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RCRA FACILITY INVESTIGATION/SITE INSPECTION TECHNICAL MEMORANDUM NO. 4
VOLUME I SITE 11 NSB KINGS BAY GA
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# FINAL

## RCRA FACILITY INVESTIGATION/SITE INSPECTION TECHNICAL MEMORANDUM No. 4, VOLUME I SITE 11, OLD CAMDEN COUNTY LANDFILL

NAVAL INSTALLATION RESTORATION PROGRAM
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

CONTRACT NO. N62467-89-D-0317

DECEMBER 1992

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA
29411-0068

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Groundwater Sample Event No. 4, RFI/SI Site 11

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

This Technical Memorandum No, 4, Volume I, summarizes findings and results based on information and data collected from Site 11, Old Camden County Landfill, as a result of groundwater sampling event No. 4, which was performed September 9 through September 13, 1992.

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# FINAL

## RCRA FACILITY INVESTIGATION/
## SITE INSPECTION
## TECHNICAL MEMORANDUM No. 4
## VOLUME I
## SITE 11, OLD CAMDEN COUNTY LANDFILL

## NAVAL SUBMARINE BASE
## KINGS BAY, GEORGIA

Prepared for:

Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina 29411-0068

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December 1992

# FOREWORD

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), the 1976 Resource Conservation and Recovery Act (RCRA) as augmented by the 1984 Hazardous and Solid Waste Amendments (HSWA), and as directed in Executive Order 12580 of January 1987, the Department of Defense (DOD) conducts an Installation Restoration (IR) Program for evaluating and remediating problems related to releases and disposal of toxic and hazardous materials at DOD facilities.

The Naval Assessment and Control of Installation Pollutants (NACIP) program was developed by the Navy to implement the IR Program for all Naval and Marine Corps facilities. The NACIP program was originally conducted in three phases: (1) Phase I, Initial Assessment Study, (2) Phase II, Confirmation Study (including a Verification Step and a Characterization Step), and (3) Phase III, Planning and Implementation of Remedial Measures. The three-phase IR Program was modified and updated to be congruent with the CERCLA/SARA and RCRA/HSWA-driven DOD IR program.

The updated nomenclature for the RCRA/SARA process is as follows:

- Preliminary Assessment and Site Inspection
- Remedial Investigation
- Feasibility Study
- Planning and Implementation of Remedial Design

Three sites at the Naval Submarine Base (NSB) in Kings Bay, Georgia, were identified for investigation under the IR Program. A work plan for conducting a RCRA Facility Investigation/Site Inspection (RFI/SI) at each of the three sites has been completed and implemented. This technical memorandum discusses the RFI/SI field program conducted at the activity and summarizes findings and results based on information and data collected as a result of the September 1992 field effort, which included the fourth of six groundwater sampling events. Certain Appendix IX parameters have been deleted from the groundwater monitoring program based on results of laboratory analysis of environmental samples collected during the RFI/SI field program and during the first two groundwater sampling events.

Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) has the responsibility for implementation of the Navy and Marine Corps IR Program in the southeastern and midwestern United States. Questions regarding this report should be addressed to the SOUTHNAVFACENGCOM Engineer-in-Charge, Mr. Ed Lohr, at (803) 743-0355.

## EXECUTIVE SUMMARY

ABB Environmental Services, Inc. (ABB-ES), under contract to the Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), conducted site investigation activities at three of four former waste disposal sites at the Naval Submarine Base (NSB), in Kings Bay, Georgia. This technical memorandum is the fourth of five technical memoranda associated with the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and Site Inspection (SI) that will continue into calendar year 1993. The RFI/SI field program and preparation of this report were completed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (contract number N62467-89-D-0317, Contract Task Order [CTO] Number 041) between SOUTHNAVFACENGCOM and ABB-ES.

Groundwater sampling event No. 4 at Site 11 included collection of 11 groundwater samples, including two duplicate samples. Samples were submitted to CH2M HILL Laboratories in Montgomery, Alabama, for analysis of a modified list of Appendix IX parameters. The following paragraphs summarize the analytical results for groundwater samples collected from Site 11 during the fourth groundwater sampling event.

Volatile organic compounds (VOCs) detected in groundwater samples collected from Site 11 during the fourth sampling include vinyl chloride, chloromethane, 1,2-dichloroethene, toluene, chlorobenzene, and 1,4-dichlorobenzene. The concentration of vinyl chloride in monitoring well KBA-11-2 exceeded the Federal Primary Drinking Water Maximum Contaminant Level (MCL) of 2 micrograms per liter ($\mu g/l$).

A Plan of Action for the investigation of the vinyl chloride contaminant plume at Site 11 was developed by ABB-ES in July 1992 (ABB-ES, 1992c) and field activities for the Phase I investigation were conducted on August 4 through 16. The results of the Phase I investigation have been submitted under separate cover (ABB-ES, 1992e). Based on analytical results of the Phase I investigation at Site 11, an Interim Corrective Measure Screening Investigation Work Plan was developed (ABB-ES, 1992f) and field activities for this investigation were scheduled to take place October 12 through November 18, 1992.

With few exceptions, concentrations of inorganic constituents in groundwater samples collected from Site 11 were similar to concentrations detected in samples collected in July 1992. Both filtered and unfiltered groundwater samples were collected during the fourth sampling event to determine whether aquifer solids in groundwater contribute to the total concentration of inorganic constituents in groundwater. Unfiltered samples were also analyzed for total dissolved solids (TDS) and total suspended solids (TSS) to determine what percentage of the total solids in groundwater represents suspended particulates.

Concentrations of inorganics were significantly lower for filtered groundwater samples compared to unfiltered samples at Site 11. The results for filtered samples are generally considered to be a more accurate representation of groundwater quality because of the relatively high concentrations of suspended solids in groundwater at Site 11 (ranging from 236 to 1,090 micrograms per liter).

**ACKNOWLEDGEMENTS**

In preparing this report, the personnel at ABB Environmental Services, Inc. commend the support, assistance, and cooperation provided by the personnel at NSB Kings Bay, Georgia, and SOUTHNAVFACENGCOM. In particular, ABB-ES acknowledges the outstanding effort, dedication, and professionalism provided by the following people in the preparation of this report.

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**RCRA Facility Investigation/Site Inspection**
**Technical Memorandum No. 4**

**Naval Installation Restoration Program**
**Naval Submarine Base**
**Kings Bay, Georgia**


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## GLOSSARY OF ACRONYMS

| | |
|---|---|
| ABB-ES | ABB Environmental Services, Inc. |
| CRQL | contract required quantitation limit |
| FID | flame ionization detector |
| IAS | Initial Assessment Study |
| IR | Installation Restoration |
| MCL | maximum contaminant level |
| µg/l | micrograms per liter |
| mg/l | milligrams per liter |
| NEESA | Naval Energy and Environmental Support Activity |
| NSB | Naval Submarine Base |
| ppm | parts per million |
| QC | Quality Control |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |
| SI | Site Inspection |
| SOUTHNAV-FACENGCOM | Southern Division, Naval Facilities Engineering Command |
| TDS | total dissolved solids |
| TSS | total suspended solids |
| USEPA | U.S. Environmental Protection Agency |
| VOC | volatile organic compound |

# 1.0 INTRODUCTION

**1.1 PURPOSE**. ABB Environmental Services, Inc. (ABB-ES), under contract to the Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), conducted site investigation activities at three of four former waste disposal sites at the Naval Submarine Base (NSB) in Kings Bay, Georgia. This Technical Memorandum is the fourth of five Technical Memoranda associated with the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and Site Inspection (SI) that will continue into calendar year 1993. The RFI/SI field program and preparation of this report were completed under the Comprehensive Long-Term Environmental Action Navy contract (contract number N62467-89-D-0317, Contract Task Order Number 041) between SOUTHNAVFACENGCOM and ABB-ES.

An Initial Assessment Study (IAS) was conducted in 1985 (C.C. Johnson and Associates, 1985) at NSB Kings Bay. The IAS identified a total of 16 waste spill sites. None of the 16 sites required further action under the Navy Installation Restoration (IR) Program; however, four sites required further action under the Hazardous Waste Facility Permit. In February 1988, a RCRA and Hazardous and Solid Waste Amendments permit was issued to NSB Kings Bay by the Georgia Department of Natural Resources, Environmental Protection Division.

The overall purpose of the RFI/SI is to characterize three of the four previously identified sites with potential for contamination and/or contaminant migration. The three sites are identified as follows:

- Site 5 - Army Reserve Disposal Area, Towhee Trail
- Site 11 - Old Camden County Landfill
- Site 16 - Army Reserve Disposal Area, Motor Missile Magazines

The fourth site, Site 12 - Army Reserve Disposal Area, Future Dry Dock, is included in the RFI/SI but no sampling or analyses will be conducted. The NSB Kings Bay Public Works Department will conduct a records search and information review to be reported in the comprehensive RFI/SI Report. The RFI/SI Report will be prepared following completion of six groundwater sampling events scheduled to extend into calendar year 1993.

The information obtained during the RFI/SI will be used to eliminate sites from further consideration within the Navy IR Program (i.e., no further action) or present the necessary information (i.e., nature and distribution of contaminants) to plan further response actions including a Corrective Measures Study and/or RCRA permit modification.

This Technical Memorandum No. 4, Volume I, presents summarized findings and results based on information and data collected from Site 11 as a result of groundwater sampling event No. 4, which was performed on September 9 through 13, 1992. Technical Memorandum No. 4, Volume II, presents summarized findings and results based on information and data collected from Sites 5 and 16 as a result of groundwater sampling event No. 4.

## 2.0 FIELD PROGRAM

**2.1 GROUNDWATER SAMPLING**. Groundwater sampling was performed from September 9 through 13, 1992. Groundwater samples were collected from the nine wells installed at Site 11 during the RFI/SI. Analysis of the samples included a modified list of Appendix IX parameters. Laboratory services were provided by CH2M HILL Laboratories, Inc., in Montgomery, Alabama. Level C data quality objectives and deliverables were specified for the analytical program. Results of groundwater sample analyses are discussed in Sections 3.0 and 4.0.

Upon opening each monitoring well, the headspace was screened for volatile organic compounds (VOCs) using a flame ionization detector (FID). Prior to sample collection, each well was purged of at least three well volumes. Samples were collected within 24 hours following purging. Decontaminated Teflon bailers were used to purge the monitoring wells and to collect samples. For unfiltered samples, groundwater was transferred from the bailer directly into labeled sample containers. For samples requiring filtration, groundwater was pumped from the bailer through a 0.45-micron filter using a Masterflex™ peristaltic pump with polyethylene tubing and then collected in a labeled sample container. ABB-ES personnel placed the filled containers on ice in ice chests immediately after collection. Chain-of-custody was initiated in the field at the time of sample collection. Samples were shipped via overnight courier service to the laboratory on the date of collection.

Appropriate preservatives were added to the empty sample containers by the laboratory before delivery of the containers to the project. Following sample collection, ABB-ES personnel checked pH values of an aliquot of all preserved samples except VOC samples. Samples for cyanide analysis were also checked for sulfide interference by testing an aliquot of the sample with lead acetate test paper.

Field parameters for groundwater samples included pH, conductivity, and temperature.

## 3.0 ANALYTICAL PROGRAM

This section summarizes the analytical program for groundwater samples collected from monitoring wells at Site 11 during groundwater sampling event No. 4 at NSB Kings Bay. In addition, it presents an assessment of data quality and useability.

**3.1 CHEMICAL ANALYSES.** Sampling activities during the third groundwater sampling event at NSB Kings Bay included collection of 11 groundwater samples, including two duplicate samples. All samples were collected in accordance with procedures outlined in the Quality Assurance Project Plan, Appendix A of the NSB Kings Bay Work Plan (ABB-ES, 1991). Samples were submitted to CH2M HILL Laboratories in Montgomery, Alabama, for chemical analyses. Table 3-1 summarizes the sampling and analysis program for samples collected from Site 11 during the fourth sampling event. Samples were analyzed in accordance with USEPA SW-846 methods (USEPA, 1986) and Naval Energy and Environmental Support Activity (NEESA) Level C documentation (NEESA, 1988) for a modified list of Appendix IX VOCs, inorganic analytes (including total cyanide and sulfide), total dissolved solids (TDS), and total suspended solids (TSS). Table 3-2 is the modified list of Appendix IX compounds and corresponding U.S. Environmental Protection Agency (USEPA) analytical method numbers.

**3.2 DATA QUALITY ASSESSMENT.** All groundwater samples collected during the RFI/SI were properly preserved, placed in coolers, and packed with bagged ice immediately after collection. All samples remained in the custody of the field operations leader until delivery to the courier service providing over-night shipment to the laboratory. All samples were shipped, complete with chain-of-custody forms, to CH2M HILL Laboratories within 24 hours for analysis. Upon arrival at CH2M HILL, the chain-of-custody and preservation of the samples checked with the contents of each cooler by CH2M HILL personnel. After verification, the chain-of-custody form was signed by CH2M HILL personnel and the samples accepted for analysis.

Review of the field notebook and chain-of-custody forms did not indicate any non-conformance relative to field instrument calibration or sample handling. All required field quality control (QC) samples were collected in conformance with the requirements of the USEPA, NEESA, and ABB-ES Quality Assurance Plans and the June 1988 NEESA "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA, 1988) (Document 20.2-047B). These field QC samples include field duplicates, equipment rinseate blanks, source water blanks, and VOC trip blanks for each VOC sample shipment.

The analytical results for environmental samples collected during groundwater sampling event No. 4 were evaluated and validated according to NEESA Level C QC criteria to determine data quality and useability. The data tables included in Appendix A reflect validation according to Level C criteria. These criteria are described in Section 7.3.2 of NEESA Document 20.2-047B. The following subsections discuss analytical performance and the evaluation of field and laboratory QC samples.

Table 3-1 Summary of Sampling and Analysis Program for Site 11

| Location and Type of Sampling | Laboratory Analysis | | | |
|---|---|---|---|---|
| | A | B | C | D |
| **Site 11** | | | | |
| Groundwater | 9 | 18 | 9 | 4 |
| **Field Duplicates** | | | | |
| Groundwater | 1 | 2 | 1 | 1 |
| **Quality Control Samples** | | | | |
| Trip Blanks | 2 | 0 | 0 | 1 |
| Rinseate Blanks | 2 | 2 | 2 | 1 |
| Field Blanks | 2 | 3 | 2 | 1 |

A - Volatile Organic Compounds (VOCs) (Method 8240)
B - Inorganic constituents (including cyanide and sulfide)
C - Total Dissolved Solids (TDS) and Total Suspended Solids (TSS)
D - Volatile Organic Compounds (VOCs) (Methods 8010/8020)

Table 3-2 Compounds and Analytical Methods for Groundwater Sampling Event No. 4 at Site 11

**Parameter:** **Volatile Organic Compounds (38 total)**
**TCL List plus 4 additional compounds**
**Method:** **SW-846 Method 8240**

| | |
|---|---|
| Chloromethane | cis-1,3-Dichloropropene |
| Bromomethane | Trichloroethene |
| Vinyl Chloride | Dibromochloromethane |
| Chloroethane | 1,1,2-Trichloroethane |
| Methylene Chloride | Benzene |
| Acetone | trans-1,3-Dichloropropene |
| Carbon Disulfide | Bromoform |
| Trichlorofluoromethane* | 2-Hexanone |
| 1,1-Dichloroethene | 4-Methyl-2-Pentanone |
| 1,1-Dichloroethane | Tetrachloroethene |
| 1,2-Dichloroethene (total) | 1,1,2,2-Tetrachloroethane |
| Chloroform | Toluene |
| 1,2-Dichloroethane | Chlorobenzene |
| 2-Butanone | Ethylbenzene |
| 1,1,1-Trichloroethane | Styrene |
| Carbon Tetrachloride | Xylene (total) |
| Vinyl Acetate | 1,3-Dichlorobenzene* |
| Bromodichloromethane | 1,4-Dichlorobenzene* |
| 1,2-Dichloropropane | 1,2-Dichlorobenzene* |

* Non-TCL compounds

**Parameter:** **Volatile Organic Compounds (35 total)**
**Method:** **SW-846 Method 8010/8020**

| | |
|---|---|
| Benzene | cis-1,2-Dichloroethene |
| Bromodichloromethane | trans-1,2-Dichloroethene |
| Bromoform | 1,2-Dichloropropane |
| Bromomethane | cis-1,3-Dichloropropene |
| Carbon tetrachloride | trans-1,3-Dichloropropene |
| Chlorobenzene | Ethyl Benzene |
| Chloroethane | Methyl tert butyl ether |
| 2-Chloroethyl vinyl ether | Methylene chloride |
| Chloroform | 1,1,2,2-Tetrachloroethane |
| Chloromethane | Tetrachloroethene |
| Dibromochloromethane | Toluene |
| 1,2-Dichlorobenzene | 1,1,1-Trichloroethane |
| 1,3-Dichlorobenzene | 1,1,2-Trichloroethane |
| 1,4-Dichlorobenzene | Trichloroethene |
| Dichlorodifluoromethane | Trichlorofluoromethane |
| 1,1-Dichloroethane | Vinyl chloride |
| 1,2-Dichloroethane | Total Xylenes |
| 1,1-Dichloroethene | |

Table 3-2 Compounds and Analytical Methods for Groundwater Sampling Event No. 4 at Site 11 (continued)

| | |
|---|---|
| **Parameter:** | **Appendix IX Inorganic Analytes (19 total)** |
| **Method:** | **SW-846 Methods (listed in parentheses)** |

| | | |
|---|---|---|
| Antimony (6010) | Copper (6010) | Thallium (7841) |
| Arsenic (7060) | Lead (7421) | Vanadium (6010) |
| Barium (6010) | Mercury (7470) | Zinc (6010) |
| Beryllium (6010) | Nickel (6010) | Tin (6010) |
| Cadmium (6010) | Selenium (7740) | Cyanide (9010) |
| Chromium (6010) | Silver (6010) | Sulfide (9030) |
| | Cobalt (6010) | |

| | |
|---|---|
| **Parameter:** | **Total Dissolved Solids (TDS)/ Total Suspended Solids (TSS)** |
| **Method:** | **Standard Methods-- Methods 2540C and 2540D** |

TCL = Target Compound List

**3.2.1 Analytical Performance** Review of analytical data indicated the laboratory generally met applicable analytical QC criteria for all chemical analyses. Extraction and analysis holding times for all sample lots were met. The data review and validation were performed under subcontract to Heartland Environmental Services, Inc., St. Peters, Missouri.

For VOC analyses, all holding times, internal standard/surrogate recoveries, precision, and accuracy criteria were met. However, one continuing calibration check standard contained compounds with percentage differences exceeding QC limits. Positive sample results for compounds associated with the differences have been appropriately qualified as estimated and flagged with a "J." Also, one tuning standard associated with three aqueous samples (KBA-11-2, KBA-11-2D, and BT-23-FB) did not meet tuning criteria. All positive sample results for these samples have been appropriately qualified as estimated and flagged with a J qualifier. All sample results qualified as estimated are considered useable data.

Two analytical blanks associated with certain VOC sample analyses contained detectable concentrations of methylene chloride, a common laboratory solvent and frequently observed artifact in laboratory method blanks. Qualifications of sample results for VOC compounds associated with blank contamination are made according to NEESA Level C QC guidelines. Table 3-3 summarizes VOC method blank analytical results. Sample results for all compounds associated with methylene chloride contamination have been appropriately qualified as undetected because sample values were less than 10 times the method blank concentration.

For inorganic analyses, all holding times were met. One matrix spike result for lead, selenium, silver, and thallium was below QC limits. One duplicate analysis for cyanide and zinc also exceeded QC limits. Associated sample results and quantitation limits were appropriately qualified as estimated. Several inorganics were detected in method blanks. Table 3-3 summarizes inorganic preparation and calibration blank analytical results. Inorganic results for environmental samples, in which concentrations of metals were also found in associated blanks, are designated undetected if the concentration in the sample is below the contract required quantitation limit (CRQL) and less than five times the blank value. For sample concentrations between five and 10 times that found in a blank exhibiting negative bias for an inorganic analyte, the sample results are qualified as estimated. No qualification is required if the sample value is more than five times the blank value and there is no negative bias, or more than 10 times the blank value if there is negative bias. All sample results qualified as estimated are considered useable data.

**3.2.2 Evaluation of Field QC Samples** Three field blanks, two trip blanks, and two rinseate blanks were collected during the fourth groundwater sampling event at Site 11. One field blank, BS-10-FB, represents organic-free, deionized water used as a final rinse during equipment decontamination procedures, and one field blank, BS-12-FB, represents regular deionized water used as an intermediate rinse during equipment decontamination procedures. The third field blank, BS-11-FB, is a filter blank that represents organic-free, deionized water passed through a 0.45-micron filter. The two equipment rinseate samples, BS-22-ER and BS-23-ER, were collected during decontamination procedures involving Teflon bailers.

Table 3-3 Summary of Organic Analyses of Method Blanks and Inorganic Analysis of Preparation Blanks

| Blank Analysis Results | | | | |
|---|---|---|---|---|
| Method Blank ID | Compound | Concentration | CRQL[a] | Associated Samples |
| **Volatile Organic Chemical Aqueous Analysis (µg/l)** | | | | |
| VBLKW | Methylene chloride | 4 J | 5 | KBA-11-1, KBA-11-4, KBA-11-5, KBA-11-7, KBA-11-8, BS-23ER |
| VBLKW | Methylene chloride | 4 J | 5 | BS-10-FB, BS-12-FB |
| **Inorganic Aqueous Analysis (µg/l)** | | | | |
| 22710 | Antimony | 12.85 J | 60 | KBA-11-1F, KBA-11-2F, KBA-11-3F, KBA-11-4F, KBA-11-5F, KBA-11-6F, KBA-11-7F, KBA-11-8F, KBA-11-9F |
| | Cobalt | -1.63 J | 50 | |
| | Mercury | -0.075 J | 0.2 | |
| 22711 | Lead | 1.95 J | 5 | KBA-11-1, KBA-11-2, KBA-11-2D, KBA-11-3, KBA-11-4, KBA-11-5, KBA-11-6, KBA-11-7, KBA-11-8, KBA-11-9, KBA-11-9D |
| 22723 | Barium | 0.67 J | 200 | BS-10-FB, BS-11-FB, BS-12-FB |
| | Lead | 0.77 J | 5 | |
| | Mercury | 0.137 J | 0.2 | |

Notes:

[a]Contract required quantitation limit
µg/l = micrograms per liter
J = indicates that the reported concentration is estimated because it is below the CRQL

The VOCs methylene chloride and acetone were detected in trip blanks BT-23-FB and BT-24-FB as shown in Table 3-4. Sample results for VOC compounds associated with trip blank contamination are qualified according to NEESA Level C QC guidelines. Sample results for methylene chloride and acetone associated with trip blank contamination were appropriately qualified as undetected because sample values were less than ten times the trip blank concentration. Acetone was also detected in field blanks BS-10-FB and BS-12-FB. None of the environmental samples associated with these field blanks contained detectable concentrations of acetone attributable to field blank contamination.

Several inorganics were detected in field blanks and rinseate blanks as shown in Table 3-5. Concentrations for all analytes are below their respective CRQLs. Blanks containing inorganic analytes below the CRQL are below any regulatory limit in water, but are considered in the evaluation of environmental samples.

Analytical results for filtered samples collected from monitoring wells at Site 11 required qualification because of filter contamination. As shown in Table 3-5, barium, beryllium, cobalt, and vanadium were detected in the filter blank, BS-11-FB, but were not detected in the field blank (BS-10-FB) representing the source water used to collect the filter blank. None of the filtered samples collected from Site 11 contained beryllium and, therefore, qualification for beryllium contamination was not required. However, several filtered samples contained barium, cobalt, and vanadium. Associated sample results for barium, cobalt, and vanadium have been appropriately qualified as non-detects because sample concentrations were less than filter blank concentrations.

With one exception, review of the field duplicates exhibited agreement with groundwater samples (Table 3-6). During field duplicate comparisons, where an analyte was not detected in one groundwater replicate, it was present at less than three times the quantitation limit in the duplicate. Variation in groundwater replicate results is common when an analyte is present in the replicated samples at or near the detection limit. Groundwater replication for inorganic analytes may also vary by factors of two to five times because of the variation in the amount of suspended solids in each sample and the nature of the inorganic constituents sorbed to those suspended solids.

As shown in Table 3-6, analytical results for vinyl chloride in duplicate samples, KBA-11-2 and KBA-11-2D, varied significantly for both VOC methods used. Differences in vinyl chloride concentrations for the two duplicate samples and the relatively low recovery of vinyl chloride in one sample (15 J micrograms per liter [$\mu$g/l]) are most likely due to the physical characteristics of vinyl chloride (i.e., low boiling point and high volatility) and sample handling techniques. Vinyl chloride is an extremely volatile compound and can easily be lost to the atmosphere from a groundwater sample during all stages of environmental sampling and chemical analysis if special care is not taken. Sample results for vinyl chloride have been qualified as estimated and flagged with a J qualifier because of the disparity among duplicate results. Careful examination of sample preparation records showed that the sample containing 15 J $\mu$g/l of vinyl chloride was prepared and placed on the autosampler approximately five hours before the analysis was performed. This type of time delay could have caused the low recovery of vinyl chloride.

Table 3-4 Summary of Organic Analyses of Trip Blanks and Field Blanks

| Compounds Detected | Trip Blanks* (µg/l) | | Field Blanks (µg/l) | |
|---|---|---|---|---|
| | BT-23-FB | BT-24-FB | BS-10-FB | BS-12-FB |
| Methylene chloride | 4 J | 6 | 5 U | 5 U |
| Acetone | 10 U | 10 | 6 J | 7 J |

Notes:

* Trip Blanks analyzed for volatile organic compounds only
J = estimated value
U = not detected at the reported value
µg/l = micrograms per liter

Table 3-5 Summary of Inorganic Analyses of Rinseate Blanks and Field Blanks

| Compounds Detected | Rinseate Blanks (μg/l) | | Field Blanks (μg/l) | | |
|---|---|---|---|---|---|
| | BS-22-ER | BS-23-ER | BS-10-FB | BS-11-FB | BS-12-FB |
| Barium | 0.62 J | 1.2 J | 1.1 U | 38.9 J | 1.2 U |
| Beryllium | 0.24 U | 0.24 U | 0.24 U | 0.47 J | 0.24 U |
| Chromium | 1.9 U | 1.9 U | 2.8 J | 3.5 J | 3.9 J |
| Cobalt | 1.6 U | 1.6 U | 1.6 U | 3.2 J | 1.6 U |
| Copper | 1.8 U | 1.8 U | 1.8 U | 1.8 U | 6.2 J |
| Silver | 1.5 UJ | 1.5 UJ | 1.5 U | 1.5 U | 1.8 J |
| Vanadium | 1.3 U | 1.3 U | 1.3 U | 6.3 J | 1.3 J |
| Zinc | 13.1 U | 10.0 U | 7.7 J | 16.0 J | 8.4 J |

Notes:

J = estimated value
U = not detected at the reported value
μg/l = micrograms per liter

Table 3-6 Summary of Field Duplicate Results for Groundwater Samples Collected from Site 11

| Sample Identification | Results[1] | | | |
|---|---|---|---|---|
| KBA-11-2/KBA-11-2D | VOCs (µg/l) | | | |
| | | | Method 8240 | Method 8010 |
| | Vinyl Chloride | | 48 J/71 J | 15 J/100 J |
| | Chloroethane | | 10 U/10 U | 1.0 U/3.3 |
| | 1,2-Dichloroethene | | 5 U/8 J | 1.0 U/4.8 |
| | Chloroform | | 4 J/5 U | 1.0 U/1.0 U |
| | Toluene | | 5 U/1 J | 1.0 U/1.1 |
| | Metals (µg/l) | | | |
| | Arsenic | 3.2 J/2.7 J | Nickel | 34.0 J/10.7 U |
| | Barium | 26.4/19.0 J | Selenium | 2.7 J/2.1 UJ |
| | Beryllium | 0.42 J/0.24 U | Silver | 3.4 J/2.8 J |
| | Chromium | 27.6/21.9 | Vanadium | 15.7 J/10.0 J |
| | Copper | 35.2/10.2 J | Zinc | 64.0/32.9 J |
| | Lead | 11.9 J/6.7 UJ | Sulfide | 200/100 U |
| | Mercury | 0.60/0.61 | | |

See notes at end of table.

Table 3-6 Summary of Field Duplicate Results for Groundwater Samples Collected from Site 11 (continued)

| Sample Identification | Results[1] | | | |
|---|---|---|---|---|
| KBA-11-9/KBA-11-9D | VOCs | | | |
| | Not analyzed for | | | |
| | Metals (µg/l) | | | |
| | Arsenic | 7.5 J/3.5 J | Mercury | 0.49/0.61 |
| | Barium | 91.9 J/52.4 J | Nickel | 11.3 J/13.0 J |
| | Beryllium | 2.4 J/1.4 J | Selenium | 2.7 J/2.1 UJ |
| | Chromium | 100/68.1 | Silver | 1.9 J/2.8 J |
| | Cobalt | 2.6 J/1.8 J | Vanadium | 61.3/41.3 J |
| | Copper | 27.4/23.5 J | Zinc | 56.5 J/41.4 J |
| | Lead | 11.6 J/7.5 UJ | Sulfide | 100 U/200 |

Notes:

[1]Numbers separated by a slash indicate respective concentrations of an analyte in replicate samples identified similarly under the heading for sample identification.
µg/l = micrograms per liter.
U = undetected at the slated detection limit
J = concentration value estimated. Either below contract required quantitation limit or due to non-rejectable quality assurance problems.
VOC = volatile organic compound

# 4.0 RESULTS OF INVESTIGATIONS

The purpose of Section 4.0 is to present the analytical results of groundwater samples collected during the fourth groundwater sampling event at Site 11, Old Camden County Landfill, in September 1992. Technical Memorandum No. 1 (ABB-ES, 1992a) presents discussions of the RFI/SI field program, including analyses of soil samples from Site 11 and groundwater sampling event No. 1. Technical Memorandum No. 2 (ABB-ES, 1992b) and Technical Memorandum No. 3 (ABB-ES, 1992d) present results from the second and third groundwater sampling events.

The following subsections discuss comparison of analytical data with data associated with previous sampling events at Site 11. Appendix A contains tables of validated analytical data for samples collected in September 1992 at Site 11. Analyses were performed by CH2M HILL Laboratories under subcontract to ABB-ES. Appendix B contains analytical data tables for compounds detected in groundwater samples collected during the first, second, and third sampling events.

**4.1 SITE 11, OLD CAMDEN COUNTY LANDFILL.** On September 9, 1992, groundwater level measurements were taken from nine monitoring wells at Site 11. Figure 4-1 is a groundwater potentiometric surface map developed from these measurements. The configuration of the potentiometric surface and the groundwater flow direction are generally unchanged from February, May, and July of 1992, when sampling events No. 1, No. 2, and No. 3 were conducted.

The headspace of monitoring wells were analyzed for VOCs using an FID. The headspace for one monitoring well at Site 11 contained detectable levels of VOCs. The detected levels of VOCs may be naturally occurring methane (Table 4-1). The headspace VOC detected concentration was 4 parts per million (ppm) at monitoring well KBA-11-9. Groundwater analytical data for the fourth sampling event do not indicate a source for the VOC headspace reading at KBA-11-9.

Field measurements of pH, specific conductance, and temperature were collected during purging of monitoring wells. Table 4-1 summarizes field measurements collected during purging of monitoring wells at Site 11. Purging continued until at least three well volumes were removed, and field parameters stabilized to within 10 percent. The final measurements of pH, specific conductance, and temperature are considered the measurements of record for the monitoring wells (USEPA, 1991). Temperature measurements are not reported because of instrument malfunction and subsequent erroneous data.

Eleven groundwater samples, including two duplicate samples, were collected from nine monitoring wells at Site 11. Groundwater samples were analyzed for VOCs, TDS, TSS, and inorganic analytes. Both filtered and unfiltered groundwater samples were collected for inorganic analysis. Table 3-2 lists specific compounds analyzed in groundwater samples collected during sampling event No. 4. Table 4-2 summarizes analytical data for compounds detected in groundwater samples collected from Site 11. Subsection 5.1 of this document describes the analytical program for sampling events Nos. 5 and 6.

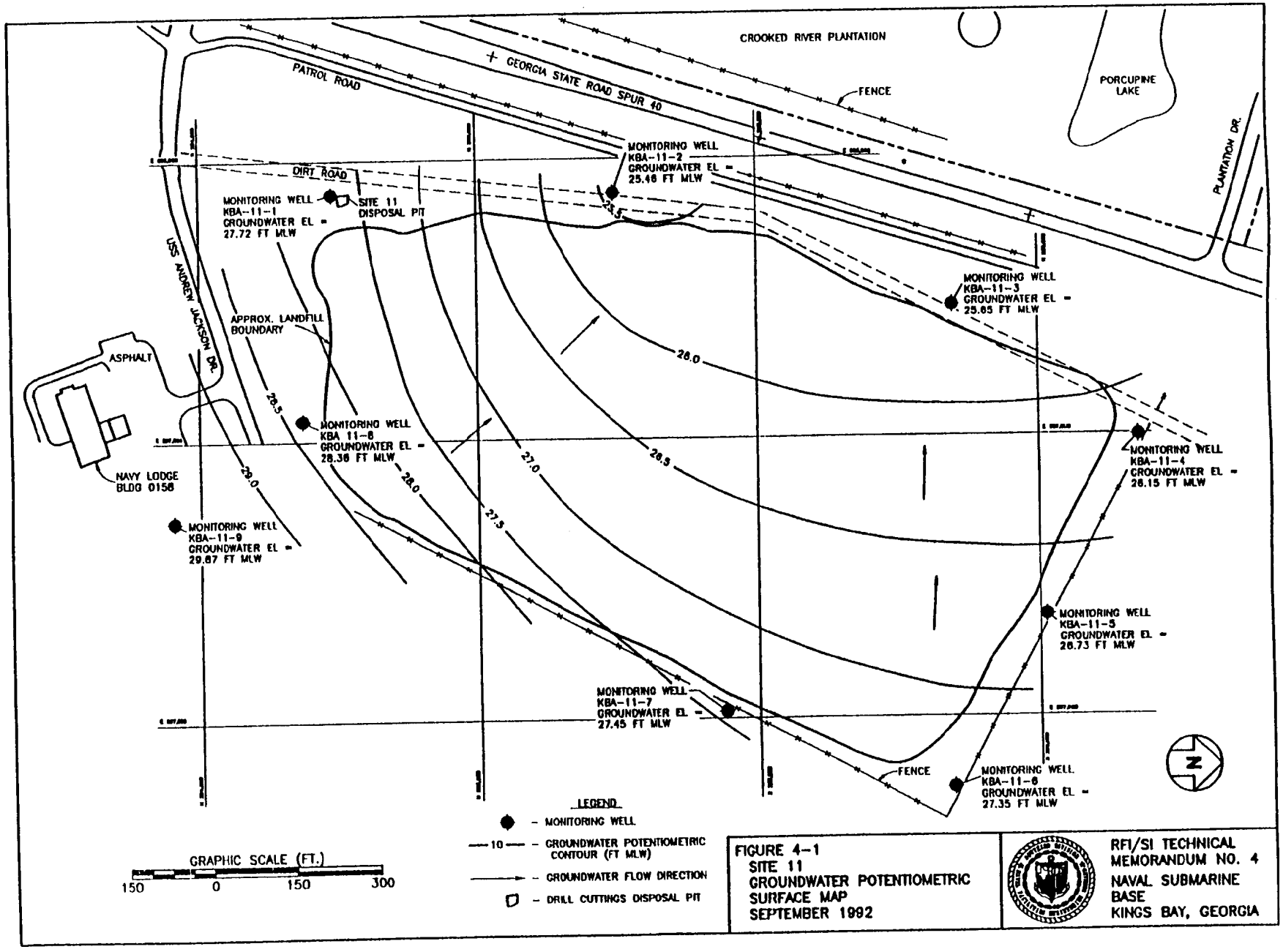


FIGURE 4-1
SITE 11
GROUNDWATER POTENTIOMETRIC SURFACE MAP
SEPTEMBER 1992

RFI/SI TECHNICAL MEMORANDUM NO. 4
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

Table 4-1 Summary of Field Measurements for Monitoring Wells at Site 11

| Monitoring Well No. | FID Headspace Data (ppm) | Field Data[1] | Well Volume No. 1 | 2 | 3 | 4 | Total Purge Vol. (gal) |
|---|---|---|---|---|---|---|---|
| KBA-11-1 | 0 | pH | 4.6 | 5.2 | 5.7 | | 2.9 |
| | | Cond. | 130 | 89 | 90 | | |
| | | Temp. | error | error | error | | |
| KBA-11-2 | 0 | pH | 8.8 | 8.0 | 7.7 | | 2.6 |
| | | Cond. | 347 | 351 | 344 | | |
| | | Temp. | error | error | error | | |
| KBA-11-3 | 0 | pH | 7.6 | 6.8 | 6.7 | | 3.0 |
| | | Cond. | 900 | 993 | 993 | | |
| | | Temp. | error | error | error | | |
| KBA-11-4 | 0 | pH | 5.6 | 5.5 | 5.2 | | 3.1 |
| | | Cond. | 485 | 700 | 730 | | |
| | | Temp. | error | error | error | | |
| KBA-11-5 | 0 | pH | 6.2 | 6.4 | 6.5 | | 2.9 |
| | | Cond. | 119 | 165 | 175 | | |
| | | Temp. | error | error | error | | |
| KBA-11-6 | 0 | pH | 6.6 | 6.7 | 6.6 | | 2.7 |
| | | Cond. | 205 | 206 | 194 | | |
| | | Temp. | error | error | error | | |
| KBA-11-7 | 0 | pH | 7.7 | 7.7 | 7.8 | | 2.8 |
| | | Cond. | 246 | 246 | 244 | | |
| | | Temp. | error | error | error | | |
| KBA-11-8 | 0 | pH | 6.0 | 6.2 | 6.1 | | 2.8 |
| | | Cond. | 1159 | 994 | 1036 | | |
| | | Temp. | error | error | error | | |
| KBA-11-9 | 4 | pH | 8.5 | 7.8 | 7.8 | 7.9 | 4.8 |
| | | Cond. | 335 | 320 | 310 | 300 | |
| | | Temp. | error | error | error | error | |

Notes:
FID = flame ionization detector
ppm = parts per million
error = analyzed, but readings were erroneous because of instrument malfunction. Instrument replaced.
1) Units are standard units (s.u.) for pH, micromhos per centimeter (umhos/cm) for specific conductance, and degrees Celsius (°C) for temperature.

Table 4-2 Summary of Compounds Detected in Groundwater Samples Collected from Site 11[1]

| Compounds Detected | | Monitoring Well Number | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CRQL | KBA-11-1 | 11-2 | 11-2D | 11-3 | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 | 11-9D |
| **APPENDIX IX VOCs (µg/l)** | | | | | | | | | | | | | |
| Vinyl Chloride[2] | (Method 8240) | 10 | 10 U | 48 J | 71 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | ---- |
| | (Method 8010) | 1 | 1.0 U | 15 J | 100 J | 1.0 U | ---- | ---- | ---- | ---- | 1.0 U | ---- | ---- |
| Chloromethane | (Method 8240) | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | ---- |
| | (Method 8010) | 1 | 1.0 U | 1.0 U | 3.3 | 1.0 U | ---- | ---- | ---- | ---- | 1.0 U | ---- | ---- |
| 1,2-Dichloroethene[3] | | 5 | 5 U | 5 U | 8 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | ---- |
| | (Method 8240) | 1 | 1.0 U | 1.0 U | 4.8 | 1.0 U | ---- | ---- | ---- | ---- | 1.0 U | ---- | ---- |
| | (Method 8010) | | | | | | | | | | | | |
| Toluene[4] | (Method 8240) | 5 | 5 U | 5 U | 1 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | ---- |
| | (Method 8010) | 1 | 1.0 U | 1.0 U | 1.1 | 1.0 U | ---- | ---- | ---- | ---- | 1.0 U | ---- | ---- |
| Chlorobenzene[4] | (Method 8240) | 5 | 5 U | 5 U | 5 U | 4 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | ---- |
| | (Method 8010) | 1 | 1.0 U | 1.0 U | 1.0 U | 3.1 | ---- | ---- | ---- | ---- | 1.0 U | ---- | ---- |
| Chloroform[4] | (Method 8240) | 5 | 5 U | 4 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | ---- |
| | (Method 8010) | 1 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | ---- | ---- | ---- | ---- | 1.0 U | ---- | ---- |
| 1,4-Dichlorobenzene[4] | | 5 | 5 U | 5 U | 5 U | 15 | 5 U | 5 U | 2 J | 5 U | 5 U | 5 U | ---- |
| | (Method 8240) | 1 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | ---- | ---- | ---- | ---- | 1.0 U | ---- | ---- |
| | (Method 8010) | | | | | | | | | | | | |
| **APPENDIX IX Inorganics (µg/l)** | | | | | | | | | | | | | |
| Arsenic[4] | unfiltered | 10 | 2.2 J | 3.2 J | 2.7 J | 4.3 J | 3.2 J | 8.2 J | 3.0 J | 10.3 | 3.8 J | 7.5 J | 3.5 J |
| | filtered | | 1.0 U | 1.2 J | --- | 1.0 U | 1.0 U | 1.0 J | 1.0 U | 1.0 U | 2.5 J | 1.0 U | --- |
| Barium[4] | unfiltered | 200 | 50.3 J | 26.4 J | 19.0 J | 97.7 J | 32.1 J | 122 J | 69.6 J | 95.6 J | 22.2 J | 91.9 J | 52.4 J |
| | filtered | | 27.0 U | 5.7 U | --- | 11.2 U | 10.0 U | 5.9 U | 8.1 U | 8.4 U | 13.0 U | 4.5 U | --- |
| Beryllium[4] | unfiltered | 5 | 0.61 J | 0.42 J | 0.24 U | 0.91 J | 0.69 J | 1.9 J | 1.3 J | 1.4 J | 0.38 J | 2.4 J | 1.4 J |
| | filtered | | .024 U | 0.24 U | --- | 0.24 U | 0.24 U | 0.24 U | 0.24 J | 0.24 U | 0.24 U | 0.24 U | --- |
| Cadmium[4] | unfiltered | 5 | 2.7 U | 2.7 U | 2.7 U | 3.5 J | 2.7 U | 2.7 U | 3.2 J | 2.7 U | 7.1 | 2.7 U | 2.7 U |
| | filtered | | 2.7 U | 2.8 J | --- | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 3.9 J | 2.7 U | --- |
| Chromium[4] | unfiltered | 10 | 38.7 | 27.6 | 21.9 | 70.1 | 40.0 | 129 | 76.0 | 132 | 18.9 | 100 | 68.1 |
| | filtered | | 2.6 J | 1.9 U | --- | 1.9 U | 1.9 U | 1.9 U | 1.9 U | 1.9 U | 1.9 U | 4.4 J | --- |

See notes at end of table.

Table 4-2 Summary of Compounds Detected in Groundwater Samples Collected from Site 11[1] (continued)

| Compounds Detected | | | Monitoring Well Number | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CRQL | KBA-11-1 | 11-2 | 11-2D | 11-3 | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 | 11-9D |
| **APPENDIX IX INORGANICS** | | | | | | | | | | | | | |
| Cobalt[4] | unfiltered | 50 | 1.6 U | 1.6 U | 1.6 U | 3.2 J | 1.6 U | 4.0 J | 2.6 J | 2.6 J | 3.2 J | 2.6 J | 1.8 J |
| | filtered | | 1.6 U | 2.0 U | --- | 1.6 UJ | 1.6 UJ | 1.6 UJ | 1.6 UJ | 1.6 UJ | 1.6 UJ | 2.9 U | --- |
| Copper[4] | unfiltered | 25 | 48.5 | 35.2 | 10.2 J | 14.8 J | 17.2 J | 107 | 19.3 J | 173 | 28.6 | 27.4 | 23.5 J |
| | filtered | | 6.0 J | 3.0 J | --- | 1.8 U | 1.8 U | 6.3 J | 5.7 J | 14.2 J | 3.9 J | 52.4 | --- |
| Lead[5] | unfiltered | 5 | 11.2 J | 11.9 J | 6.7 UJ | 10.1 J | 13.3 J | 22.0 J | 19.4 J | 11.1 J | 5.0 UJ | 11.6 J | 7.5 UJ |
| | filtered | | 1.4 U | 6.4 | --- | 5.4 | 2.9 J | 3.1 | 4.6 | 3.8 | 1.4 U | 3.5 | --- |
| Mercury[6] | unfiltered | 0.2 | 0.72 | 0.60 | 0.61 | 0.61 | 4.1 | 0.72 | 0.72 | 0.91 | 0.55 | 0.49 | 0.61 |
| | filtered | | 0.03 UJ | 0.03 UJ | --- | 0.03 UJ | 0.03 UJ | 0.03 UJ | 0.03 UJ | 0.03 UJ | 0.03 UJ | 0.03 UJ | --- |
| Nickel[4] | unfiltered | 40 | 10.7 U | 34.0 J | 10.7 U | 10.9 J | 10.7 U | 37.6 J | 10.7 U | 83.0 | 23.4 J | 11.3 J | 13.0 J |
| | filtered | | 10.7 U | 10.7 U | --- | 10.7 U | 10.7 U | 10.7 U | 10.7 U | 10.7 U | 10.7 U | 10.7 U | --- |
| Selenium[4,5] | unfiltered | 5 | 2.1 UJ | 2.7 J | 2.1 UJ | 5.9 J | 3.9 J | 2.1 UJ | 2.1 UJ | 2.1 UJ | 2.1 UJ | 2.7 J | 2.1 UJ |
| | filtered | | 2.1 U | 2.1 U | --- | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | 2.1 U | --- |
| Silver[4,5] | unfiltered | 10 | 1.9 J | 3.4 J | 2.8 J | 3.0 J | 2.7 J | 4.8 J | 4.1 J | 1.5 J | 10.1 J | 1.9 J | 2.8 J |
| | filtered | | 1.5 U | 1.5 U | --- | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 2.5 J | --- |
| Vanadium[4] | unfiltered | 50 | 12.3 J | 15.7 J | 10.0 J | 54.8 | 28.6 J | 70.0 | 30.1 J | 45.6 J | 11.6 J | 61.3 | 41.3 J |
| | filtered | | 2.0 U | 5.2 U | --- | 2.0 U | 1.3 U | 2.0 U | 1.3 U | 1.3 U | 1.3 U | 8.8 U | --- |
| Zinc[4,7] | unfiltered | 20 | 53.8 J | 64.0 J | 32.9 J | 44.7 J | 36.4 J | 278 J | 39.0 J | 291 J | 39.8 J | 56.5 J | 41.4 J |
| | filtered | | 15.5 J | 11.4 J | --- | 8.4 J | 8.4 J | 66.5 J | 11.4 J | 27.4 J | 52.6 J | 32.4 J | --- |
| Cyanide[4] | unfiltered | 10 | 2.2 U | 2.2 U | 2.2 U | 4.2 J | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U |
| | filtered | | 2.2 U | 2.2 U | --- | 3.2 J | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | --- |
| Sulfide | unfiltered | 100 | 100 U | 200 | 100 U | 200 | 200 | 200 | 300 | 500 | 200 | 100 U | 200 |
| | filtered | | 100 U | 300 | --- | 200 | 100 U | 200 | 100 U | 100 U | 300 | 100 U | --- |

See notes at end of table.

Table 4-2 Summary of Compounds Detected in Groundwater Samples Collected from Site 11[1] (continued)

| Compounds Detected | | Monitoring Well Number | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CRQL | KBA-11-1 | 11-2 | 11-2D | 11-3 | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 | 11-9D |
| **PHYSICAL PARAMETERS** | | | | | | | | | | | | |
| Total Solids (mg/l) | | 431 | 718 | 947 | 2100 | 1414 | 1293 | 1117 | 1143 | 831 | 612 | --- |
| TDS (mg/l) | | 79 | 298 | 282 | 1090 | 870 | 233 | 122 | 53 | 595 | 144 | --- |
| TSS (mg/l) | | 352 | 420 | 665 | 1010 | 544 | 1060 | 995 | 1090 | 236 | 468 | --- |
| % TSS | | 82 | 58 | 70 | 48 | 38 | 82 | 89 | 95 | 28 | 76 | --- |

Notes:
CRQL = Contract Required Quantitation Limit
U = not detected above or below CRQL
--- = Analysis not required/performed
µg/l = micrograms per liter
VOCs = volatile organic compounds
[1] Groundwater samples were analyzed for VOCs and inorganic constituents only.
[2] Sample results flagged J as estimated due to differences in duplicate results.
[3] Sample quantitation limits flagged J as estimated due to a noncompliant tuning standard.
[4] Sample results flagged J as estimated because concentration is less than the CRQL.
[5] Sample results and sample quantitation limits flagged J and UJ as estimated because matrix spike recovery for lead, selenium, and silver were below QC limits.
[6] Sample quantitation limits flagged UJ as estimated because the associated preparation blank exhibited negative bias for mercury.
[7] Sample results flagged J as estimated because duplicate analysis for zinc was outside QC limits.

**4.1.1 Volatile Organic Compounds in Groundwater** All groundwater samples collected from Site 11 were analyzed for VOCs using SW-846 Method 8240. During the fourth sampling event, additional samples were collected from four monitoring wells, KBA-11-1, KBA-11-2, KBA-11-3, and KBA-11-8, and analyzed for VOCs using SW-846 Methods 8010 and 8020. The purpose of using the two additional VOC analytical methods was to achieve lower compound detection limits at these four monitoring wells to establish whether site-related VOCs, especially vinyl chloride, were present at concentrations below the normal detection limits of 5 and 10 µg/l (Method 8240).

VOCs were detected in groundwater samples collected from three monitoring wells, KBA-11-2, KBA-11-3, and KBA-11-6 (see Table 4-2). VOCs were also detected in these monitoring wells during the first three groundwater sampling events, including vinyl chloride, chloromethane, toluene, chlorobenzene, chloroform, 1,4-dichlorobenzene, and 1-2,dichloroethene.

Concentrations of chlorobenzene and 1,4-dichlorobenzene in monitoring well KBA-11-3 were 4 J µg/l and 15 µg/l, respectively (using Method 8240). Chlorobenzene was also detected in the sample collected from KBA-11-3 analyzed by Method 8020 (see Table 4-1). Chlorobenzene and an isomer of 1,4-dichlorobenzene, 1,3-dichlorobenzene, were also detected in KBA-11-3 during the second and third sampling events (May and July, 1992). 1,4-Dichlorobenzene was detected in groundwater samples from monitoring well KBA-11-6 during sampling events No. 2, No. 3, and No. 4, but the concentrations were near the instrument detection limit for this compound.

Vinyl chloride, 1,2-dichloroethene, chloroform, and toluene were detected in duplicate samples from monitoring well KBA-11-2 that were analyzed using Method 8240. Vinyl chloride, 1,2-dichloroethene, and toluene were also detected in samples from KBA-11-2 that were analyzed using Method 8010. Chloroform was not detected using Method 8010 and has not been detected in previous sampling events. Chloromethane was not detected using Method 8240 but was detected by Method 8010, and was also detected in samples collected from KBA-11-2 during sampling event No. 2.

Concentrations of vinyl chloride in duplicate samples collected from monitoring well KBA-11-2 were 48 J µg/l and 71 J µg/l (using Method 8240) and 15 J µg/l and 100 J µg/l (using Method 8010). As discussed in Subsection 3.2.2, differences in vinyl chloride concentrations for the two duplicate samples and the low recovery of vinyl chloride in one sample (15 J µg/l) are most likely caused by the physical characteristics of vinyl chloride (i.e., low boiling point, high volatility) and sample handling techniques. Vinyl chloride is an extremely volatile compound and can be lost to the atmosphere from a groundwater sample during all stages of environmental sampling and chemical analysis if special care is not taken. Sample results for vinyl chloride were qualified as estimated and flagged with a J qualifier because of the disparity between duplicate results. Vinyl chloride was detected in well KBA-11-2 during the first three sampling events at concentrations ranging from 18 to 150 µg/l. The Federal Drinking Water Standard Maximum Contaminant Level (MCL) for vinyl chloride is 2 µg/l.

Based on analytical results for samples collected from KBA-11-2 during the second sampling event (July 1992), SOUTHNAVFACENGCOM and NSB Kings Bay elected to take immediate measures to evaluate the vinyl chloride contaminant plume. A Plan of Action for this investigation was developed by ABB-ES in July 1992 (ABB-ES,

1992c) and field activities for a Phase I investigation were conducted on August 4 through 16, 1992. Field activities included collection of groundwater samples and stratigraphic characterization using cone penetrometer testing. The results of the Phase I investigation have been submitted under separate cover (ABB-ES, 1992e). Based on analytical results of the Phase I investigation at Site 11, an Interim Corrective Measure Screening Investigation Work Plan was developed (ABB-ES, 1992f) and field activities for this investigation were scheduled to take place October 12 through November 18, 1992.

**4.1.2 Inorganic Constituents in Groundwater** With few exceptions, concentrations of inorganic constituents in groundwater samples from each monitoring well at Site 11 were similar to concentrations detected in samples collected during the third sampling event in July 1992. Mercury and silver were detected in groundwater samples collected during sampling event No. 4 at concentrations greater than those detected in corresponding monitoring wells during sampling event No. 3. Increased concentrations were observed in groundwater samples from both upgradient and downgradient monitoring wells. Therefore, the increase in concentrations for these constituents may be caused by seasonal variations.

Chromium was detected in one groundwater sample from downgradient well KBA-11-5 and arsenic, chromium, copper, nickel, and zinc were detected in one groundwater sample from upgradient well KBA-11-7 at concentrations above those detected in samples collected from these wells during sampling event No. 3. Concentrations of chromium in these monitoring wells exceeded the Federal Drinking Water Standard MCL of 100 $\mu$g/l. Increased concentrations of inorganic constituents in the sample collected from KBA-11-7 may be due to the order of magnitude increase of suspended solids in this sample relative to values obtained during the third sampling event.

Cadmium was detected in groundwater samples from two downgradient wells, KBA-11-3 and KBA-11-6, and one upgradient well, KBA-11-7, at concentrations above those detected in samples collected from these wells during sampling event No. 3. The concentration of cadmium in the sample from KBA-11-8, 7.1 $\mu$g/l, exceeded the MCL of 5 $\mu$g/l.

Both filtered and unfiltered groundwater samples were collected for inorganic analyses from the nine monitoring wells at Site 11. The purpose of collecting and analyzing filtered and unfiltered samples was to establish what fraction of the total concentration of inorganics in groundwater samples is attributable to suspended particulates. Groundwater samples from Site 11 were also analyzed for TDS and TSS to determine what percentage of the total solids in groundwater represent suspended particulates.

TDS and TSS results for groundwater samples are shown in Table 4-2. Total solids (the sum of TDS and TSS) in groundwater ranged from 431 mg/l in KBA-11-1 to 2,100 mg/l in KBA-11-3. The fraction of total solids in groundwater that represents suspended solids ranged from 28 percent (236 milligrams per liter [mg/l]) for KBA-11-8 to 95 percent (1,090 mg/l) for KBA-11-7. The total amount of solids and suspended solids in the upgradient monitoring wells KBA-11-1, KBA-11-8, and KBA-11-9 were comparable to the solids found in downgradient wells. The concentration of suspended solids in one upgradient well KBA-11-7 (1,090 mg/l) and one downgradient well, KBA-11-5 (1,060 mg/l), significantly increased when compared to concentrations detected in samples collected from these wells during the third sampling event (102 and 392 mg/l, respectively). The increase in

the third sampling event (102 and 392 mg/l, respectively). The increase in suspended solids is most likely attributable to seasonal variations in the aquifer.

The concentrations of inorganic constituents detected in unfiltered samples collected from downgradient monitoring wells were compared to concentrations detected in upgradient, unfiltered groundwater samples. The following paragraphs discuss general observations regarding the constituents and concentrations detected in filtered and unfiltered samples collected in September 1992. Table 4-2 summarizes inorganic constituents detected in groundwater samples collected during sampling event No.4.

Barium, selenium, and cyanide were detected in a unfiltered sample collected from monitoring well KBA-11-3 at concentrations exceeding upgradient concentrations; however, concentrations were less than two times upgradient concentrations. Barium and selenium were not detected in the filtered sample collected from KBA-11-3.

Lead, mercury, and selenium were detected in a unfiltered sample collected from monitoring well KBA-11-4 at concentrations exceeding upgradient concentrations; however, concentrations of lead and selenium were less than two times upgradient concentrations. The concentration of mercury in the unfiltered sample at KBA-11-4, 4.1 µg/l, exceeds the Federal Drinking Water MCL of 2 µg/l. Concentrations of mercury in this monitoring well ranged from non-detect to 1.4 µg/l during the first three sampling events. Mercury was not detected in the filtered groundwater samples collected from KBA-11-4 during the third and fourth sampling events.

Barium, cobalt, lead, and vanadium were detected in a unfiltered sample collected from monitoring well KBA-11-5 and lead was detected in a unfiltered sample from KBA-11-6 at concentrations exceeding upgradient concentrations. However, concentrations were less than two times corresponding upgradient concentrations. Concentrations of lead in KBA-11-5, 22.0 J µg/l, and KBA-11-6, 19.4 J µg/l, exceed the 15 µg/l MCL for lead that will be effective on December 7, 1992, but do not exceed the present MCL for lead of 50 µg/l. Concentrations of lead in filtered samples collected from these wells were considerably lower and do not exceed the MCL effective December 7, 1992.

Chromium was detected in unfiltered groundwater samples from two upgradient monitoring wells, KBA-11-7 and KBA-11-9, and one downgradient well, KBA-11-5, at concentrations exceeding the MCL for chromium of 100 µg/l. The unfiltered groundwater sample collected from KBA-11-5 during the third sampling event in July 1992 also exceeded the 100 µg/l MCL. Chromium was not detected in the filtered samples collected from KBA-11-7 and KBA-11-5 during the third and fourth sampling rounds. Chromium was detected in the filtered sample collected from upgradient well KBA-11-9, but at a considerably lower concentration of 4.4 J µg/l.

In general, the results for the filtered groundwater samples are considered to be a more accurate representation of groundwater quality at Site 11 because of the relatively high percentage of suspended solids in unfiltered samples.

Concentrations of inorganic constituents in unfiltered groundwater samples collected from Site 11 were compared to Federal Primary Drinking Water Standard MCLs. Appendix C presents inorganic data for unfiltered groundwater samples

collected at Site 11 during the first four sampling events. Data are presented in bar chart form for the seven inorganic constituents regulated under the Safe Drinking Water Act. Figure 4-2 summarizes concentrations of inorganics having MCLs for the filtered and unfiltered groundwater samples collected at Site 11 during the fourth sampling event.

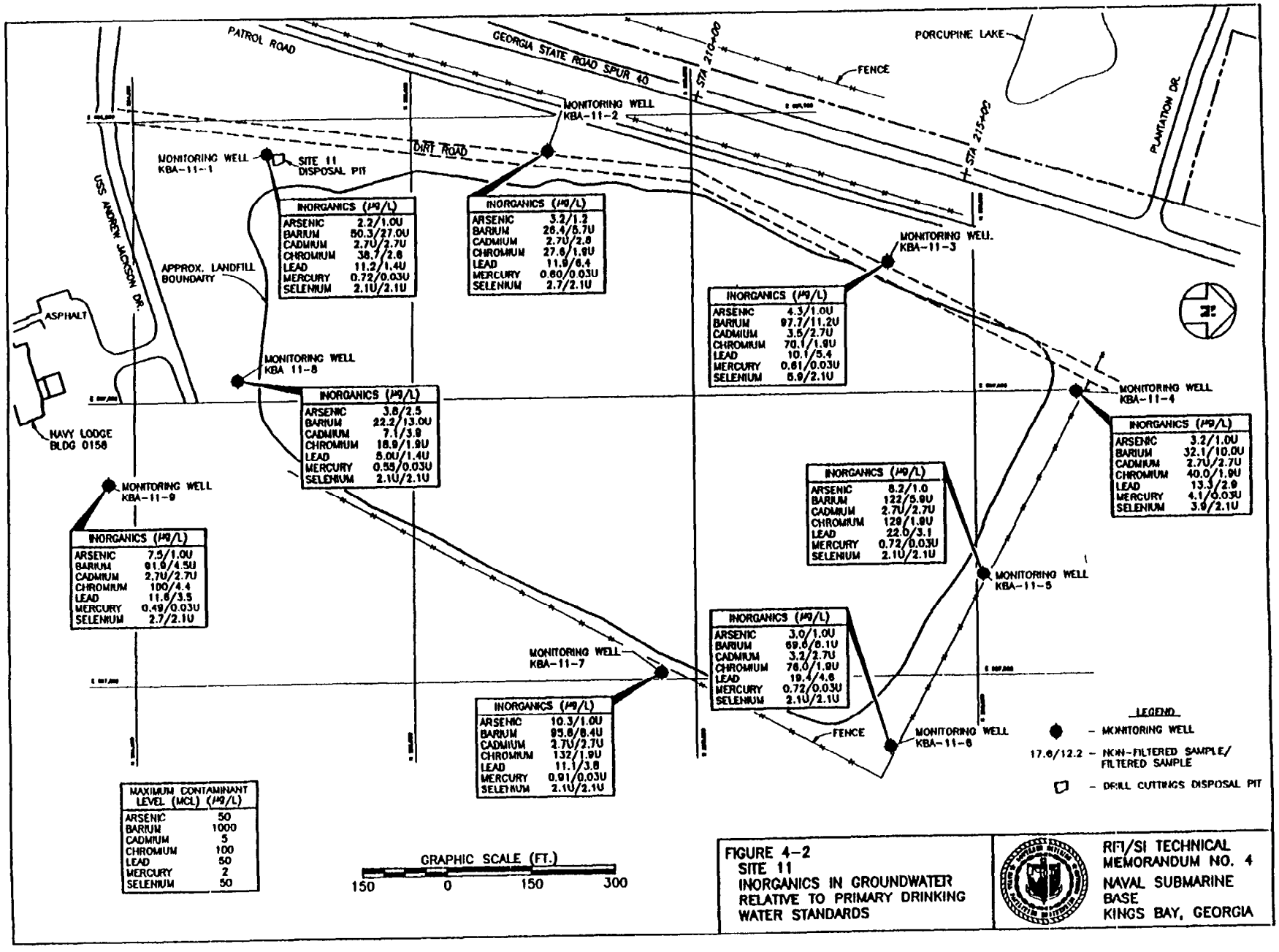


FIGURE 4-2
SITE 11
INORGANICS IN GROUNDWATER RELATIVE TO PRIMARY DRINKING WATER STANDARDS

RFI/SI TECHNICAL MEMORANDUM NO. 4
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

## 5.0 SUMMARY

This section summarizes results from the fourth groundwater sampling event at Site 11 and outlines the groundwater monitoring analytical program for groundwater sampling events Nos. 5 and 6 at Site 11. The analytical program has been developed based on information obtained from analysis of soil samples collected during the RFI/SI field program and four groundwater sampling events conducted at NSB, Kings Bay, Georgia.

Groundwater samples collected during the fourth groundwater sampling event at Site 11 were analyzed for a modified list of Appendix IX constituents, including VOCs, inorganic constituents, TDS, and TSS.

VOCs detected in groundwater samples collected from Site 11 during the fourth sampling event include vinyl chloride, chloromethane, 1,2-dichloroethene, toluene, chlorobenzene, and 1,4-dichlorobenzene. The concentrations of vinyl chloride in monitoring well KBA-11-2 exceeded the Federal Drinking Water MCL of 2 $\mu$g/l.

A Plan of Action for the investigation of the vinyl chloride contaminant plume at Site 11 was developed by ABB-ES in July 1992 (ABB-ES, 1992c) and field activities for the Phase I investigation were conducted on August 4 through 16. The results of the Phase I investigation have been submitted under separate cover (ABB-ES, 1992e). Based on analytical results of the Phase I investigation at Site 11, an Interim Corrective Measure Screening Investigation Work Plan was developed (ABB-ES, 1992f) and field activities for this investigation were scheduled to take place October 12 through November 18, 1992.

With few exceptions, concentrations of inorganic constituents in groundwater samples from each monitoring well at Site 11 were similar to concentrations detected in samples collected in July 1992. Both filtered and unfiltered groundwater samples were collected during the fourth sampling event at Site 11 to determine whether aquifer solids in groundwater contribute to the total concentration of inorganic constituents in groundwater. Unfiltered samples were also analyzed for TDS and TSS to determine what percentage of the total solids in groundwater represents suspended particulates.

Chromium, cadmium, lead, and mercury were detected in one or more unfiltered groundwater samples collected from Site 11 at concentrations exceeding corresponding Federal Drinking Water Standard MCLs. Chromium was detected in two upgradient monitoring wells KBA-11-7 and KBA-11-9 and one downgradient monitoring well KBA-11-5 at concentrations exceeding the MCL for chromium of 100 $\mu$g/l. Cadmium was detected in a groundwater sample from upgradient well KBA-11-8 at a concentration exceeding the MCL for cadmium of 5 $\mu$g/l. Mercury was detected in a groundwater sample from downgradient well KBA-11-4 at a concentration exceeding the MCL for mercury of 2 $\mu$g/l. Concentrations of lead in downgradient monitoring wells KBA-11-5 and KBA-11-6 exceeded the 15 $\mu$g/l MCL for lead that will be effective on December 7, 1992, but do not exceed the present MCL for lead of 50 $\mu$g/l.

Concentrations of inorganics in filtered groundwater samples collected from Site 11 (including concentrations for chromium, cadmium, lead, and mercury) were well below any Federal Primary Drinking Water Standard MCLs for inorganic constituents. The results for filtered samples are generally considered to be

a more accurate representation of groundwater quality at Site 11 because of the relatively high concentrations of suspended solids in groundwater (ranging from 236 to 1,090 mg/l).

Table 5-1 is a summary of the sampling and analysis program for groundwater sampling events Nos. 5 and 6. Table 5-2 lists the compounds and analytical methods included in the analytical program for groundwater sampling events Nos. 5 and 6 at Site 11. Concentrations of inorganics were significantly lower for filtered groundwater samples than for unfiltered samples at Site 11.

Table 5-1 Summary of Sampling and Analysis Program for Groundwater Sampling Events Nos. 5 and 6 at Site 11

| Location and Type of Sampling | Laboratory Analysis | | |
|---|---|---|---|
| | A | B | C |
| **Site 11** | | | |
| Groundwater | 9 | 18 | 9 |
| **Field Duplicates** | | | |
| Groundwater | 1 | 2 | 1 |
| **Quality Control Samples** | | | |
| Trip Blanks | 3 | 0 | 0 |
| Rinseate Blanks | 3 | 2 | 2 |
| Field Blanks | 2 | 3 | 2 |

A - Volatile Organic Compounds (VOCs) (Method 8240)
B - Inorganic constituents (including cyanide and sulfide)
C - Total Dissolved Solids (TDS) and Total Suspended Solids (TSS)

Table 5-2 Compounds and Analytical Methods for Groundwater Sampling Event Nos. 5 and 6 at Site 11

**Parameter:** **Volatile Organic Compounds (38 total)**
**TCL List plus 4 additional compounds**
**Method:** **SW-846 Method 8240**

| | |
|---|---|
| Chloromethane | cis-1,3-Dichloropropene |
| Bromomethane | Trichloroethene |
| Vinyl Chloride | Dibromochloromethane |
| Chloroethane | 1,1,2-Trichloroethane |
| Methylene Chloride | Benzene |
| Acetone | trans-1,3-Dichloropropene |
| Carbon Disulfide | Bromoform |
| Trichlorofluoromethane* | 2-Hexanone |
| 1,1-Dichloroethene | 4-Methyl-2-Pentanone |
| 1,1-Dichloroethane | Tetrachloroethene |
| 1,2-Dichloroethene (total) | 1,1,2,2-Tetrachloroethane |
| Chloroform | Toluene |
| 1,2-Dichloroethane | Chlorobenzene |
| 2-Butanone | Ethylbenzene |
| 1,1,1-Trichloroethane | Styrene |
| Carbon Tetrachloride | Xylene (total) |
| Vinyl Acetate | 1,3-Dichlorobenzene* |
| Bromodichloromethane | 1,4-Dichlorobenzene* |
| 1,2-Dichloropropane | 1,2-Dichlorobenzene* |

* Non-TCL compounds

**Parameter:** **Appendix IX Inorganic Analytes (19 total)**
**Method:** **SW-846 Methods (listed in parentheses)**

| | | |
|---|---|---|
| Antimony (6010) | Copper (6010) | Thallium (7841) |
| Arsenic (7060) | Lead (7421) | Vanadium (6010) |
| Barium (6010) | Mercury (7470) | Zinc (6010) |
| Beryllium (6010) | Nickel (6010) | Tin (6010) |
| Cadmium (6010) | Selenium (7740) | Cyanide (9010) |
| Chromium (6010) | Silver (6010) | Sulfide (9030) |
| | Cobalt (6010) | |

**Parameter:** **Total Dissolved Solids (TDS)/ Total Suspended Solids (TSS)**
**Method:** **Standard Methods-- Methods 2540C and 2540D**

TCL = Target Compound List

## REFERENCES


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# APPENDIX A
# ANALYTICAL DATA VALIDATION SUMMARY TABLES
# SAMPLE EVENT NO. 4
# SEPTEMBER 1992

## DEFINITION OF DATA QUALIFIERS

Organic Data Qualifiers

J - Indicates an estimated concentration because results are either below the concentration required detection level (CRQL) or quality control criteria were not met.

U - Indicates that compound was analyzed but not detected.

UJ - Indicates that quantitation level was estimated because QC criteria were not met.

NJ - Presumptive evidence for the presence of a compound at an estimated value.

E - Indicates that the analyte concentration exceeded the calibration range of the GC/MS and re-analysis of diluted sample within calibration range.

D - Indicates that sample concentration was obtained by dilution to bring result within calibration range.

X - Total concentration of two indistinguishable isomers (i.e., 3-Methylphenol and 4-Methylphenol).

UR - Indicates that the reported detection limit is unusable because QA criteria were not met.

Inorganic Data Qualifiers

J - Indicates an estimated concentration because results are either below the concentration required detection level (CRQL) or quality control criteria were not met.

U - Indicates that compound was analyzed but not detected.

UJ - Indicates that quantitation level was estimated because QC criteria were not met.

E - The reported concentration is estimated because of the presence of an interference.

UR - Indicates that the reported detection limit is unusable because QC criteria were not met.

| PROJECT: NSB KINGS BAY, GEORGIA | | VOLATILE AQUEOUS ANALYSES (ug/l) | | | | | Validation/Summary Table | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION: | | KBA-11-1 | KBA-11-2 | KBA-11-2D | KBA-11-3 | KBA-11-4 | KBA-11-5 | KBA-11-6 |
| LAB NUMBER: | | 22711002 | 22711005 | 22711014 | 22711006 | 22711007 | 22711010 | 22711011 |
| DATE SAMPLED: | | 09/10/92 | 09/09/92 | 09/09/92 | 09/10/92 | 09/10/92 | 09/10/92 | 09/10/92 |
| DATE ANALYZED: | | 09/17/92 | 09/18/92 | 09/18/92 | 09/23/92 | 09/17/92 | 09/17/92 | 09/23/92 |
| DILUTION FACTOR: | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| VOLATILES -- METHOD 8240 | | | | | | | | |
| ANALYTE | CRQL | | | | | | | |
| Chloromethane | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | 10 | 10 U | 48 J | 71 J | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | 5 | 7 U | 5 U | 5 U | 7 U | 6 U | 6 U | 5 U |
| Acetone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Carbon Disulfide | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichlorofluoromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,1-Dichloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,1-Dichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichloroethene (total) | 5 | 5 U | 5 U | 8 J | 5 U | 5 U | 5 U | 5 U |
| Chloroform | 5 | 5 U | 4 J | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 2-Butanone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Carbon Tetrachloride | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Vinyl Acetate | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichloropropane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| cis-1,3-Dichloropropene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Dibromochloromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,1,2-Trichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| trans-1,3-Dichloropropene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Bromoform | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 2-Hexanone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-Pentanone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,1,2,2-Tetrachloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Toluene | 5 | 5 U | 5 U | 1 J | 5 U | 5 U | 5 U | 5 U |
| Chlorobenzene | 5 | 5 U | 5 U | 5 U | 4 J | 5 U | 5 U | 5 U |
| Ethylbenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Styrene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Xylene (total) | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,3-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,4-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 15 | 5 U | 5 U | 2 J |
| 1,2-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |

| PROJECT: NSB KINGS BAY, GEORGIA | | VOLATILE AQUEOUS ANALYSES (ug/l) | | | | | Validation/Summary Table | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION: | | KBA-11-7 | KBA-11-8 | KBA-11-9 | | | | |
| LAB NUMBER: | | 22711012 | 22711001 | 22711013 | | | | |
| DATE SAMPLED: | | 09/10/92 | 09/10/92 | 09/10/92 | | | | |
| DATE ANALYZED: | | 09/16/92 | 09/16/92 | 09/23/92 | | | | |
| DILUTION FACTOR: | | 1.0 | 1.0 | 1.0 | | | | |
| VOLATILES -- METHOD 8240 | | | | | | | | |
| ANALYTE | CRQL | | | | | | | |
| Chloromethane | 10 | 10 U | 10 U | 10 U | | | | |
| Bromomethane | 10 | 10 U | 10 U | 10 U | | | | |
| Vinyl Chloride | 10 | 10 U | 10 U | 10 U | | | | |
| Chloroethane | 10 | 10 U | 10 U | 10 U | | | | |
| Methylene Chloride | 5 | 6 U | 8 U | 5 U | | | | |
| Acetone | 10 | 10 U | 11 U | 10 U | | | | |
| Carbon Disulfide | 5 | 5 U | 5 U | 5 U | | | | |
| Trichlorofluoromethane | 5 | 5 U | 5 U | 5 U | | | | |
| 1,1-Dichloroethene | 5 | 5 U | 5 U | 5 U | | | | |
| 1,1-Dichloroethane | 5 | 5 U | 5 U | 5 U | | | | |
| 1,2-Dichloroethene (total) | 5 | 5 U | 5 U | 5 U | | | | |
| Chloroform | 5 | 5 U | 5 U | 5 U | | | | |
| 1,2-Dichloroethane | 5 | 5 U | 5 U | 5 U | | | | |
| 2-Butanone | 10 | 10 U | 10 U | 10 U | | | | |
| 1,1,1-Trichloroethane | 5 | 5 U | 5 U | 5 U | | | | |
| Carbon Tetrachloride | 5 | 5 U | 5 U | 5 U | | | | |
| Vinyl Acetate | 10 | 10 U | 10 U | 10 U | | | | |
| Bromodichloromethane | 5 | 5 U | 5 U | 5 U | | | | |
| 1,2-Dichloropropane | 5 | 5 U | 5 U | 5 U | | | | |
| cis-1,3-Dichloropropene | 5 | 5 U | 5 U | 5 U | | | | |
| Trichloroethene | 5 | 5 U | 5 U | 5 U | | | | |
| Dibromochloromethane | 5 | 5 U | 5 U | 5 U | | | | |
| 1,1,2-Trichloroethane | 5 | 5 U | 5 U | 5 U | | | | |
| Benzene | 5 | 5 U | 5 U | 5 U | | | | |
| trans-1,3-Dichloropropene | 5 | 5 U | 5 U | 5 U | | | | |
| Bromoform | 5 | 5 U | 5 U | 5 U | | | | |
| 2-Hexanone | 10 | 10 U | 10 U | 10 U | | | | |
| 4-Methyl-2-Pentanone | 10 | 10 U | 10 U | 10 U | | | | |
| Tetrachloroethene | 5 | 5 U | 5 U | 5 U | | | | |
| 1,1,2,2-Tetrachloroethane | 5 | 5 U | 5 U | 5 U | | | | |
| Toluene | 5 | 5 U | 5 U | 5 U | | | | |
| Chlorobenzene | 5 | 5 U | 5 U | 5 U | | | | |
| Ethylbenzene | 5 | 5 U | 5 U | 5 U | | | | |
| Styrene | 5 | 5 U | 5 U | 5 U | | | | |
| Xylene (total) | 5 | 5 U | 5 U | 5 U | | | | |
| 1,3-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | | | | |
| 1,4-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | | | | |
| 1,2-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | | | | |

PROJECT: NSB KINGS BAY, GEORGIA

VOLATILE AQUEOUS ANALYSES (ug/l)

Validation/Summary Table

| SAMPLE LOCATION: | | KBA-11-1 | KBA-11-2 | KBA-11-2D | KBA-11-3 | KBA-11-8 | | |
|---|---|---|---|---|---|---|---|---|
| LAB NUMBER: | | 117488R1 | 117489R1 | 117490R1 | 117494R1 | 117487R1 | | |
| DATE SAMPLED: | | 09/10/92 | 09/09/92 | 09/09/92 | 09/10/92 | 09/10/92 | | |
| DATA ANALYZED: | | 09/17/92 | 09/18/92 | 09/17/92 | 09/18/92 | 09/17/92 | | |
| DILUTION FACTOR: | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | | |
| VOLATILES -- METHOD 8010/8020 | | | | | | | | |
| ANALYTE | CRQL | | | | | | | |
| Chloromethane | 1.0 | 1.0 UJ | 1.0 UJ | 1.0 UJ | 1.0 UJ | 1.0 UJ | | |
| Bromomethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Vinyl Chloride | 1.0 | 1.0 U | 15 J | 100 J | 1.0 U | 1.0 U | | |
| Chloroethane | 1.0 | 1.0 U | 1.0 U | 3.3 | 1.0 U | 1.0 U | | |
| Methylene Chloride | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Trichlorofluoromethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,1-Dichloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,1-Dichloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| cis-1,2-Dichloroethene | 1.0 | 1.0 U | 1.0 U | 4.8 | 1.0 U | 1.0 U | | |
| trans-1,2-Dichloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Chloroform | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,2-Dichloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,1,1-Trichloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 2-Chloroethyl vinyl ether | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Dichlorodifluoromethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Methyl tert butyl ether | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Carbon Tetrachloride | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Bromodichloromethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,2-Dichloropropane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| cis-1,3-Dichloropropene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Trichloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Dibromochloromethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,1,2-Trichloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Benzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| trans-1,3-Dichloropropene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Bromoform | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Tetrachloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,1,2,2-Tetrachloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Toluene | 1.0 | 1.0 U | 1.0 U | 1.1 | 1.0 U | 1.0 U | | |
| Chlorobenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 3.1 | 1.0 U | | |
| Ethylbenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Xylene (total) | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,3-Dichlorobenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,4-Dichlorobenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| 1,2-Dichlorobenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |

| PROJECT: NSB KINGS BAY, GEORGIA | | INORGANIC AQUEOUS ANALYSES (ug/l) | | | | | Validation/Summary Table | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION: | | KBA-11-1 | KBA-11-1F | KBA-11-2 | KBA-11-2D | KBA-11-2F | KBA-11-3 | KBA-11-3F |
| LAB NUMBER: | | 22711002 | 22710002 | 22711015 | 22711016 | 22710006 | 22711019 | 22710005 |
| DATE SAMPLED: | | 09/09/92 | 09/09/92 | 09/09/92 | 09/09/92 | 09/09/92 | 09/09/92 | 09/09/92 |
| ANALYTE | CRQL | | | | | | | |
| Antimony | 60 | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U |
| Arsenic | 10 | 2.2 J | 1.0 U | 3.2 J | 2.7 J | 1.2 J | 4.3 J | 1.0 U |
| Barium | 200 | 50.3 J | 27.0 U | 26.4 J | 19.0 J | 5.7 U | 97.7 J | 11.2 U |
| Beryllium | 5 | 0.61 J | 0.24 U | 0.42 J | 0.24 U | 0.24 U | 0.91 J | 0.24 U |
| Cadmium | 5 | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.8 J | 3.5 J | 2.7 U |
| Chromium | 10 | 38.7 | 2.6 J | 27.6 | 21.9 | 1.9 U | 70.1 | 1.9 U |
| Cobalt | 50 | 1.6 U | 1.6 U | 1.6 U | 1.6 U | 2.0 U | 3.2 J | 1.6 UJ |
| Copper | 25 | 48.5 | 6.0 J | 35.2 | 10.2 J | 3.0 J | 14.8 J | 1.8 U |
| Lead | 5 | 11.2 J | 1.4 U | 11.9 J | 6.7 UJ | 6.4 | 10.1 J | 5.4 |
| Mercury | 0.2 | 0.72 | 0.03 UJ | 0.60 | 0.61 | 0.03 UJ | 0.61 | 0.03 UJ |
| Nickel | 40 | 10.7 U | 10.7 U | 34.0 J | 10.7 U | 10.7 U | 10.9 J | 10.7 U |
| Selenium | 5 | 2.1 UJ | 2.1 U | 2.7 J | 2.1 UJ | 2.1 U | 5.9 J | 2.1 U |
| Silver | 10 | 1.9 J | 1.5 U | 3.4 J | 2.8 J | 1.5 U | 3.0 J | 1.5 U |
| Thallium | 10 | 1.6 UJ | 1.6 U | 1.6 UJ | 1.6 UJ | 1.6 U | 1.6 UJ | 1.6 U |
| Vanadium | 50 | 12.3 J | 2.0 U | 15.7 J | 10.0 J | 5.2 U | 54.8 | 2.0 U |
| Zinc | 20 | 53.8 J | 15.5 J | 64.0 J | 32.9 J | 11.4 J | 44.7 J | 8.4 J |
| Cyanide | 10 | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 4.2 J | 3.2 J |
| Tin | 200 | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U |
| Sulfide | 100 | 100 U | 100 U | 200 | 100 U | 300 | 200 | 200 |
| Total Dissolved Solids (mg/L) | | 79 | --- | 298 | 282 | --- | 1090 | --- |
| Total Suspended Solids (mg/L) | | 352 | --- | 420 | 665 | --- | 1010 | --- |

| PROJECT: NSB KINGS BAY, GEORGIA | | INORGANIC AQUEOUS ANALYSES (ug/l) | | | | | Validation/Summary Table | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION: | | KBA-11-4 | KBA-11-4F | KBA-11-5 | KBA-11-5F | KBA-11-6 | KBA-11-6F | KBA-11-7 |
| LAB NUMBER: | | 22711007 | 22710003 | 22711010 | 22710004 | 22711011 | 22710007 | 22711012 |
| DATE SAMPLED: | | 09/10/92 | 09/10/92 | 09/10/92 | 09/10/92 | 09/10/92 | 09/10/92 | 09/10/92 |
| ANALYTE | CRQL | | | | | | | |
| Antimony | 60 | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U |
| Arsenic | 10 | 3.2 J | 1.0 U | 8.2 J | 1.0 J | 3.0 J | 1.0 U | 10.3 |
| Barium | 200 | 32.1 J | 10.0 U | 122 J | 5.9 U | 69.6 J | 8.1 U | 95.6 J |
| Beryllium | 5 | 0.69 J | 0.24 U | 1.9 J | 0.24 U | 1.3 J | 0.24 U | 1.4 J |
| Cadmium | 5 | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 3.2 J | 2.7 U | 2.7 U |
| Chromium | 10 | 40.0 | 1.9 U | 129 | 1.9 U | 76.0 | 1.9 U | 132 |
| Cobalt | 50 | 1.6 U | 1.6 UJ | 4.0 J | 1.6 UJ | 2.6 J | 1.6 UJ | 2.6 J |
| Copper | 25 | 17.2 J | 1.8 U | 107 | 6.3 J | 19.3 J | 5.7 J | 173 |
| Lead | 5 | 13.3 J | 2.9 J | 22.0 J | 3.1 | 19.4 J | 4.6 | 11.1 J |
| Mercury | 0.2 | 4.1 | 0.03 UJ | 0.72 | 0.03 UJ | 0.72 | 0.03 UJ | 0.91 |
| Nickel | 40 | 10.7 U | 10.7 U | 37.6 J | 10.7 U | 10.7 U | 10.7 U | 83.0 |
| Selenium | 5 | 3.9 J | 2.1 U | 2.1 UJ | 2.1 U | 2.1 UJ | 2.1 U | 2.1 UJ |
| Silver | 10 | 2.7 J | 1.5 U | 4.8 J | 1.5 U | 4.1 J | 1.5 U | 1.5 J |
| Thallium | 10 | 1.6 UJ | 1.6 U | 1.6 UJ | 1.6 U | 1.6 UJ | 1.6 U | 1.6 UJ |
| Vanadium | 50 | 28.6 J | 1.3 U | 70.0 | 2.0 U | 30.1 J | 1.3 U | 45.6 J |
| Zinc | 20 | 36.4 J | 8.4 J | 278 J | 66.5 J | 39.0 J | 11.4 J | 291 J |
| Cyanide | 10 | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U |
| Tin | 200 | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U |
| Sulfide | 100 | 200 | 100 U | 200 | 200 | 300 | 100 U | 500 |
| Total Dissolved Solids (mg/L) | | 870 | --- | 233 | --- | 122 | --- | 53 |
| Total Suspended Solids (mg/L) | | 544 | --- | 1060 | --- | 995 | --- | 1090 |

| PROJECT: NSB KINGS BAY, GEORGIA | | | INORGANIC AQUEOUS ANALYSES (ug/l) | | | | Validation/Summary Table | |
|---|---|---|---|---|---|---|---|---|
| | SAMPLE LOCATION: | KBA-11-7F | KBA-11-8 | KBA-11-8F | KBA-11-9 | KBA-11-9D | KBA-11-9F | |
| | LAB NUMBER: | 22710008 | 22711001 | 22710001 | 22711013 | 22711018 | 22710009 | |
| | DATE SAMPLED: | 09/10/92 | 09/09/92 | 09/09/92 | 09/10/92 | 09/10/92 | 09/10/92 | |
| ANALYTE | CRQL | | | | | | | |
| Antimony | 60 | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U | |
| Arsenic | 10 | 1.0 U | 3.8 J | 2.5 J | 7.5 J | 3.5 J | 1.0 U | |
| Barium | 200 | 8.4 U | 22.2 J | 13.0 U | 91.9 J | 52.4 J | 4.5 U | |
| Beryllium | 5 | 0.24 U | 0.38 J | 0.24 U | 2.4 J | 1.4 J | 0.24 U | |
| Cadmium | 5 | 2.7 U | 7.1 | 3.9 J | 2.7 U | 2.7 U | 2.7 U | |
| Chromium | 10 | 1.9 U | 18.9 | 1.9 U | 100 | 68.1 | 4.4 J | |
| Cobalt | 50 | 1.6 UJ | 3.2 J | 1.6 UJ | 2.6 J | 1.8 J | 2.9 U | |
| Copper | 25 | 14.2 J | 28.6 | 3.9 J | 27.4 | 23.5 J | 52.4 | |
| Lead | 5 | 3.8 | 5.0 UJ | 1.4 U | 11.6 J | 7.5 UJ | 3.5 | |
| Mercury | 0.2 | 0.03 UJ | 0.55 | 0.03 UJ | 0.49 | 0.61 | 0.03 UJ | |
| Nickel | 40 | 10.7 U | 23.4 J | 10.7 U | 11.3 J | 13.0 J | 10.7 U | |
| Selenium | 5 | 2.1 U | 2.1 UJ | 2.1 U | 2.7 J | 2.1 UJ | 2.1 U | |
| Silver | 10 | 1.5 U | 10.1 J | 1.5 U | 1.9 J | 2.8 J | 2.5 J | |
| Thallium | 10 | 1.6 U | 1.6 UJ | 1.6 U | 1.6 UJ | 1.6 UJ | 1.6 U | |
| Vanadium | 50 | 1.3 U | 11.6 J | 1.3 U | 61.3 | 41.3 J | 8.8 U | |
| Zinc | 20 | 27.4 J | 39.8 J | 52.6 J | 56.5 J | 41.4 J | 32.4 J | |
| Cyanide | 10 | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | |
| Tin | 200 | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U | |
| Sulfide | 100 | 100 U | 200 | 300 | 100 U | 200 | 100 U | |
| Total Dissolved Solids (mg/L) | | --- | 595 | --- | 144 | --- | --- | |
| Total Suspended Solids (mg/L) | | --- | 236 | --- | 468 | --- | --- | |

Note:
KBA-XX-X = non-filtered groundwater sample
KBA-XX-XF = filtered groundwater sample
KBA-XX-XD = duplicate groundwater sample

# TRIP BLANKS
# SOURCE WATER BLANKS
# SAMPLE EVENT NO. 4
# SEPTEMBER 1992

PROJECT: NSB KINGS BAY, GEORGIA

VOLATILE AQUEOUS ANALYSES (ug/l)

Validation/Summary Table

| SAMPLE LOCATION: | | BT-23-FB | BT-24-FB | BS-22-ER | BS-23-ER | BS-10-FB | BS-12-FB |
|---|---|---|---|---|---|---|---|
| LAB NUMBER: | | 22711003 | 22711009 | 22711004 | 22711008 | 22725008 | 22725009 |
| DATE SAMPLED: | | 09/09/92 | 09/10/92 | 09/09/92 | 09/10/92 | 09/13/92 | 09/13/92 |
| DATA ANALYZED: | | 09/18/92 | 09/23/92 | 09/23/92 | 09/17/92 | 09/24/92 | 09/24/92 |
| DILUTION FACTOR: | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| VOLATILES -- METHOD 8240 | | | | | | | |
| ANALYTE | CRQL | | | | | | |
| Chloromethane | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | 5 | 4 J | 6 | 5 U | 6 U | 5 U | 5 U |
| Acetone | 10 | 10 U | 10 | 10 U | 10 U | 6 J | 7 J |
| Carbon Disulfide | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichlorofluoromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,1-Dichloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,1-Dichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichloroethene (total) | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chloroform | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 2-Butanone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Carbon Tetrachloride | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Vinyl Acetate | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichloropropane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| cis-1,3-Dichloropropene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Dibromochloromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,1,2-Trichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| trans-1,3-Dichloropropene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Bromoform | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 2-Hexanone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-Pentanone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,1,2,2-Tetrachloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Toluene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Ethylbenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Styrene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Xylene (total) | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,3-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,4-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |

PROJECT: NSB KINGS BAY, GEORGIA

VOLATILE AQUEOUS ANALYSES (ug/l)

Validation/Summary Table

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION: | | BT-22-FB | BS-22-ER | BS-09-FB | | | | |
| LAB NUMBER: | | 117492R1 | 117491R1 | 117493R1 | | | | |
| DATE SAMPLED: | | 09/09/92 | 09/10/92 | 09/09/92 | | | | |
| DATA ANALYZED: | | 09/18/92 | 09/17/92 | 09/18/92 | | | | |
| DILUTION FACTOR: | | 1.0 | 1.0 | 1.0 | | | | |
| VOLATILES -- METHOD 8010/8020 | | | | | | | | |
| ANALYTE | CRQL | | | | | | | |
| Chloromethane | 1.0 | 1.0 UJ | 1.0 UJ | 1.0 UJ | | | | |
| Bromomethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Vinyl Chloride | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Chloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Methylene Chloride | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Trichlorofluoromethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,1-Dichloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,1-Dichloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| cis-1,2-Dichloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| trans-1,2-Dichloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Chloroform | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,2-Dichloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,1,1-Trichloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 2-Chloroethyl vinyl ether | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Dichlorodifluoromethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Methyl tert butyl ether | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Carbon Tetrachloride | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Bromodichloromethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,2-Dichloropropane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| cis-1,3-Dichloropropene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Trichloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Dibromochloromethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,1,2-Trichloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Benzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| trans-1,3-Dichloropropene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Bromoform | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Tetrachloroethene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,1,2,2-Tetrachloroethane | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Toluene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Chlorobenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Ethylbenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| Xylene (total) | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,3-Dichlorobenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,4-Dichlorobenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |
| 1,2-Dichlorobenzene | 1.0 | 1.0 U | 1.0 U | 1.0 U | | | | |

| PROJECT: NSB KINGS BAY, GEORGIA | | INORGANIC AQUEOUS ANALYSES (ug/l) | | | | | Validation/Summary Table | |
|---|---|---|---|---|---|---|---|---|
| | SAMPLE LOCATION: | BS-22-ER | BS-23-ER | BS-10-FB | BS-11-FB | BS-12-FB | | |
| | LAB NUMBER: | 22711017 | 22711008 | 22725008 | 22725010 | 22725009 | | |
| | DATE SAMPLED: | 09/09/92 | 09/10/92 | 09/13/92 | 09/13/92 | 09/13/92 | | |
| ANALYTE | CRQL | | | | | | | |
| Antimony | 60 | 12.4 U | 12.4 U | 12.4 U | 12.4 U | 12.4 U | | |
| Arsenic | 10 | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 U | | |
| Barium | 200 | 0.62 J | 1.2 J | 1.1 U | 38.9 J | 1.2 U | | |
| Beryllium | 5 | 0.24 U | 0.24 U | 0.24 U | 0.47 J | 0.24 U | | |
| Cadmium | 5 | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.7 U | | |
| Chromium | 10 | 1.9 U | 1.9 U | 2.8 J | 3.5 J | 3.9 J | | |
| Cobalt | 50 | 1.6 U | 1.6 U | 1.6 U | 3.2 J | 1.6 U | | |
| Copper | 25 | 1.8 U | 1.8 U | 1.8 U | 1.8 U | 6.2 J | | |
| Lead | 5 | 2.5 UJ | 2.1 UJ | 0.91 U | 2.1 U | 1.3 U | | |
| Mercury | 0.2 | 0.03 U | 0.03 U | 0.22 U | 0.03 U | 0.18 U | | |
| Nickel | 40 | 10.7 U | 10.7 U | 10.7 U | 10.7 U | 10.7 U | | |
| Selenium | 5 | 2.1 UJ | 2.1 UJ | 2.1 U | 2.1 U | 2.1 U | | |
| Silver | 10 | 1.5 UJ | 1.5 UJ | 1.5 U | 1.5 U | 1.8 J | | |
| Thallium | 10 | 1.6 UJ | 1.6 UJ | 1.6 U | 1.6 U | 1.6 U | | |
| Vanadium | 50 | 1.3 U | 1.3 U | 1.3 U | 6.3 J | 1.3 J | | |
| Zinc | 20 | 13.1 U | 10.0 U | 7.7 J | 16.0 J | 8.4 J | | |
| Cyanide | 10 | 2.2 U | 2.2 U | 2.2 UJ | 2.2 UJ | 2.2 UJ | | |
| Tin | 200 | 26.4 U | 26.4 U | 26.4 U | 26.4 U | 26.4 U | | |
| Sulfide | 100 | 100 U | 100 U | 100 U | 100 U | 100 U | | |
| Total Dissolved Solids (mg/L) | | 29 | 13 | 10 U | --- | 10 U | | |
| Total Suspended Solids (mg/L) | | 4 | 4 U | 4 U | --- | 4 U | | |

# APPENDIX B
# ANALYTICAL DATA FOR GROUNDWATER
# SAMPLE EVENT NOs. 1, 2, AND 3
# FEBRUARY 1992
# MAY 1992
# JULY 1992

**Table B-1**
**Groundwater Sampling Event No. 1**
**Summary of Laboratory Analysis of Groundwater Samples**
**Collected from Site 11[1]**

| Compounds Detected | Monitoring Well Number | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| KBA- | CRQL | 11-1 | 11-2 | 11-3 | 11-3D | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 |
| **APPENDIX IX VOCs (µg/L)** | | | | | | | | | | | |
| Vinyl Chloride[2] | 10 | 10 U | 18 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 2 J | 10 U |
| 1,2-Dichloroethene | 5 | 5 U | 7 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 4-Methyl-2-Pentanone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 3 J | 10 U | 10 U | 10 U |
| Chlorobenzene | 5 | 5 U | 5 U | 6 | 7 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Ethylbenzene[2] | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 1 J | 5 U |
| Xylene (total)[2] | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 2 J | 2 J | 5 U | 5 | 3 J |
| 1,4-Dichlorobenzene[2] | 5 | 5 U | 5 U | 13 | 15 | 5 U | 5 U | 1 J | 5 U | 5 U | 5 U |
| **APPENDIX IX SVOCs (µg/L)** | | | | | | | | | | | |
| 1,4-Dichlorobenzene[2,3] | 10 | 10 U | 10 U | 4 J | 7 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Diethylphthalate[2,3] | 10 | 10 U | 10 U | 10 UJ | 10 U | 10 U | 10 U | 10 U | 10 U | 9 J | 10 U |
| bis(2-Ethylhexyl)-Phthalate[3] | 10 | 10 U | 10 U | 31 UJ | 10 U | 10 U | 10 U | 10 U | 94 | 10 U | 10 U |
| **APPENDIX IX Inorganics (µg/L)** | | | | | | | | | | | |
| Antimony[2,4] | 60 | 10.9 U | 10.9 UJ | 11.1 J | 10.9 UJ | 11.4 J | 10.9 U | 10.9 U | 10.9 U | 10.9 U | 10.9 U |
| Arsenic[2] | 10 | 1.9 J | 3.5 J | 2.3 U | 0.69 U | 0.69 U | 89.0 | 7.3 J | 16.9 | 7.7 J | 3.5 J |
| Barium[2] | 200 | 61.6 J | 228 | 155 J | 280 | 192 J | 617 | 262 | 285 | 102 J | 135 J |
| Beryllium[2] | 5 | 0.72 J | 4.3 J | 2.0 J | 2.9 J | 5.8 | 10.2 | 4.8 J | 4.1 J | 2.5 J | 3.0 J |

**Table B-1**
**Groundwater Sampling Event No. 1**
**Summary of Laboratory Analysis of Groundwater Samples**
**Collected from Site 11[1]**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cadmium[2] | 5 | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 2.9 U | 3.5 J | 2.9 U | 2.9 U | 2.9 U | 2.9 U |
| Chromium[2] | 10 | 44.4 J | 247 | 113 | 177 | 297 J | 620 J | 261 J | 354 J | 139 J | 121 J |
| Cobalt[2] | 50 | 3.6 U | 5.6 J | 3.9 J | 5.1 J | 7.4 J | 16.8 J | 6.5 J | 5.9 J | 3.6 U | 3.6 U |
| Copper | 25 | 26.8 U | 53.5 U | 41.0 U | 86.5 U | 68.8 | 384 | 49.0 | 121 | 62.2 | 43.2 |
| lLead[2] | 5 | 12.6 J | 18.1 J | 18.8 J | 14.8 J | 24.7 J | 53.5 J | 16.3 J | 20.4 J | 16.8 J | 17.6 J |
| Mercury | 0.2 | 0.16 U | 0.60 | 0.60 | 0.67 | 1.4 | 2.9 | 1.0 | 1.9 | 0.58 | 0.28 |
| Nickel[2] | 40 | 12.8 J | 32.2 J | 19.6 U | 42.2 | 41.6 | 107 | 31.2 J | 44.7 | 18.6 J | 17.0 J |
| Selenium | 5 | 6.9 | 25.6 | 24.5 | 26.0 | 14.6 | 9.4 | 13.8 | 10.4 | 11.4 | 6.4 U |
| Vanadium[2] | 50 | 24.8 J | 94.6 | 87.4 | 138 | 209 | 314 | 108 | 143 | 67.8 | 80.2 |
| Zinc | 20 | 20.1 U | 53.3 U | 54.8 U | 102 | 86.1 | 269 | 211 | 82.1 | 93.6 | 38.1 |
| Cyanide[2] | 10 | 1.8 U | 1.8 U | 3.0 J | 1.8 U | 2.3 J | 1.8 U | 1.8 U | 1.8 U | 3.8 J | 1.8 U |
| Sulfide | 100 | 100 U | 500 | 600 | 1000 | 1300 | 700 | 400 | 3400 | 300 | 200 |

Notes:
CRQL = Contract Required Quantitation Limit
U = not detected above or below CRQL
[1] No Appendix IX pesticides, PCBs, herbicides, or dioxins/furans were detected in groundwater samples.

Data Qualifiers
[1] Samples results flagged J as estimated because concentrations are less than the CRQL.
[3] Samples results for KBA-11-3 flagged J/UJ as estimated because surrogate recoveries were below QC limits.
[4] Technical Memorandum No. 1ed quantitation limits flagged UJ as estimated because matrix spike recoveries were below QC limits.
[5] Sample results flagged J as estimated because duplicate analysis was outside QC limits.

Table B-2 Summary of Laboratory Analysis of Groundwater Samples Collected from Site 11[1] -- May 1992

| Compounds Detected | Monitoring Well Number | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CRQL | KBA-11-1 | 11-2 | 11-2D | 11-3 | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 |
| **APPENDIX IX VOCs (μg/L)** | | | | | | | | | | | |
| Vinyl Chloride | 10 | 10 U | 64 | 100 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane[2] | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 2 J | 10 U |
| 1,2-Dichloroethene | 5 | 5 U | 16 | 22 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichloroethene[2] | 5 | 5 U | 5 U | 1 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Tetrachloroethene[2] | 5 | 5 U | 1 J | 1 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Toluene[2] | 5 | 5 U | 5 U | 1 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chlorobenzene | 5 | 5 U | 5 U | 5 U | 6 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Xylene (total)[2] | 5 | 5 U | 2 J | 4 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,3-Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 15 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,4-Dichlorobenzene[2] | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 1 J | 5 U | 5 U | 5 U |
| **APPENDIX IX SVOCs (μg/L)** | | | | | | | | | | | |
| 1,4-Dichlorobenzene | 10 | 10 U | 10 U | 10 U | 13 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| bis(2-Ethylhexyl-Phthalate[2] | 10 | 10 U | 10 U | 10 U | 31 | 10 U | 4 J | 5 J | | | |

See notes at end of table.

Table B-2 Summary of Laboratory Analysis of Groundwater Samples Collected from Site 11[1] -- May 1992

| Compounds Detected | | Monitoring Well Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CRQL | KBA-11-1 | 11-2 | 11-2D | 11-3 | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 |
| **APPENDIX IX Inorganics (μg/L)** | | | | | | | | | | | |
| Arsenic[3] | 10 | 0.70UJ | 0.70UJ | 3.5 UJ | 0.70 U | 0.70 U | 0.70 U | 3.5 U | 0.70UJ | 1.7 J | 0.70UJ |
| Barium[2] | 200 | 95.7 J | 26.2 J | 25.9 J | 54.2 J | 30.2 J | 71.7 J | 34.6 J | 26.2 J | 43.4 J | 43.8 J |
| Beryllium[2] | 5 | 2.3 J | 1.7 J | 1.7 J | 1.1 J | 2.2 J | 4.0 J | 2.3 J | 1.7 J | 1.7 J | 2.3 J |
| Cadmium[4] | 5 | 1.0 UJ | 1.0 UJ | 1.0 UJ | 1.0 U | 1.0 U | 1.0 U | 1.0 U | 1.0 UJ | 1.3 J | 1.0 UJ |
| Chromium | 10 | 92.8 | 38.1 | 37.2 | 20.8 | 29.0 | 27.1 | 40.5 | 54.6 | 23.8 | 49.1 |
| Copper[2] | 25 | 21.7 J | 6.4 J | 6.2 J | 4.4 J | 3.1 J | 6.2 J | 7.9 J | 10.3 J | 13.7 J | 14.2 J |
| Lead[2] | 5 | 23.3 | 4.5 | 5.6 J | 3.9 J | 3.9 J | 2.9 J | 4.3 J | 3.8 J | 4.0 J | 12.2 |
| Mercury[2] | 0.2 | 0.11 J | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U |
| Selenium[2] | 5 | 5.6 | 2.7 J | 2.9 J | 3.8 J | 2.4 J | 0.55 J | 2.5 J | 3.4 J | 1.7 J | 5.4 |
| Thallium[2] | 10 | 0.80 U | 0.80 U | 0.80 U | 1.6 J | 0.80 U | 0.80 U | 0.80 U | 0.80 U | 0.80 U | 0.80 U |
| Vanadium[2,4] | 50 | 29.9 J | 20.2 J | 24.5 J | 44.3 J | 59.4 | 64.5 | 25.7 J | 25.0 J | 33.2 J | 42.8 J |
| Zinc | 20 | 7.6 U | 7.5 U | 10.3 U | 19.5 U | 10.9 U | 555 | 9.3 U | 6.5 U | 23.4 U | 8.7 U |
| Cyanide[3] | 10 | 1.8 UJ | 6.1 J | 6.1 J | 1.8 UJ | 10.8 J | 1.8 UJ | 1.8 UJ | 1.8 UJ | 26.2 J | 1.8 UJ |
| Sulfide | 100 | 500 | 2600 | 1000 | 200 | 300 | 1500 | 100 U | 200 | 2900 | 300 |

Notes:
CRQL = Contract Required Quantitation Limit
U = not detected above or below CRQL
[1] No Appendix IX pesticides, PCBs, herbicides, or dioxins/furans were detected in groundwater samples.
Data Qualifiers
[2] Samples results flagged J as estimated because concentrations are less than the CRQL.
[3] Samples quantitation limits flagged UJ as estimated and sample results flagged J as estimated because matrix spike recoveries were below QC limits.
[4] Samples quantitation limits flagged UJ as estimated and sample results flagged J as estimated because the corresponding preparation blank exhibited negative bias for cadmium and vanadium.

Table B-3 Summary of Laboratory Analysis of Groundwater Samples Collected from Site 11[1] -- July 1992

| Compounds Detected | | Monitoring Well Number | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CRQL | KBA-11-1 | 11-2 | 11-2D | 11-3 | 11-3D | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 |
| **APPENDIX IX VOCs (µg/L)** | | | | | | | | | | | | | |
| Vinyl Chloride | | 10 | 10 U | 63 | 150 | 10 U | --- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane[2] | | 10 | 10 U | 10 U | 5 J | 10 U | --- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethene | | 5 | 5 U | 5 | 10 | 5 U | --- | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Toluene[2] | | 5 | 5 U | 5 U | 2 J | 5 U | --- | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chlorobenzene[2] | | 5 | 5 U | 5 U | 5 U | 4 J | --- | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Xylene (total)[2] | | 5 | 5 U | 5 U | 2 J | 5 U | --- | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,3-Dichlorobenzene | | 5 | 5 U | 5 U | 5 U | 13 | --- | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1,4-Dichlorobenzene[2] | | 5 | 5 U | 5 U | 5 U | 5 U | --- | 5 U | 5 U | 1 J | 5 U | 5 U | 5 U |
| **APPENDIX IX Inorganics (µg/L)** | | | | | | | | | | | | | |
| Arsenic[2] | non-filtered | 10 | 1.00 U | 2.4 J | 2.4 J | 2.7 J | 2.6 J | 3.3 J | 6.7 J | 1.1 J | 1.9 J | 3.7 J | 3.6 J |
| | filtered | | 1.00 U | 1.4 J | --- | 1.00 U | --- | 1.00 U | 1.4 J | 1.00 U | 1.00 UJ | 2.0 J | 2.5 J |
| Barium[2] | non-filtered | 200 | 61.4 J | 30.2 J | 24.0 J | 49.0 J | 57.6 J | 27.4 J | 158 J | 41.5 J | 65.5 J | 30.8 J | 44.2 J |
| | filtered | | 37.9 J | 5.8 J | --- | 14.9 U | --- | 12.2 U | 8.4 U | 12.2 U | 12.1 J | 15.4 J | 7.4 J |
| Beryllium[2] | non-filtered | 5 | 0.32 J | 0.49 J | 0.26 J | 0.45 J | 0.73 J | 0.80 J | 2.4 J | 0.54 J | 0.75 J | 0.54 J | 0.91 J |
| | filtered | | 0.20 U | 0.24 U | --- | 0.20 U | --- | 0.20 U | 0.20 U | 0.20 U | 0.24 U | 0.24 U | 0.24 U |
| Cadmium[2] | non-filtered | 5 | 3.0 J | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.7 U | 2.7 U |
| | filtered | | 2.7 U | 2.7 U | --- | 2.7 U | --- | 2.7 U | 3.1 J | 2.7 U | 2.7 U | 2.7 U | 2.7 U |
| Chromium[2,3] | non-filtered | 10 | 32.9 | 27.2 | 27.9 | 34.3 | 38.7 | 43.6 | 157 | 38.5 | 77.2 | 29.3 | 44.8 |
| | filtered | | 1.9 UJ | 1.9 U | --- | 2.7 J | --- | 1.9 UJ | 1.9 UJ | 1.9 UJ | 1.9 U | 3.5 U | 4.6 U |
| Cobalt[2] | non-filtered | 50 | 1.6 J | 4.6 U | 5.6 U | 1.6 U | 1.6 J | 2.8 J | 6.1 J | 1.6 U | 5.9 U | 6.7 U | 6.5 U |
| | filtered | | 1.6 U | 4.1 U | --- | 1.6 U | --- | 1.6 U | 2.0 J | 1.8 J | 3.4 U | 5.9 U | 4.6 U |
| Copper[2,4] | non-filtered | 25 | 128 J | 27.8 | 16.1 U | 27.6 J | 72.6 J | 72.3 J | 239 J | 114 J | 19.6 J | 81.4 | 69.1 |
| | filtered | | 17.1 J | 9.1 U | --- | 9.1 UJ | --- | 10.2 UJ | 6.8 UJ | 8.0 UJ | 1.8 U | 4.7 U | 24.0 J |

See notes at end of table.

Table B-3 Summary of Laboratoy Analysis of Groundwater Samples Collected from Site 11[1] -- July 1992 (continued)

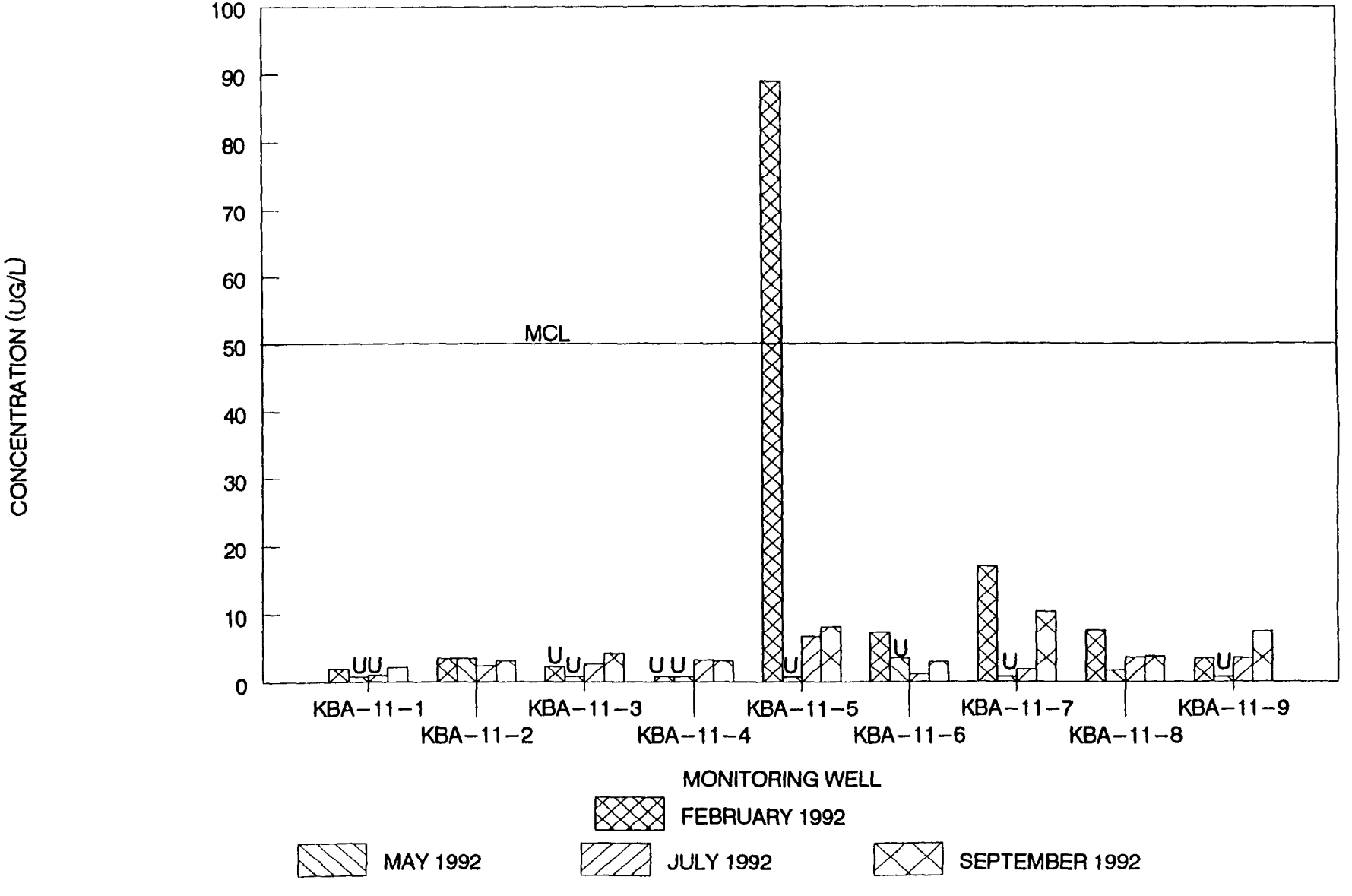
| Compounds Detected | | | Monitoring Well Number | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CRQL | KBA-11-1 | 11-2 | 11-2D | 11-3 | 11-3D | 11-4 | 11-5 | 11-6 | 11-7 | 11-8 | 11-9 |
| **APPENDIX IX VOCs (µg/L)** | | | | | | | | | | | | | |
| Lead[2,5] | non-filtered | 5 | 24.6 J | 8.5 J | 10.3 J | 12.4 J | 87.2 J | 23.9 J | 33.1 J | 6.7 J | 16.1 J | 4.1 J | 8.8 J |
| | filtered | | 0.94 U | 2.5 J | --- | 0.94 U | --- | 0.94 U | 1.0 J | 1.2 J | 0.98 J | 1.6 J | 1.1 J |
| Mercury[2] | non-filtered | 0.2 | 0.16 U | 0.16 U | 0.16 U | 0.16 U | 0.16 U | 0.19 J | 0.46 | 0.16 U | 0.16 U | 0.16 U | 0.19 J |
| | filtered | | 0.16 U | 0.16 U | --- | 0.16 U | --- | 0.16 U | 0.16 U | 0.16 U | 0.16 U | 0.16 U | 0.16 U |
| Nickel[2] | non-filtered | 40 | 89.1 | 23.9 J | 23.6 J | 10.7 U | 61.4 | 42.3 | 68.2 | 66.3 | 10.7 U | 78.7 | 18.1 J |
| | filtered | | 10.7 U | 10.7 U | --- | 10.7 U | --- | 10.7 U | 10.7 U | 10.7 U | 10.7 U | 10.7 U | 10.7 U |
| Selenium[2] | non-filtered | 5 | 2.0 J | 1.9 U | 2.2 J | 6.4 | 5.5 | 5.2 | 1.9 U | 3.5 J | 2.9 J | 4.2 J | 4.3 J |
| | filtered | | 1.9 U | 1.9 U | --- | 1.9 U | --- | 1.9 U | 1.9 U | 1.9 U | 1.9 U | 1.9 U | 1.9 U |
| Silver[2] | non-filtered | 10 | 1.5 U | 1.7 J | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U |
| | filtered | | 1.5 U | 1.5 U | --- | 1.5 U | --- | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U |
| Vanadium[2] | non-filtered | 50 | 8.6 J | 13.4 J | 11.6 J | 26.2 J | 30.2 J | 26.0 J | 82.5 | 14.6 J | 23.8 J | 15.2 J | 32.0 J |
| | filtered | | 1.3 U | 4.1 J | --- | 2.9 J | --- | 1.8 J | 2.2 J | 1.3 U | 1.4 J | 1.8 J | 4.5 J |
| Zinc[2,4] | non-filtered | 20 | 208 J | 48.5 U | 43.2 U | 37.3 J | 128 J | 237 J | 320 J | 178 J | 22.0 U | 101 | 74.0 |
| | filtered | | 14.1 J | 74.3 | --- | 25.7 J | --- | 9.4 J | 49.4 J | 77.0 J | 14.7 U | 16.5 U | 33.9 U |
| Cyanide[2] | non-filtered | 10 | 2.2 U | 2.2 U | 2.2 U | 4.4 J | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U |
| | filtered | | 2.2 U | 2.2 U | --- | 2.2 U | --- | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U |
| Sulfide | non-filtered | 100 | 200 U | 300 | 200 | 200 | 200 | 200 | 100 U | 200 | 200 | 300 | 100 |
| | filtered | | 100 U | 200 | --- | 100 U | --- | 100 U | 100 U | 100 U | 100 U | 100 U | 100 |

Notes:
CRQL = Contract Required Quantitation Limit
U = not detected above or below CRQL
--- = Analysis not required/performed
[1] Groundwater samples were analyzed for VOCs and inorganic constituents only.
[2] Sample results flagged J as estimated because concentration is less than the CRQL.
[3] Sample quantitation limits flagged UJ as estimated because associated preparation blank exhibited negative bias for chromium.
[4] Sample results flagged J and UJ as estimated because duplicate analysis for copper and zinc exceeded QC limits.
[5] Sample results flagged J as estimated because matrix spike recovery for lead was outside QC limits.

# APPENDIX C
# BAR-CHART GRAPHICS OF GROUNDWATER INORGANIC DATA

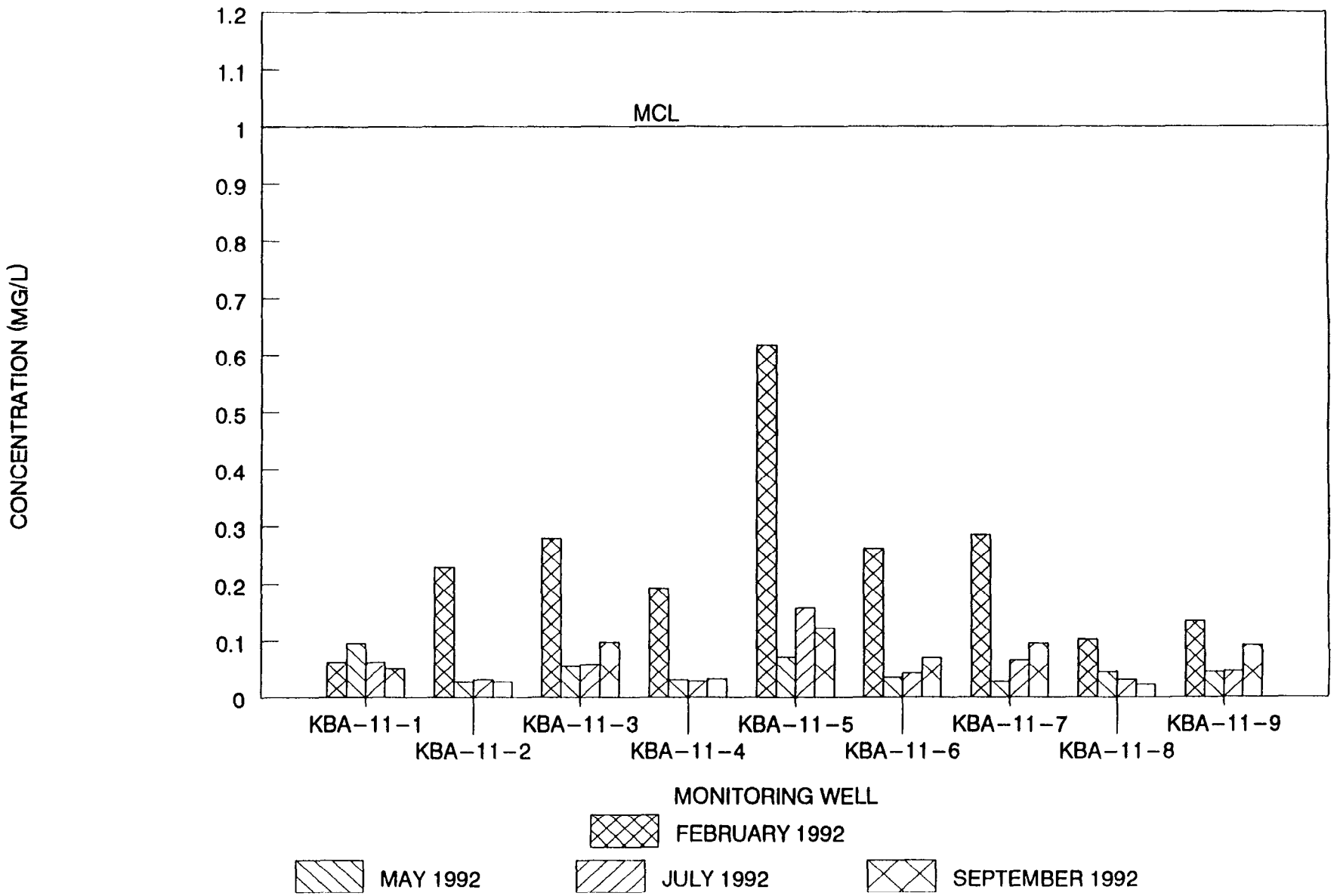
NSB KINGS BAY, GEORGIA

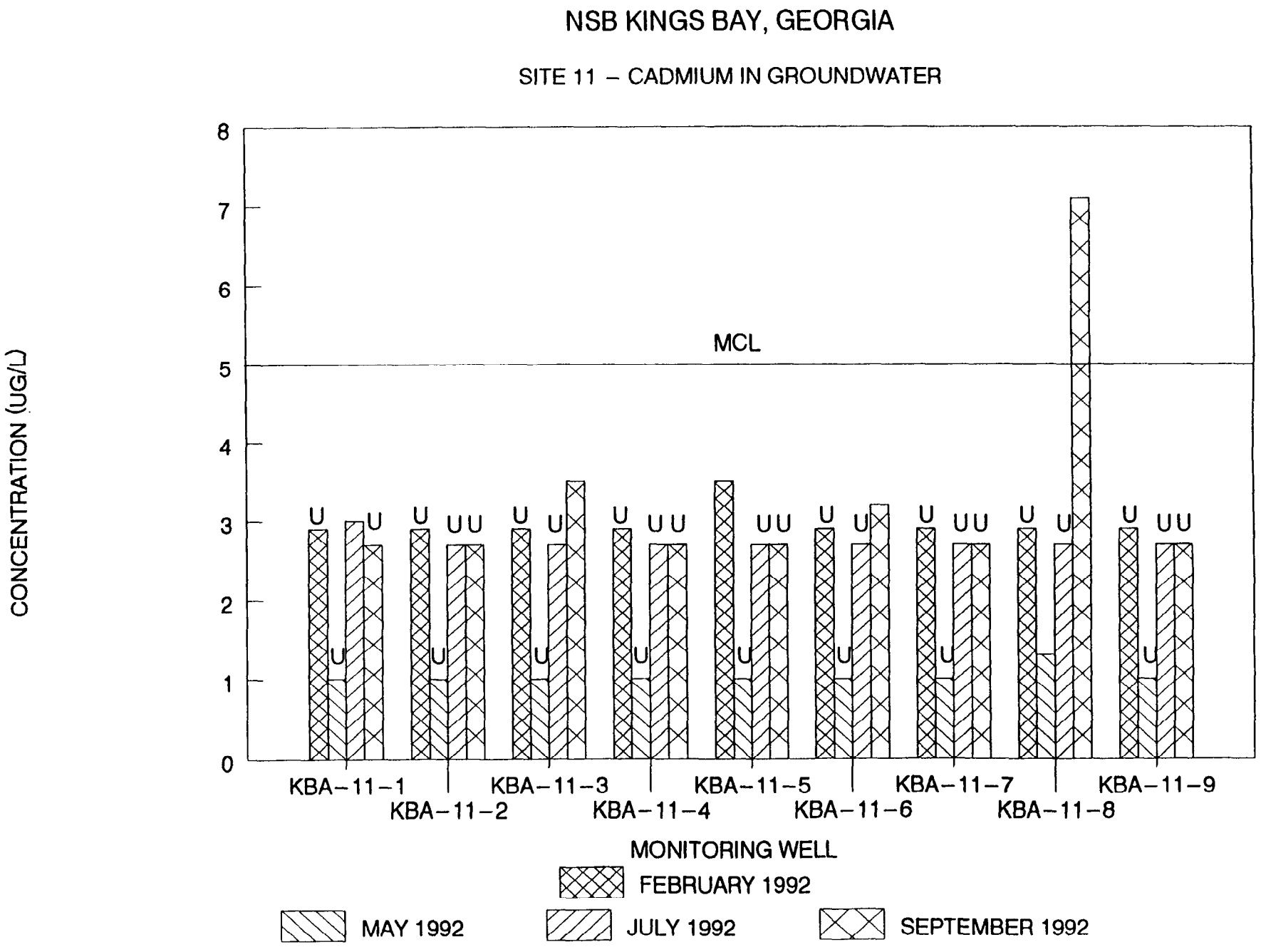
SITE 11 – ARSENIC IN GROUNDWATER

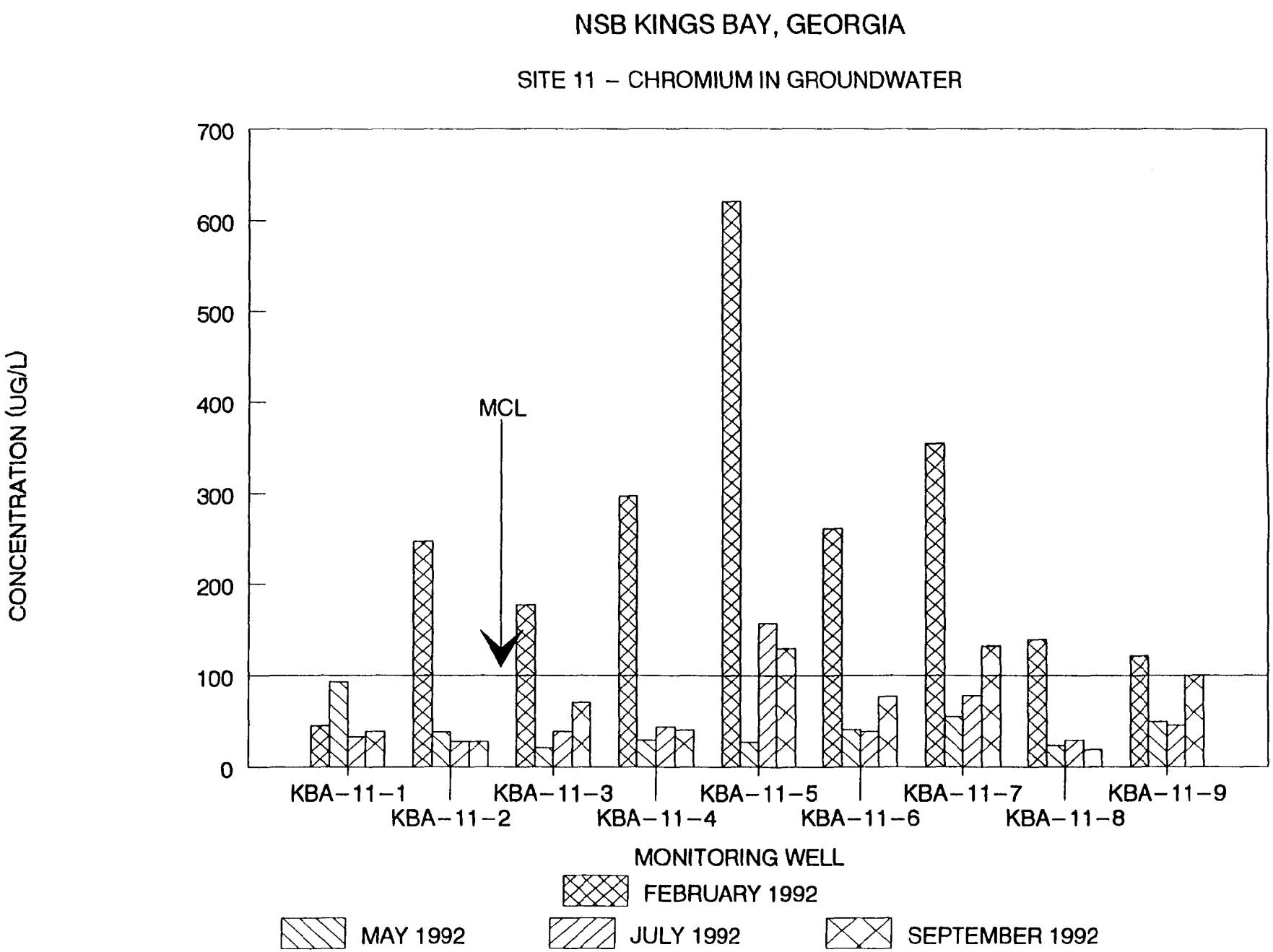


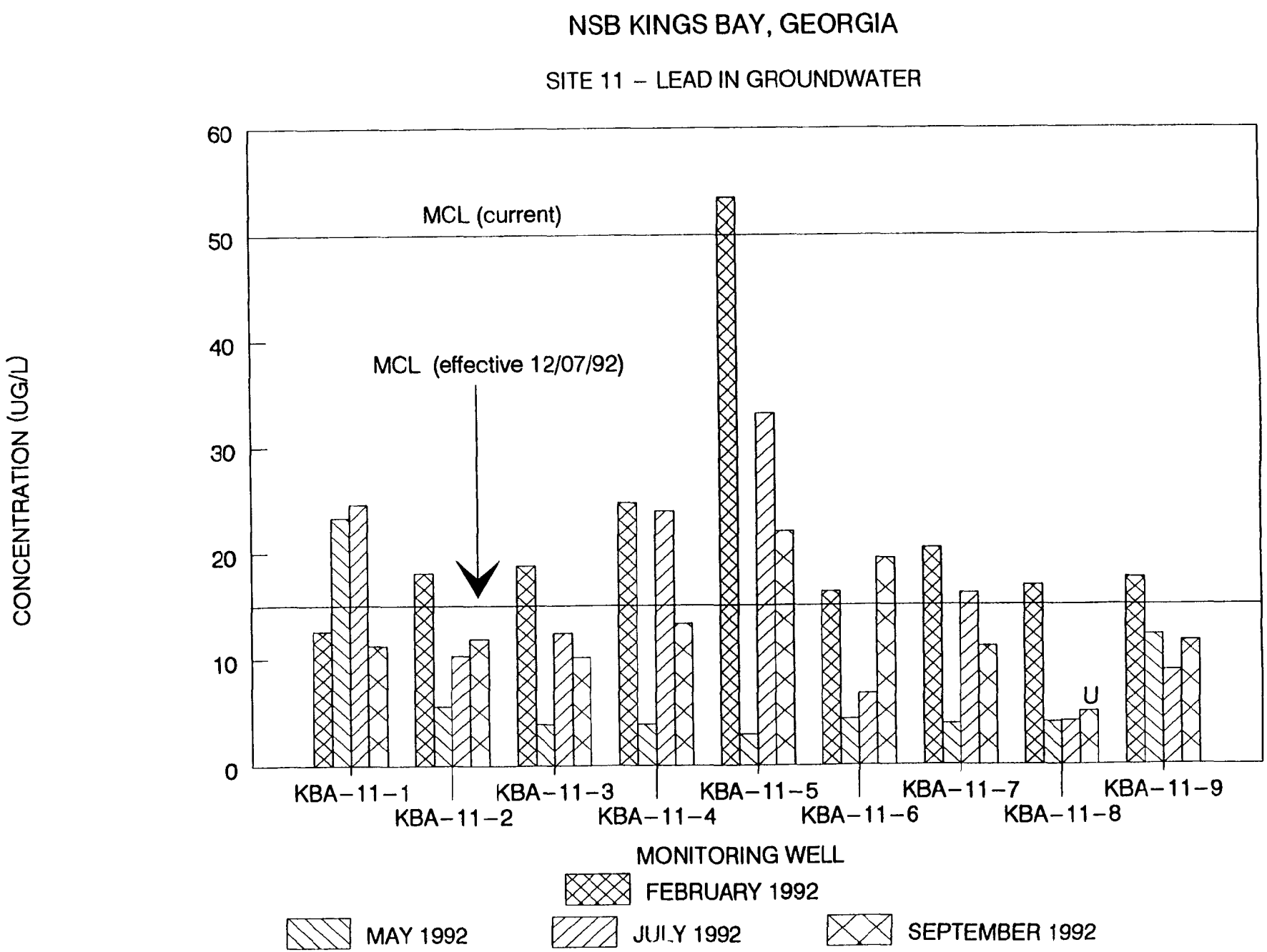
NSB KINGS BAY, GEORGIA

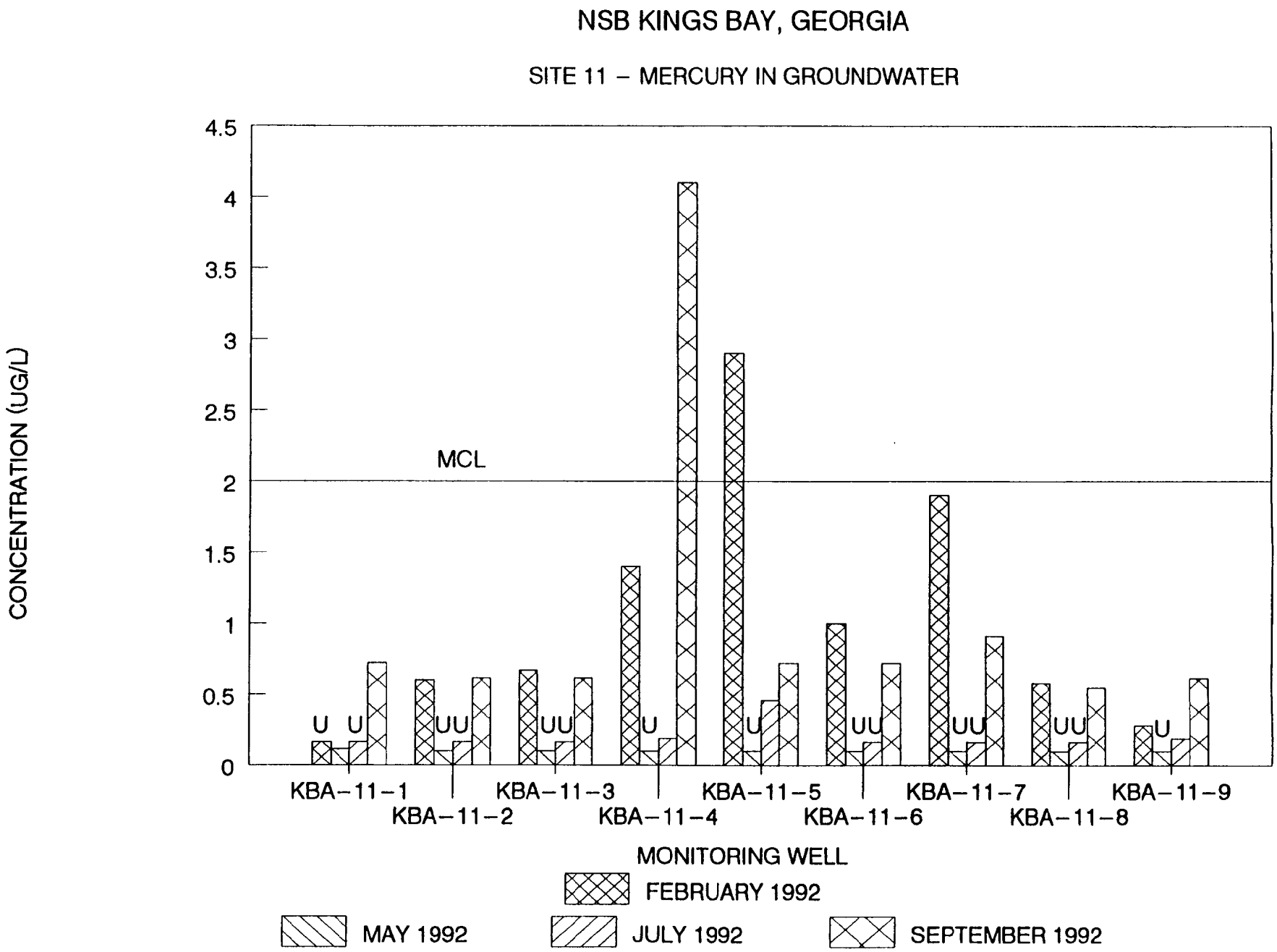
SITE 11 – BARIUM IN GROUNDWATER

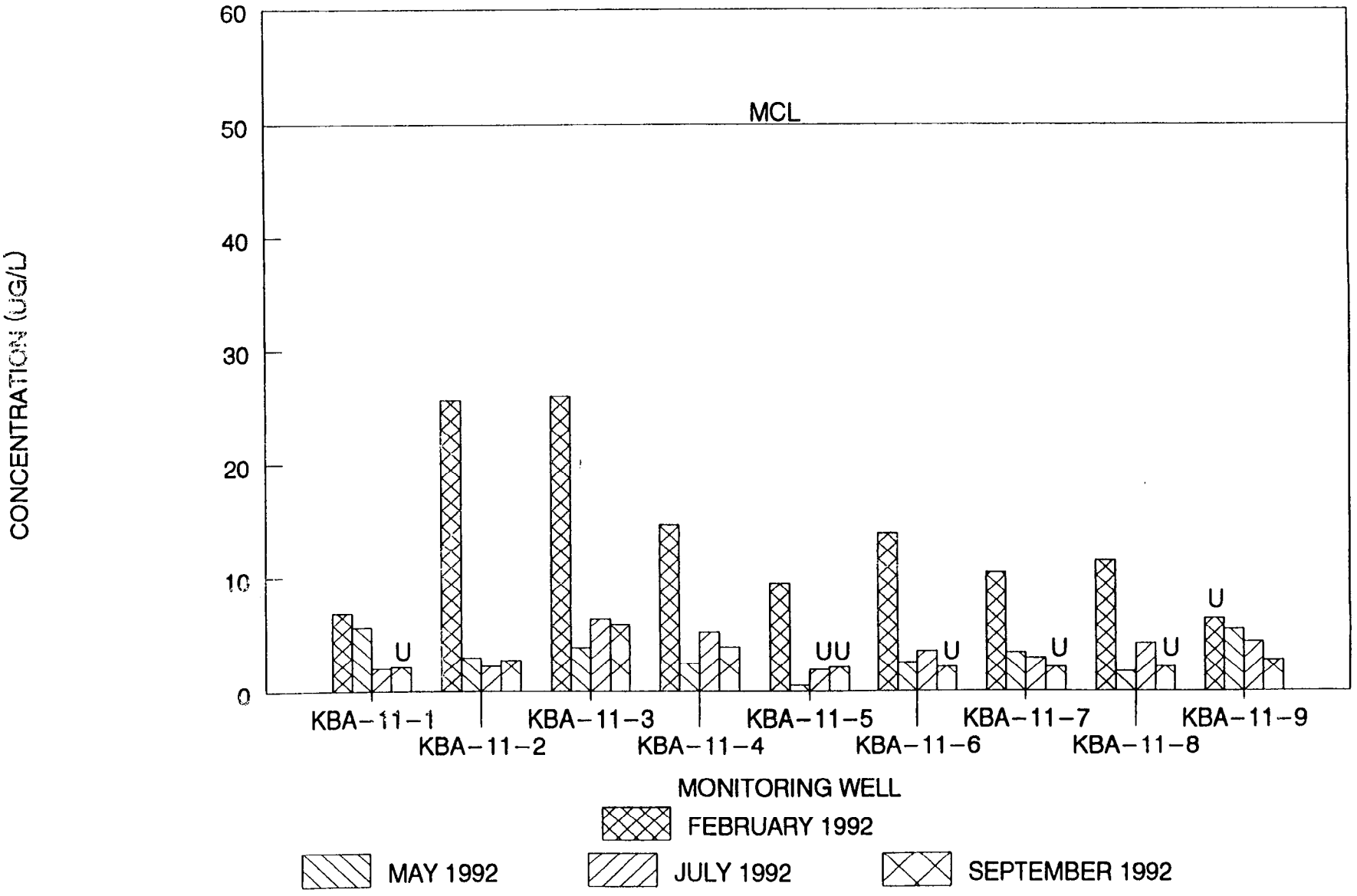



NSB KINGS BAY, GEORGIA
SITE 11 – CADMIUM IN GROUNDWATER
CONCENTRATION (UG/L)
8
7
6
5
4
3
2
1
0
MCL
U
KBA-11-1
KBA-11-2
KBA-11-3
KBA-11-4
KBA-11-5
KBA-11-6
KBA-11-7
KBA-11-8
KBA-11-9
MONITORING WELL
FEBRUARY 1992
MAY 1992
JULY 1992
SEPTEMBER 1992


NSB KINGS BAY, GEORGIA
SITE 11 – CHROMIUM IN GROUNDWATER
CONCENTRATION (UG/L)
700
600
500
400
300
200
100
0
MCL
KBA-11-1
KBA-11-2
KBA-11-3
KBA-11-4
KBA-11-5
KBA-11-6
KBA-11-7
KBA-11-8
KBA-11-9
MONITORING WELL
FEBRUARY 1992
MAY 1992
JULY 1992
SEPTEMBER 1992


NSB KINGS BAY, GEORGIA
SITE 11 – LEAD IN GROUNDWATER
CONCENTRATION (UG/L)
60
50
40
30
20
10
0
MCL (current)
MCL (effective 12/07/92)
U
KBA-11-1
KBA-11-2
KBA-11-3
KBA-11-4
KBA-11-5
KBA-11-6
KBA-11-7
KBA-11-8
KBA-11-9
MONITORING WELL
FEBRUARY 1992
MAY 1992
JULY 1992
SEPTEMBER 1992


NSB KINGS BAY, GEORGIA
SITE 11 – MERCURY IN GROUNDWATER
CONCENTRATION (UG/L)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
MCL
U
U
UU
UU
U
U
UU
UU
UU
U
KBA-11-1
KBA-11-2
KBA-11-3
KBA-11-4
KBA-11-5
KBA-11-6
KBA-11-7
KBA-11-8
KBA-11-9
MONITORING WELL
FEBRUARY 1992
MAY 1992
JULY 1992
SEPTEMBER 1992

NSB KINGS BAY, GEORGIA

SITE 11 – SELENIUM IN GROUNDWATER