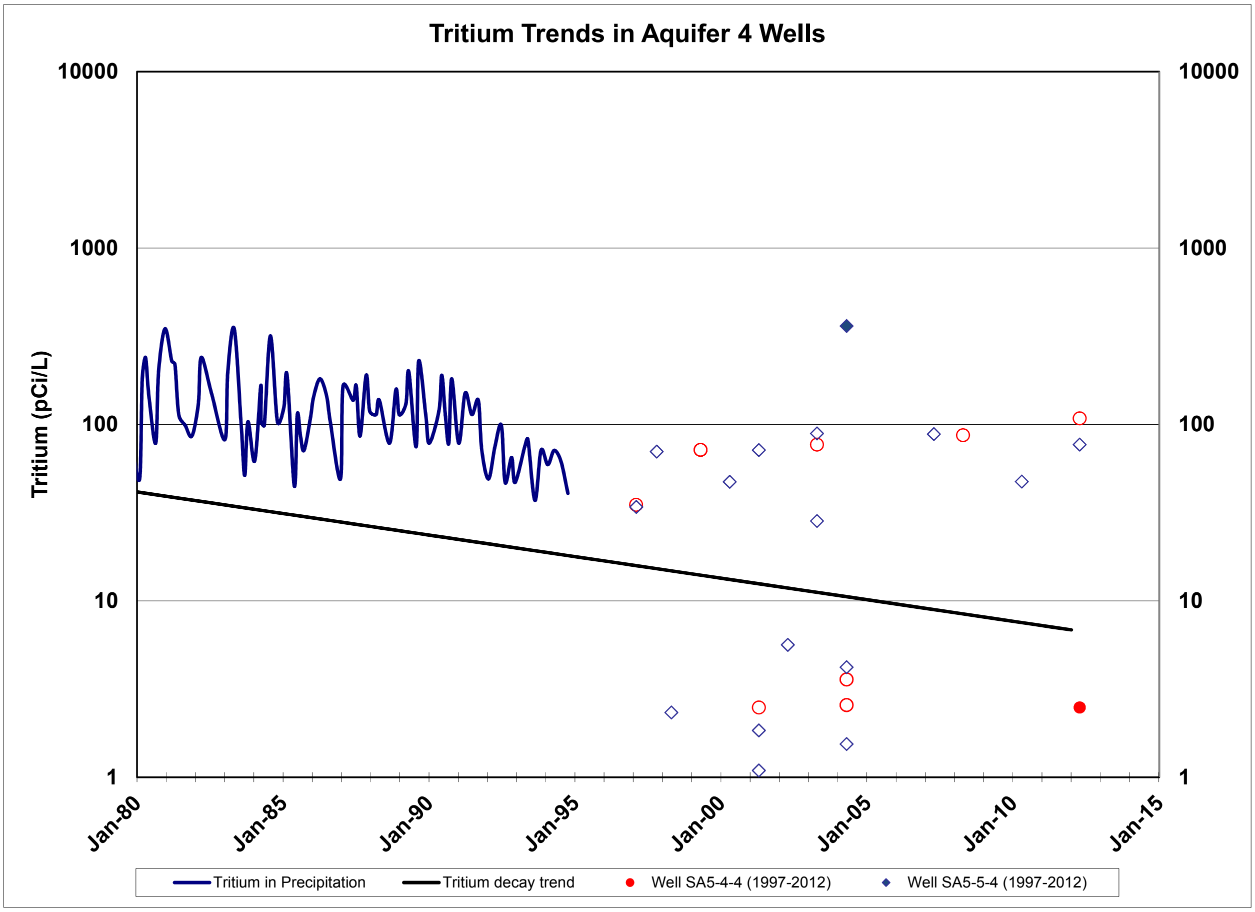

Figure C–6. Tritium concentration trends through 2012 in two wells in Aquifer 4 are displayed.

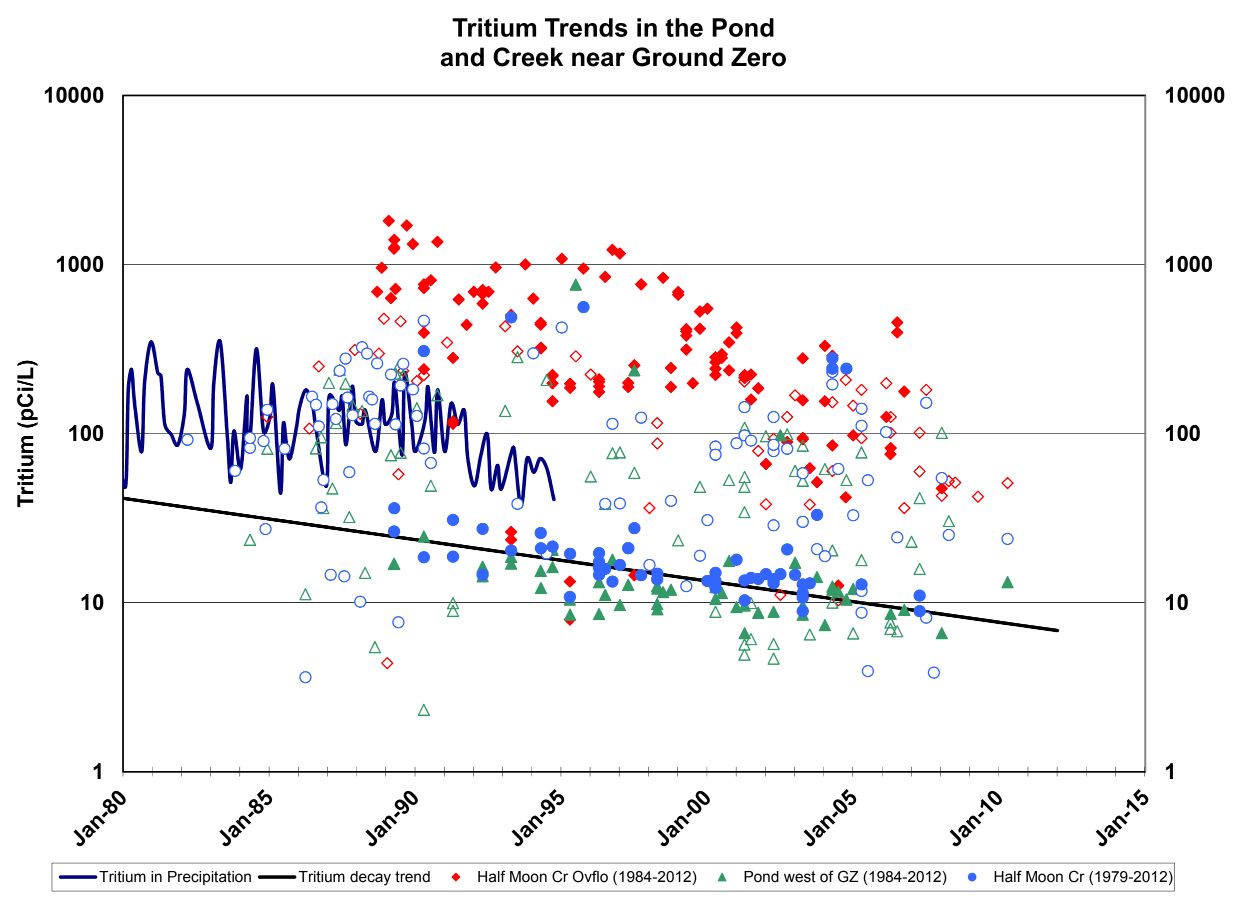

Figure C–7. Tritium concentration trends through 2012 in surface water samples collected from the pond and creek overflow near ground zero and the creek at a location downstream from ground zero.

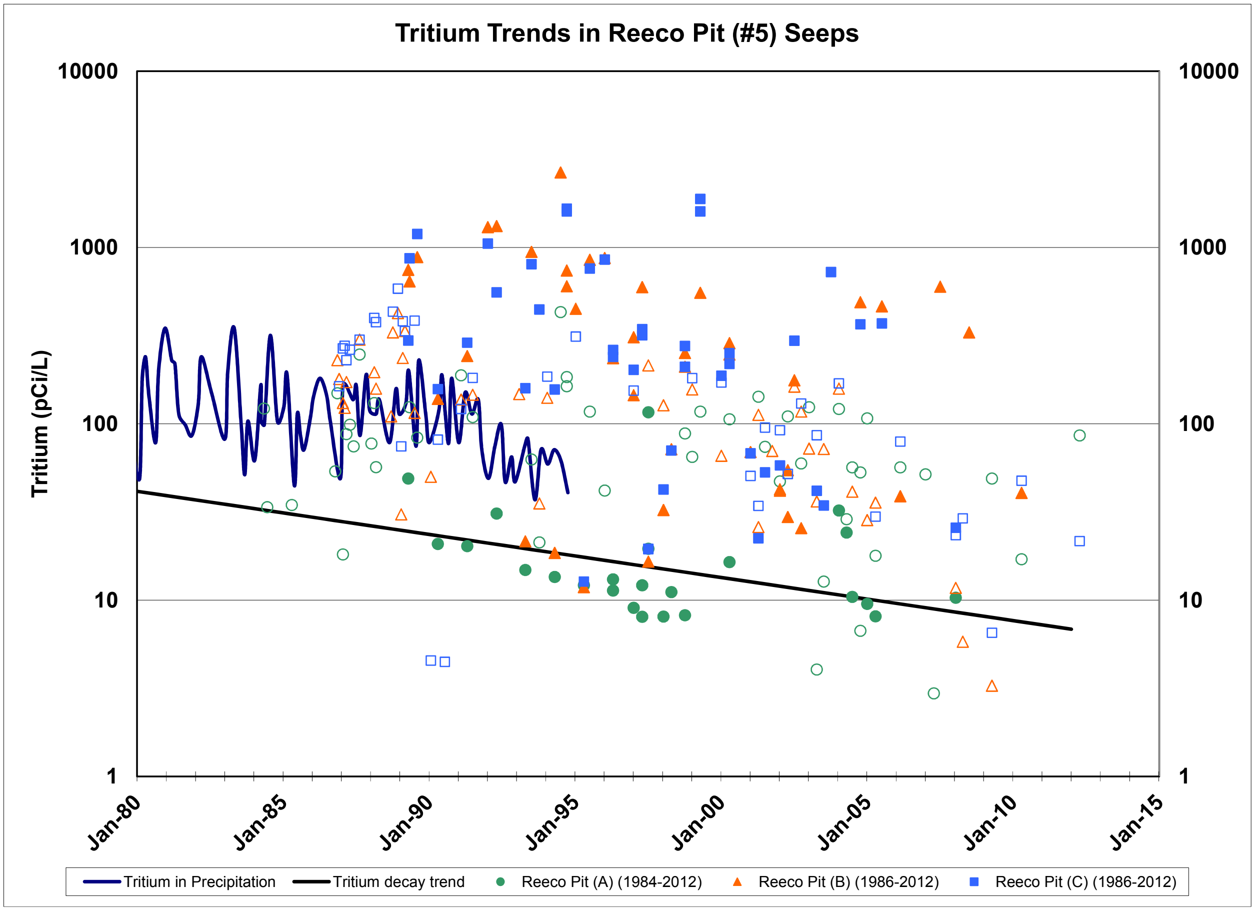

Figure C–8. Tritium concentration trends through 2012 in water samples collected from seeps in the area of Reeco Pit #5. Occasionally a seep does not flow water as in April 2011 when the seeps at (B) and (C) were dry.

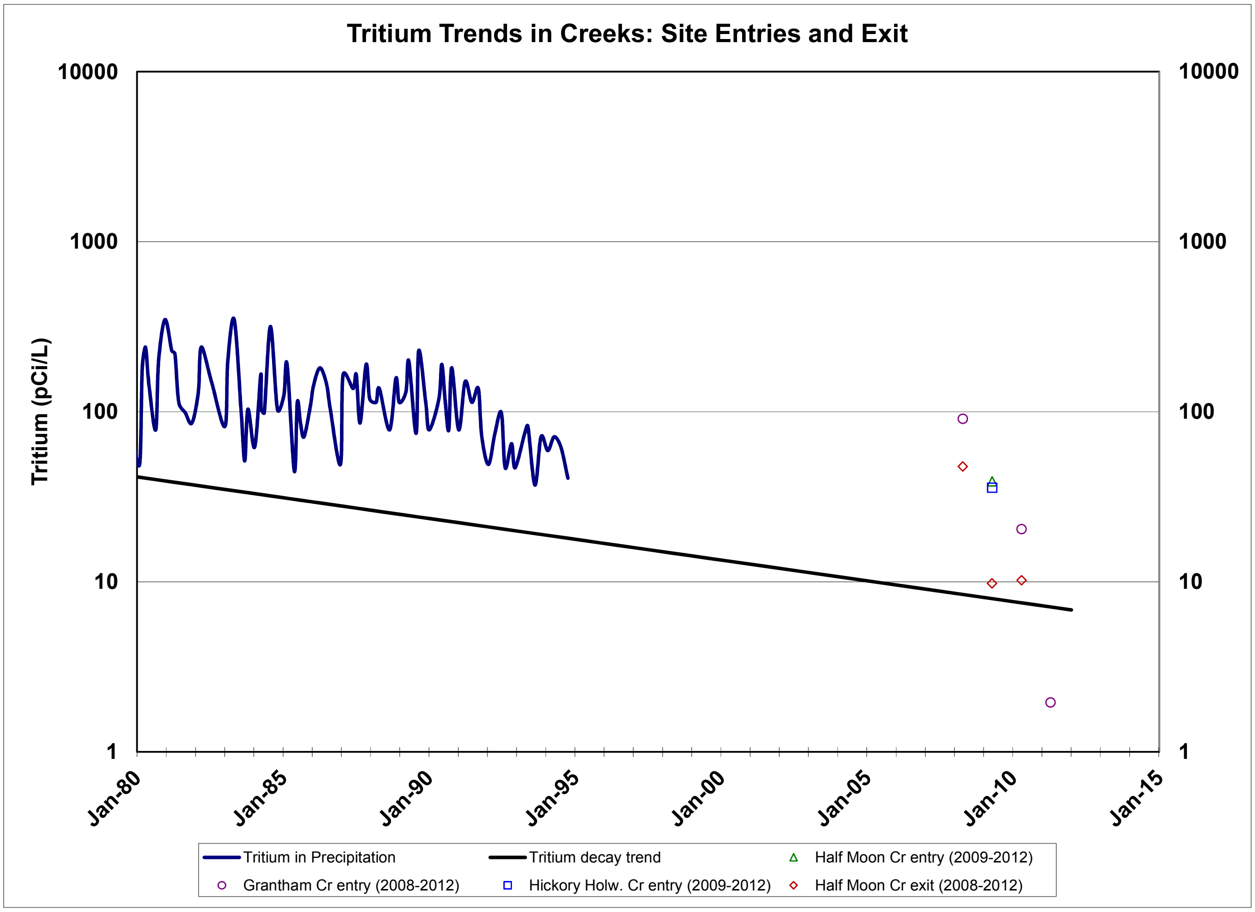

Figure C–9. Tritium concentration trends through 2012 at site-boundary locations where the creeks enter and leave the site.

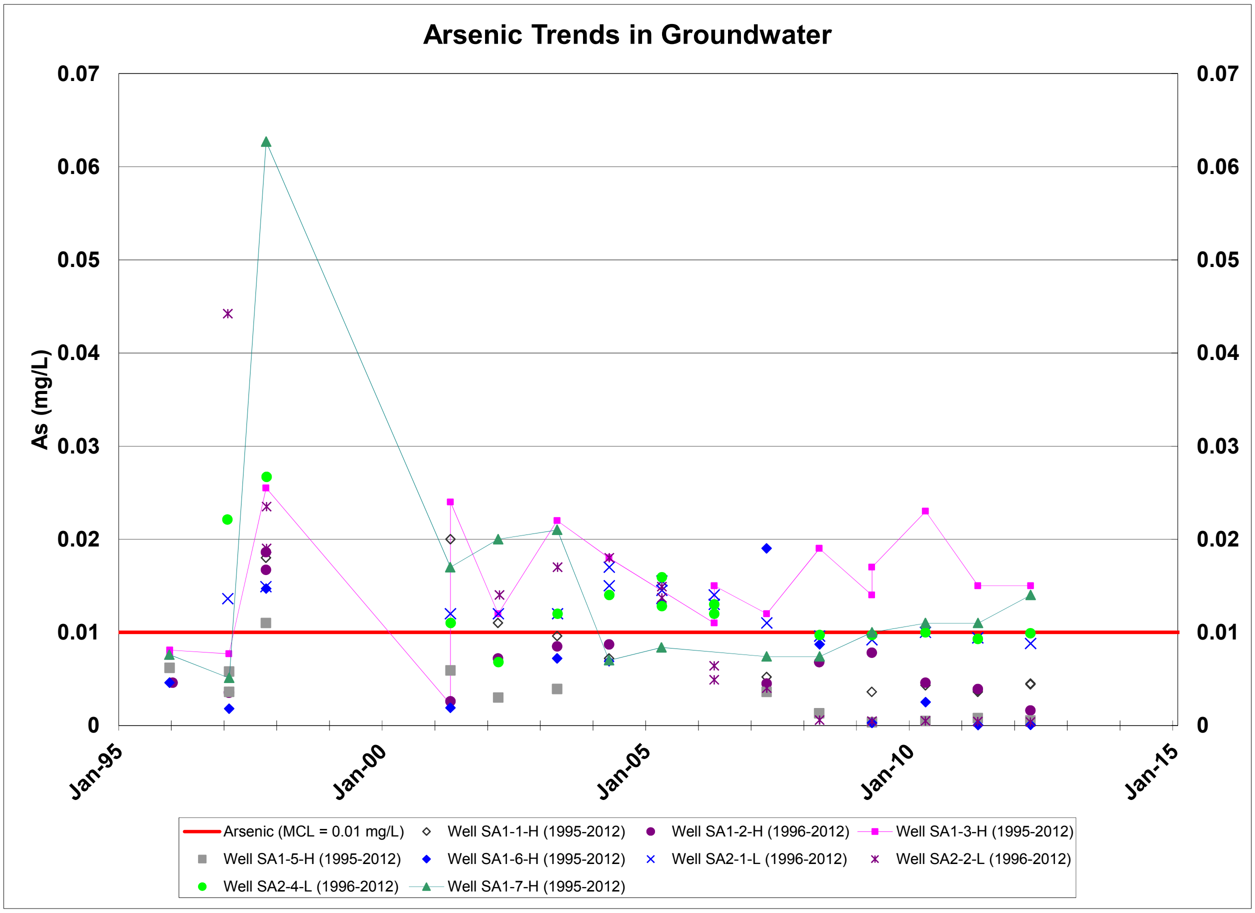

Figure C–10. Arsenic reported through 2012 in groundwater collected from onsite wells. Well names ending in "H" are in the Alluvial Aquifer; wells ending in "L" are in the Local Aquifer.

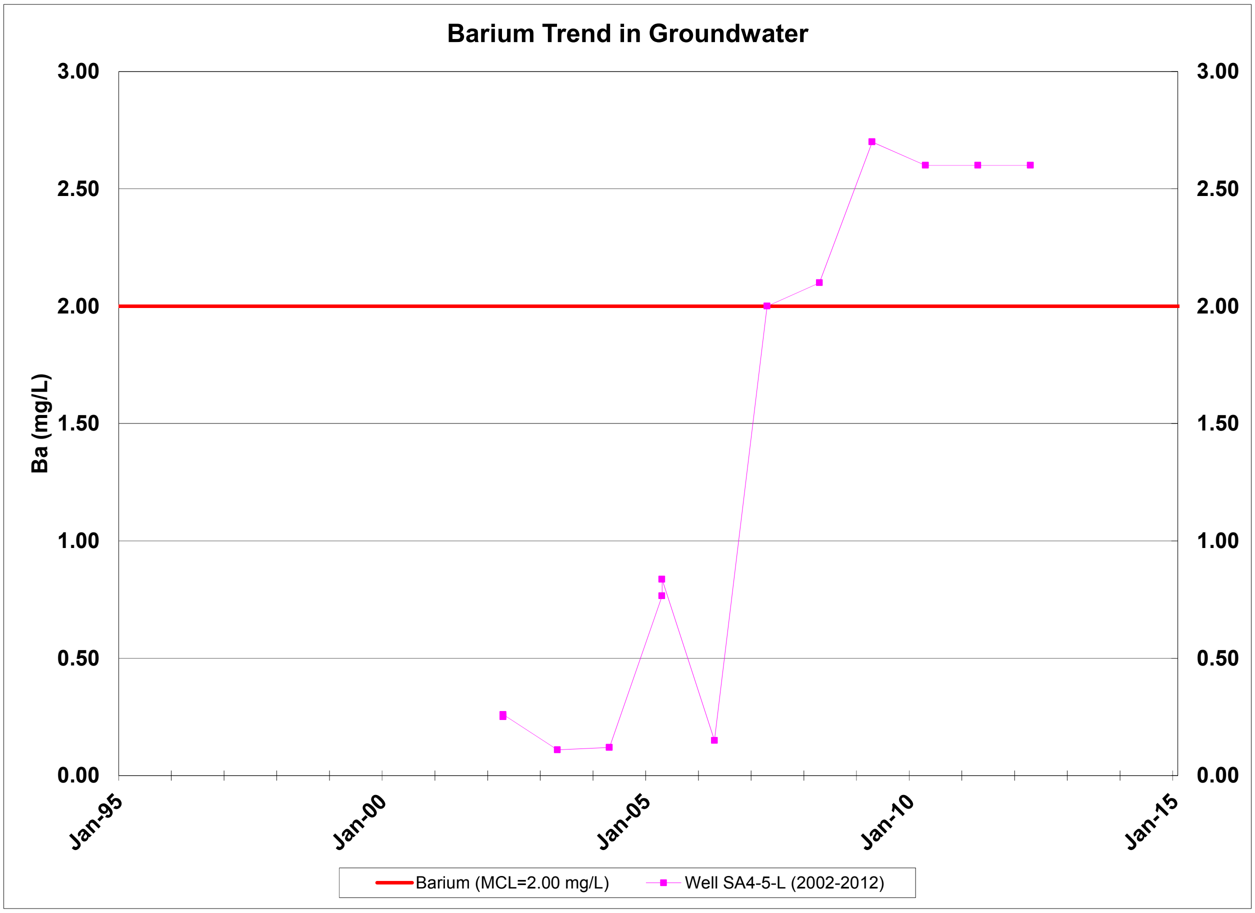

Figure C–11. Barium reported through 2012 in groundwater collected from well SA4-5-L. This is the only well in which barium is detected above the MCL.

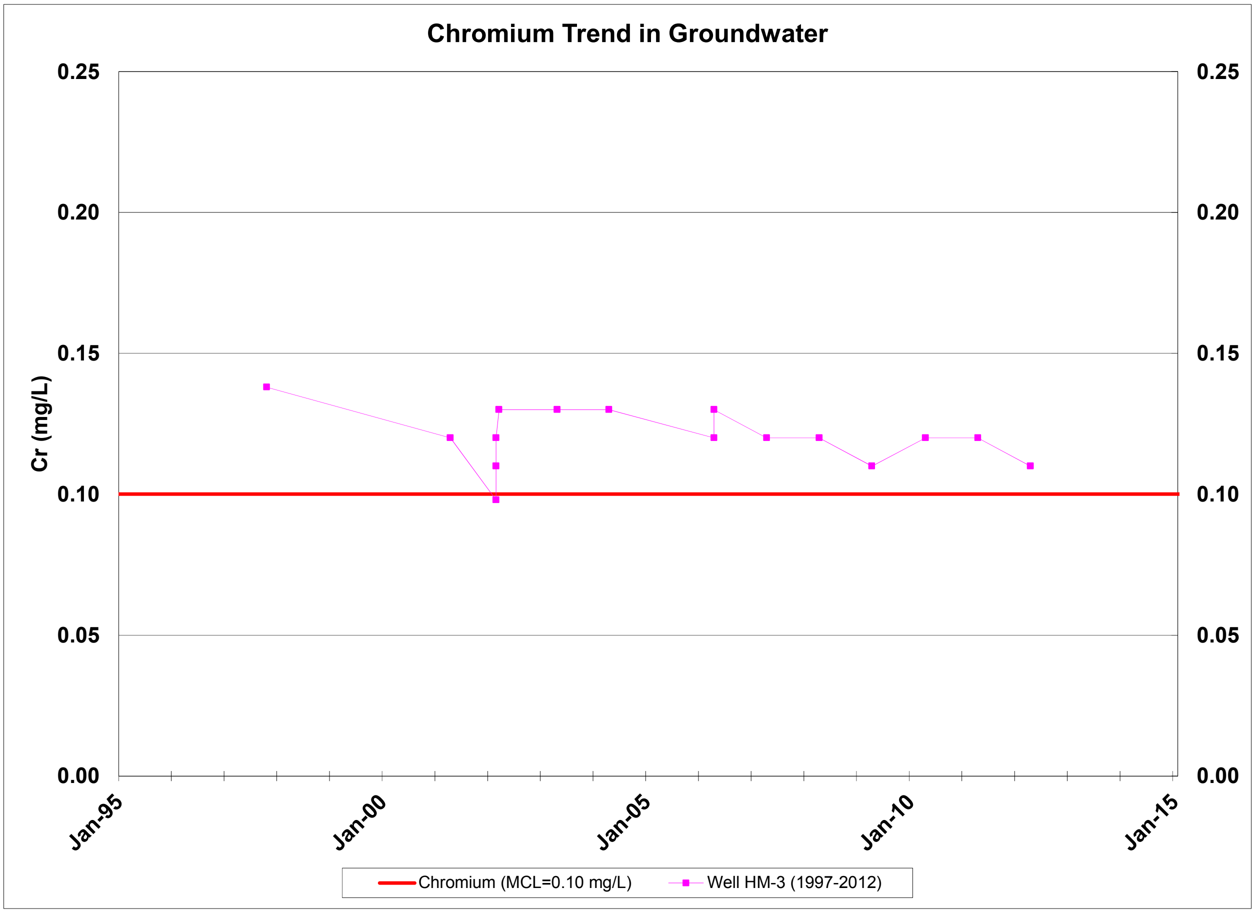

Figure C–12. Chromium reported through 2012 in groundwater collected from well HM-3. This is the only well chromium has been detected above the MCL. Prior to 1997, the laboratory's reported detection limit for chromium was greater than the MCL.

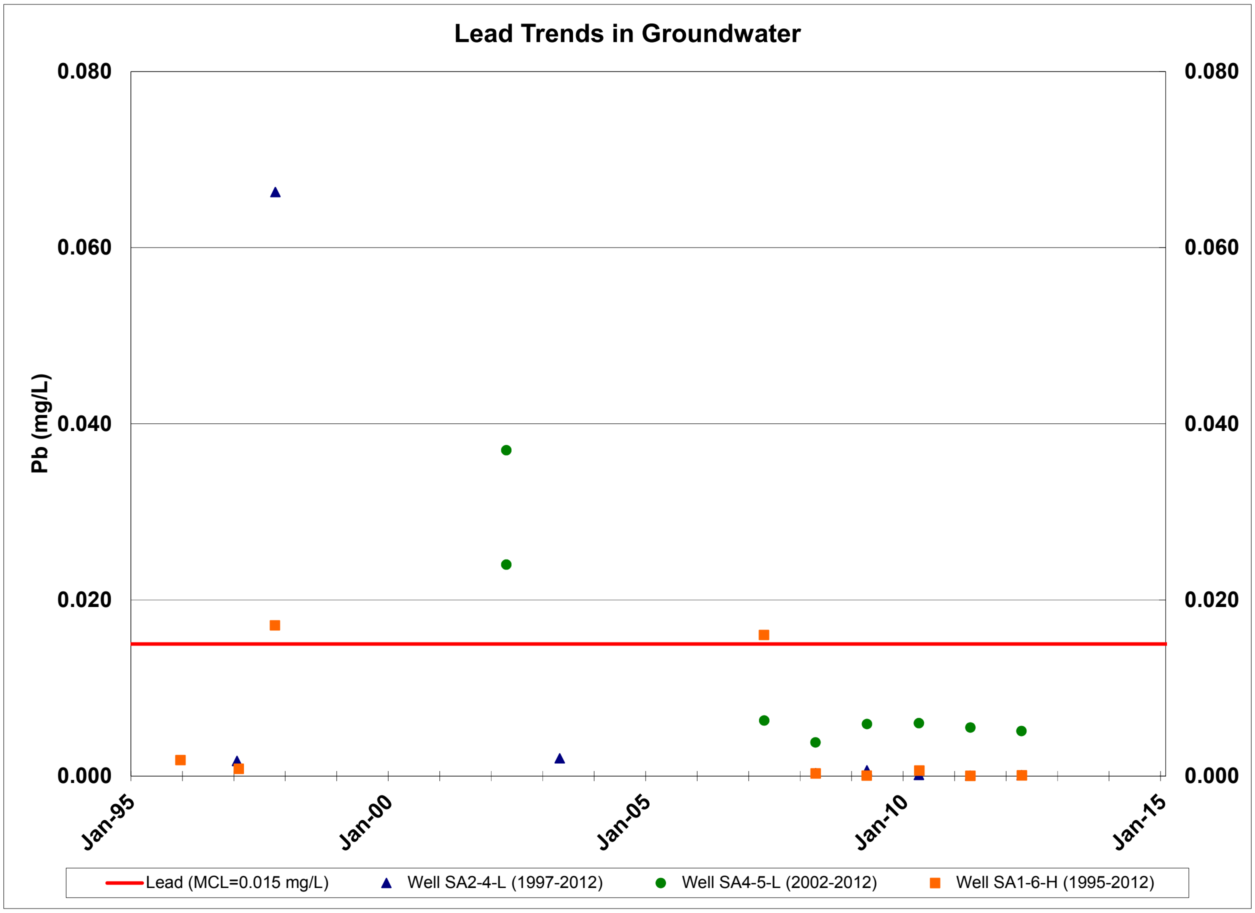

Figure C–13. Lead reported through 2012 in groundwater collected from three onsite wells.

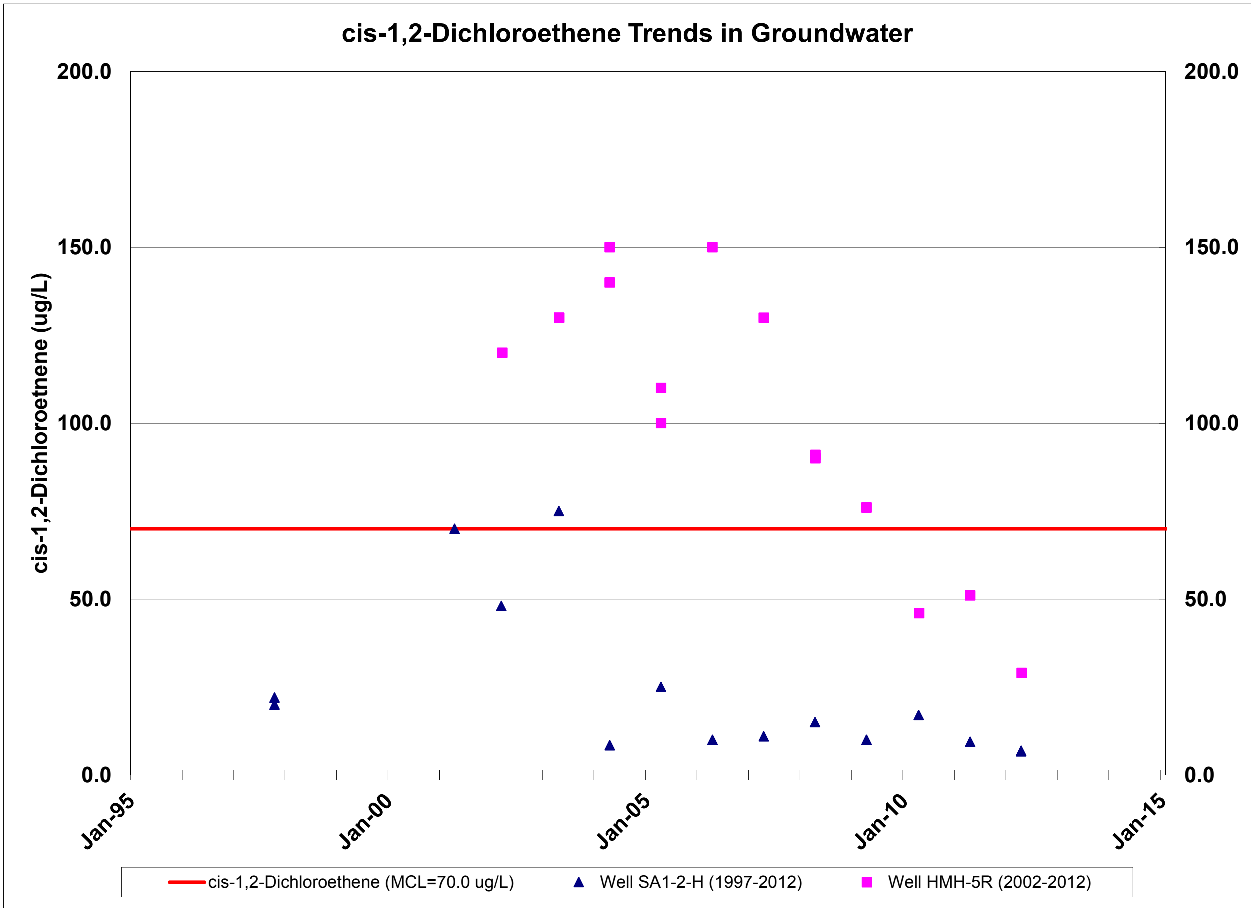

Figure C–14. cis-*1,2,-Dichloroethene reported through 2012 in groundwater collected from two wells in the Alluvial Aquifer.*

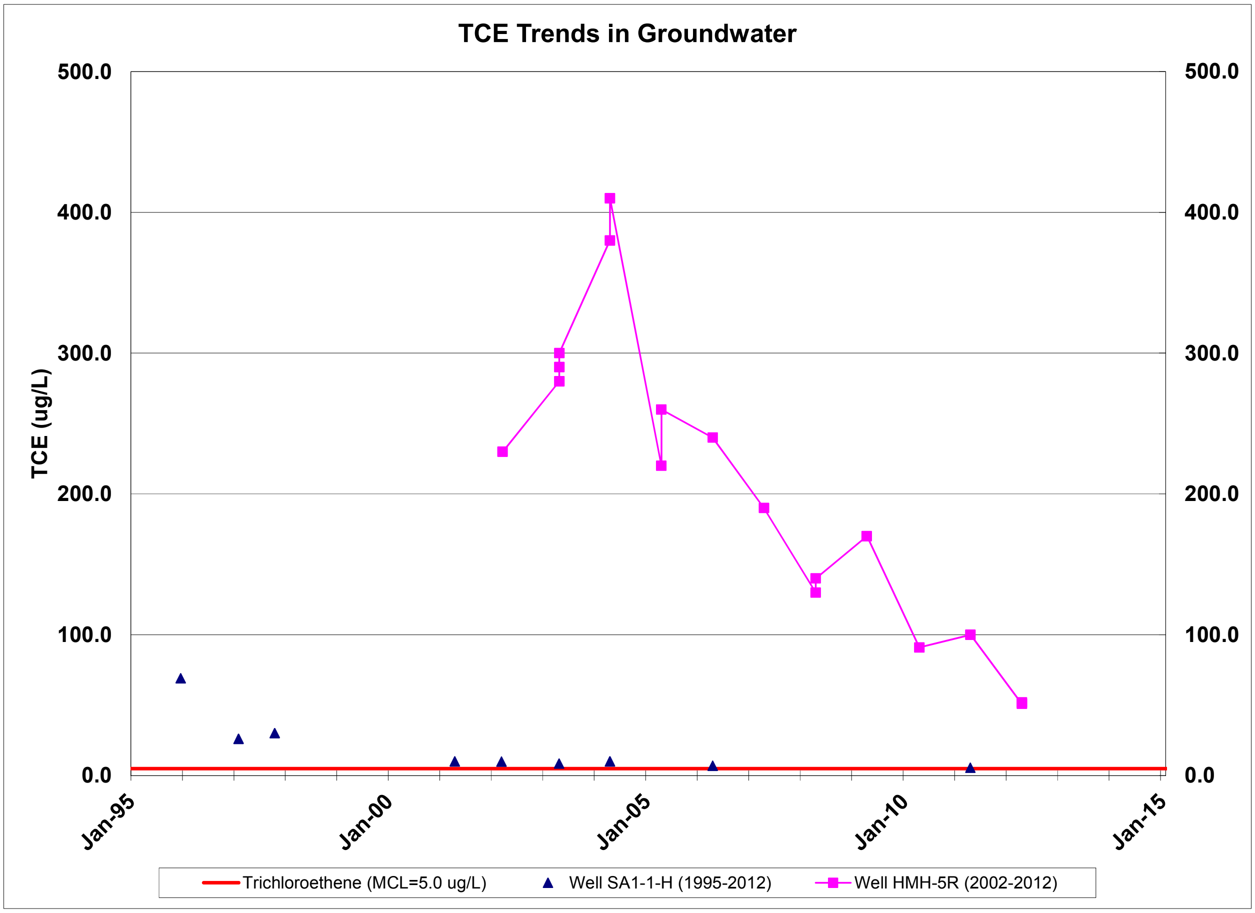

Figure C–15. Trichloroethene (TCE) reported through 2012 in groundwater collected from two onsite wells.

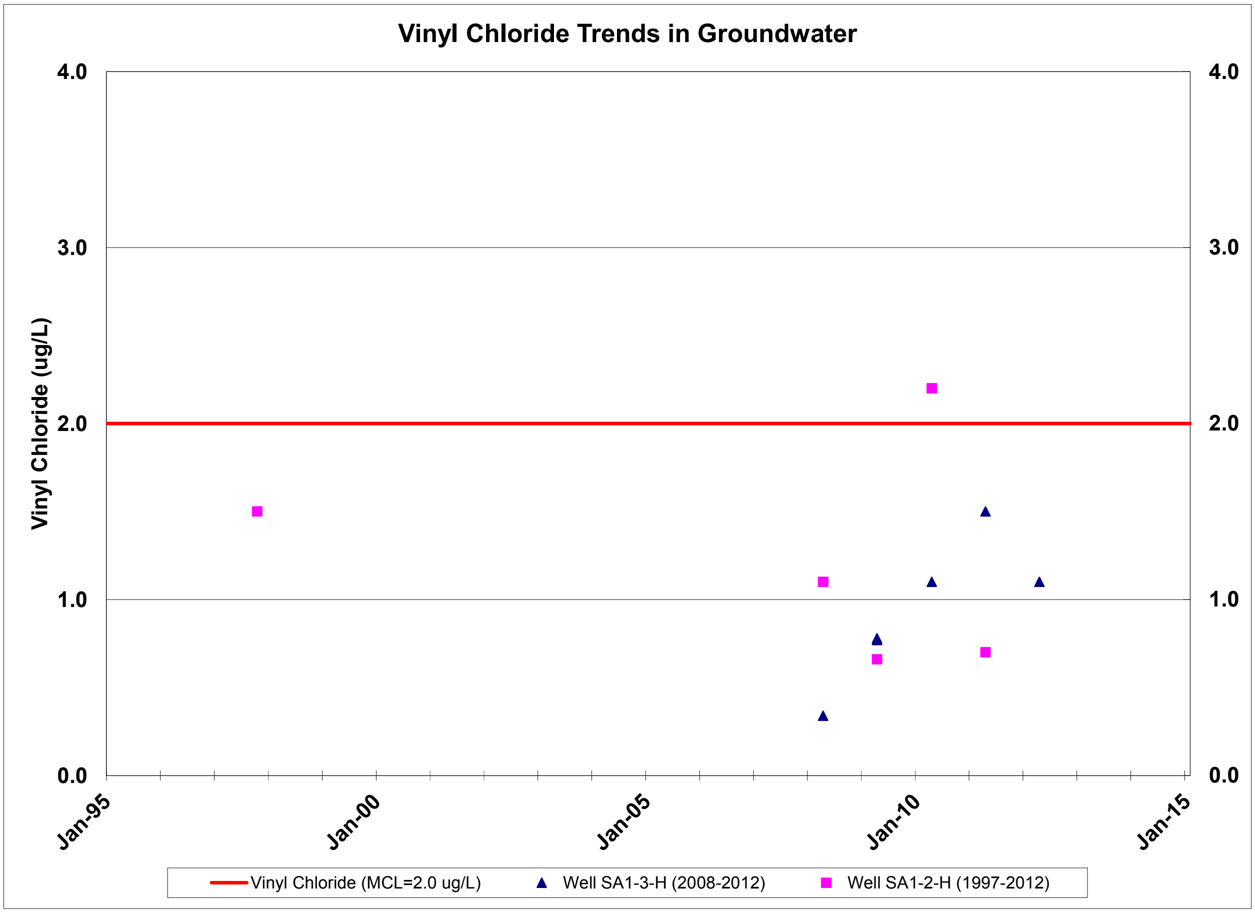

Figure C–16. Vinyl chloride reported through 2012 in groundwater collected from two onsite wells. The vinyl chloride concentration detected in well SA1-3H is displayed because of the increasing trend since 2008. The trend appears to have changed course in 2012.

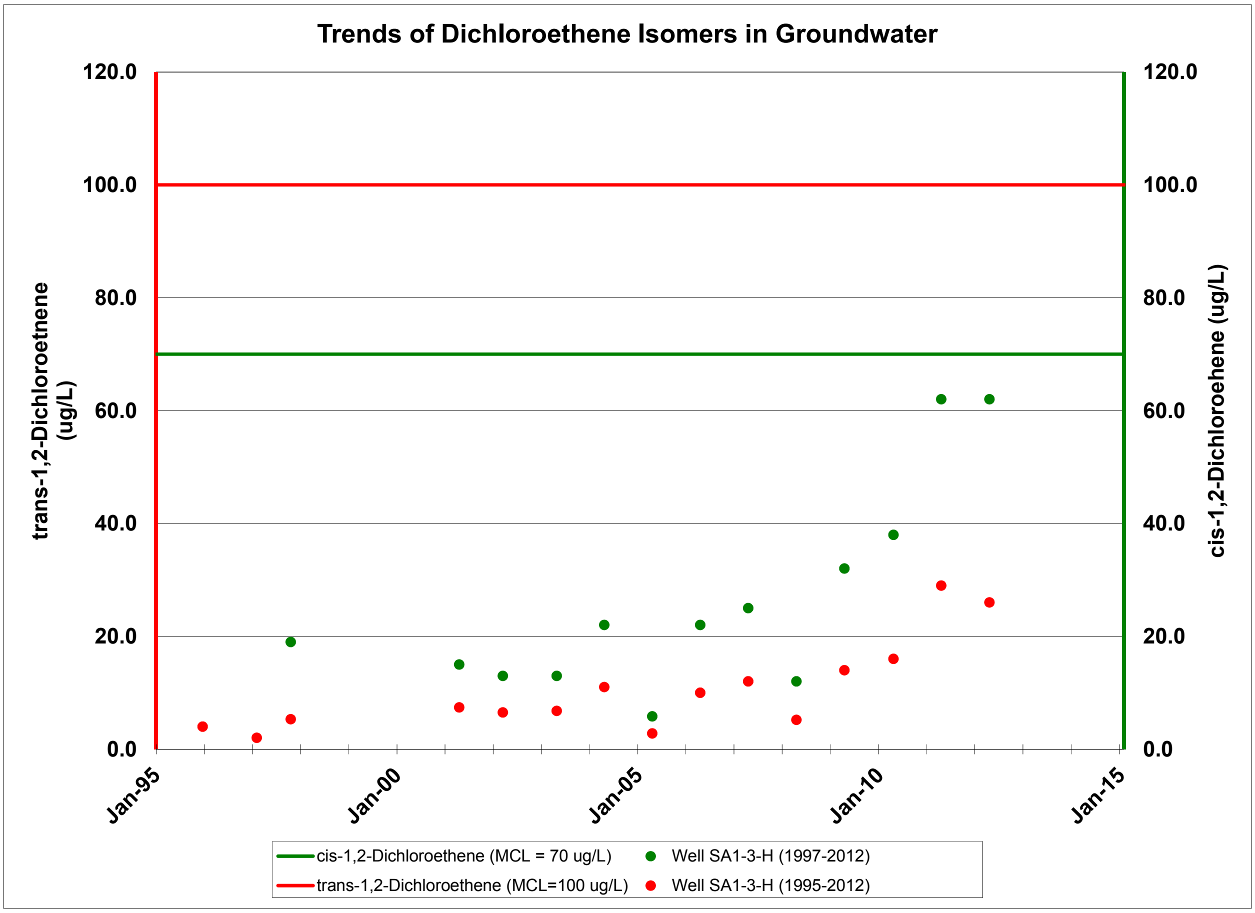

Figure C–17. Isomers of dichloroethene detected through 2012 in groundwater collected from well SA1-3-H. These isomers are displayed because recent concentration trends have been increasing.

Appendix D

2011 Water-Level Elevations
and
Hydrographs

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Aquifer	Well	Measurement Period (Date)			
		Q1	Q2	Q3	Q4
		(1/5/2012)	(4/19/2012)	(8/2/2012)	(10/4/2012)
Alluvial	HMH-16R	231.91	237.65	231.93	234.53
Alluvial	HMH-5R	234.06	235.29	231.73	235.44
Alluvial	HM-S	235.46	236.40	233.10	236.55
Alluvial	SA1-1-H	234.90	236.12	232.55	236.27
Alluvial	SA1-2-H	235.09	236.05	232.83	236.21
Alluvial	SA1-3-H	235.36	236.17	233.04	236.31
Alluvial	SA1-4-H	236.02	236.96	233.53	237.21
Alluvial	SA1-5-H	236.04	237.16	233.52	237.28
Alluvial	SA1-6-H	236.04	237.65	233.80	237.52
Alluvial	SA1-7-H	236.49	237.27	233.92	237.25
Alluvial	SA1-12-H	231.63	234.31	230.90	233.79
Alluvial	SA3-4-H	236.61	237.99	233.81	238.33
Local	HM-L	NA	152.53	NA	152.15
Local	HM-L2	NA	155.86	NA	NA
Local	SA1-8-L	NA	156.92	NA	NA
Local	SA2-1-L	156.76	157.13	156.63	156.75
Local	SA2-2-L	NA	156.95	NA	NA
Local	SA2-4-L	NA	157.41	NA	NA
Local	SA4-5-L	NA	155.05	NA	NA
1	HM-1	145.83	146.58	146.16	146.40
2	HM-2A	127.59	128.58	127.46	127.64
2	HM-2B	NA	119.27	118.81	118.97
3	HM-3	119.97	120.77	120.26	120.35
3	SA1-11-3	NA	118.87	118.25	118.37
3	SA3-11-3	117.05	117.85	117.28	117.41
4	SA5-4-4	NA	133.47	134.86	136.10
4	SA5-5-4	NA	136.24	135.70	135.85
3/Caprock	E-7	NA	120.32	NA	NA

Abbreviations

Q1, Q3, Q4	Calendar quarter (Q) during which the water-level measurements were made by Mississippi Department of Health Radiologic Health Division
Q2	DOE Office of Legacy Management
NA	Not available, no value was reported

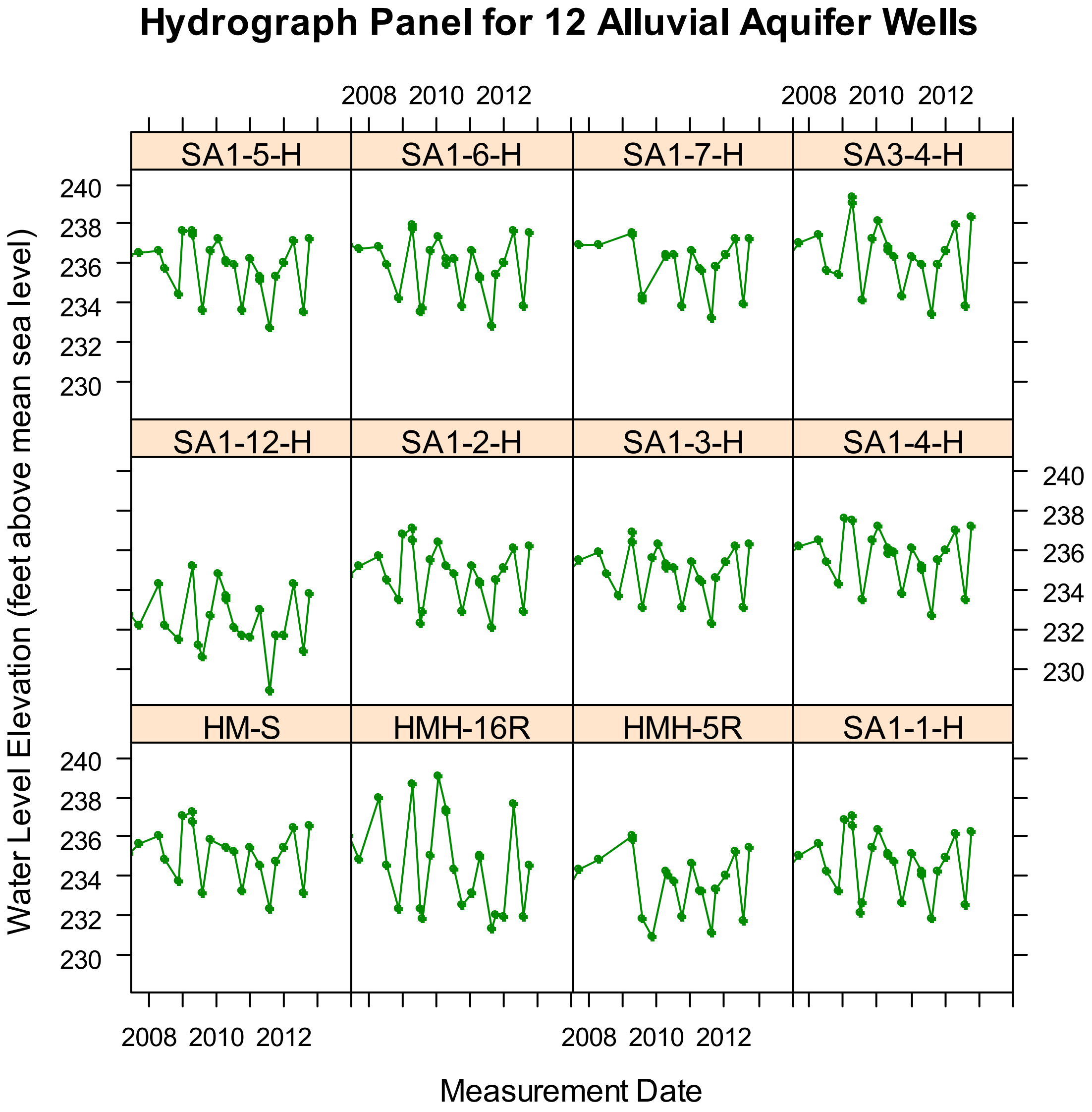

Figure D–1. Hydraulic head in Alluvial Aquifer wells versus quarterly measurement date, through 2012. The 12 wells are within 1,100 feet of ground zero.

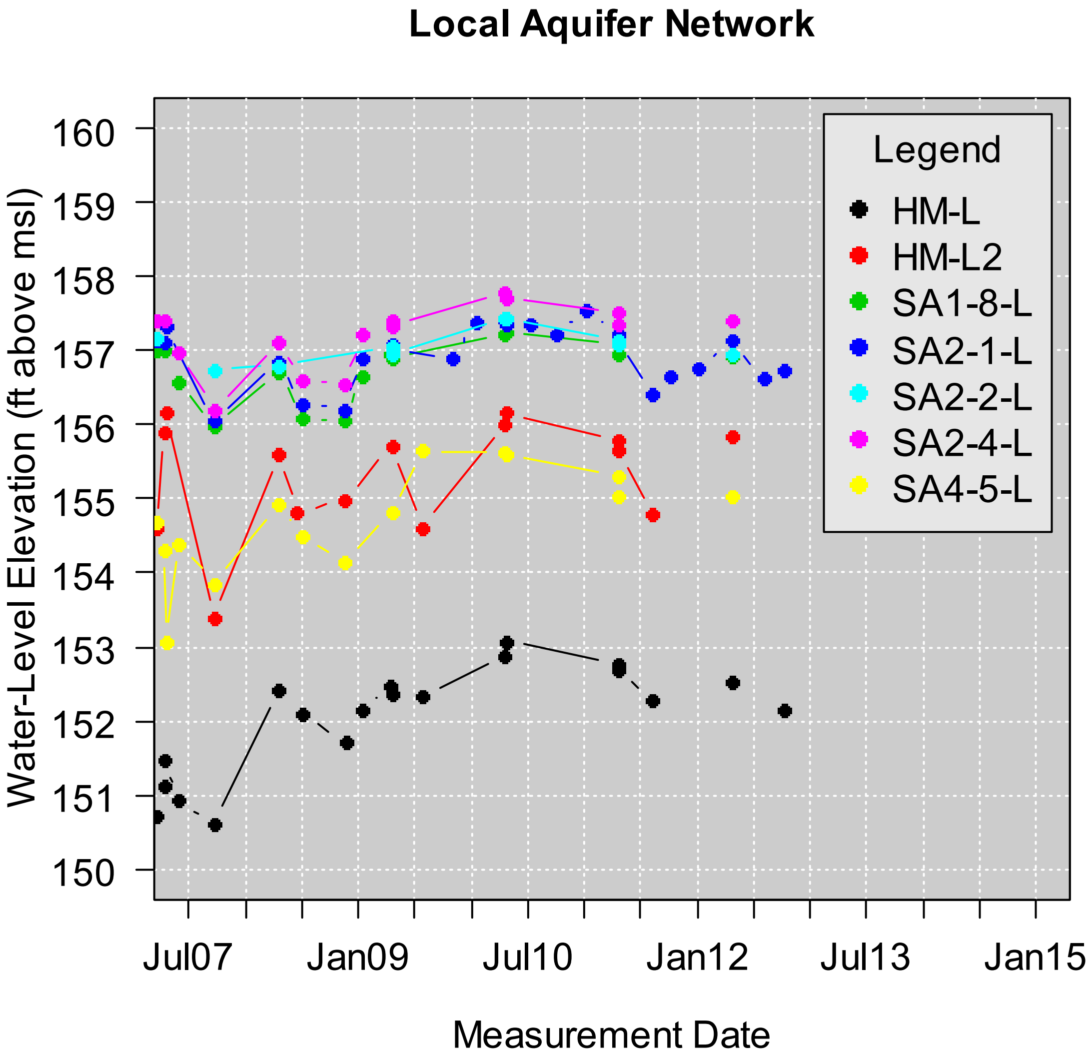

Figure D–2. Hydraulic head in Local Aquifer wells versus quarterly measurement date, through 2012. There are seven wells in the Local Aquifer: one is at ground zero (HM-L), the other six are on the surrounding highlands: three wells on the northeast highlands, two wells on the southwest highlands, and one well on the northwest highlands.

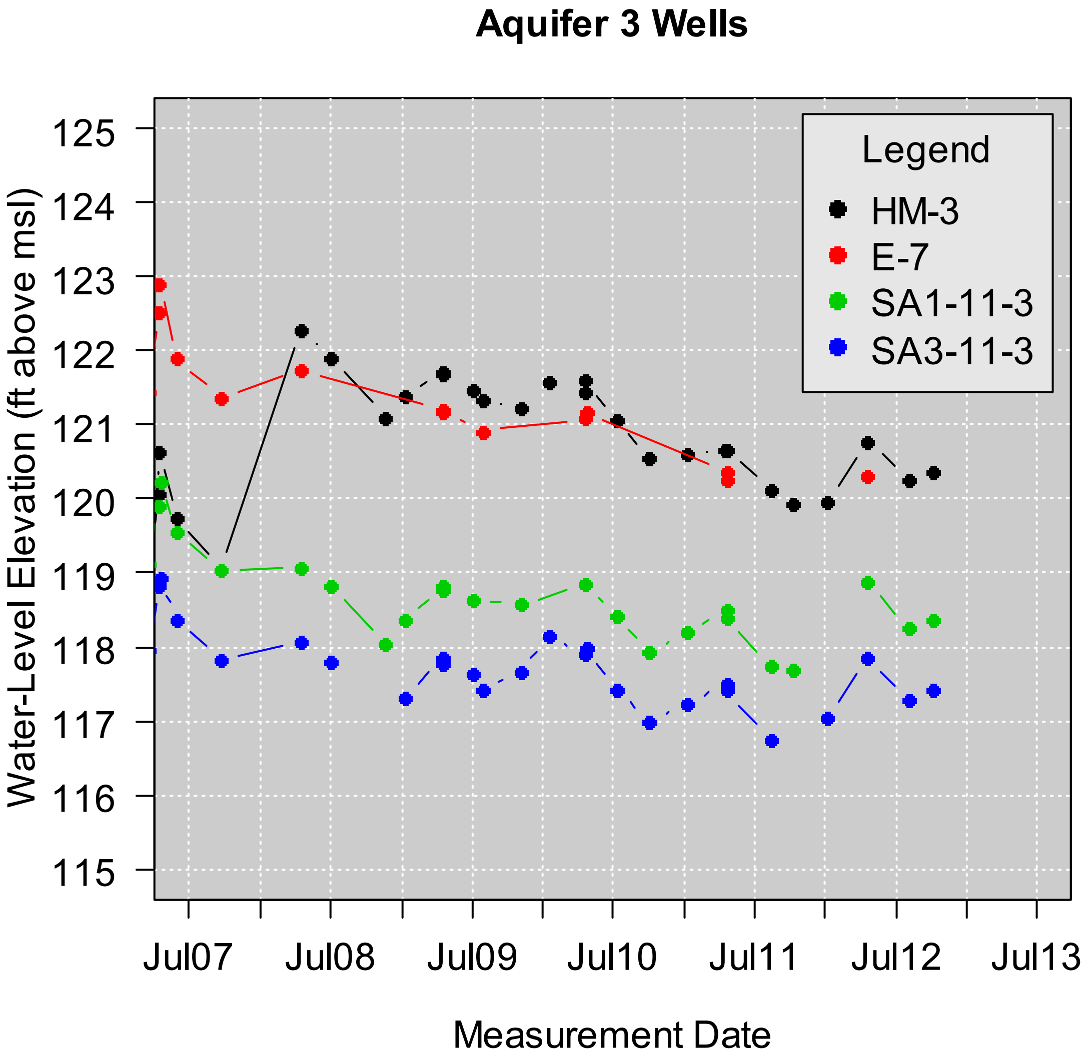

Figure D–3. Hydraulic head in Aquifer 3 wells versus quarterly measurement date, through 2012. Well HM-3 is located at ground zero; the other three wells are south and southeast of ground zero. Well E-7 may be in contact with the Caprock Aquifer.

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