U.S Army Corps of Engineers

New England District

REVISED DRAFT
PHASE II COMPREHENSIVE SITE ASSESSMENT AND RESPONSE ACTION OUTCOME REPORT

Cpl. Gordon Craig U.S. Army Reserve Center
Brockton, Massachusetts

Prepared Under:

CONTRACT NO. DACW33-94-D-0007
DELIVERY ORDER NO. 0033

FEBRUARY 2002

Stone & Webster

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	February 2002	Draft

4. TITLE AND SUBTITLE
Revised Draft Phase II Comprehensive Site Assessment and Response Action Outcome Report
Cpl. Gordon Craig U.S. Army Reserve Center, Brockton,MA

5. FUNDING NUMBERS
Contract No.
DACW33-94-D-0007
Delivery Order No.
0033

6. AUTHOR(S)
Stone & Webster

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Stone & Webster
100 Technology Center Drive
Stoughton, MA 02072

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers, New England District
696 Virginia Road
Concord, MA 01742-2751

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
This report supersedes "Draft Phase II Comprehensive Site Assessment Report, Cpl. Gordon Craig U.S. Army Reserve Center, Brockton, Massachusetts" dated June 2000.

12a. DISTRIBUTION AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The Phase II investigation assessed four areas at the Site: former UST 153, the former gasoline fuel storage pod area (GFPSA), the intermittent stream and drainage swale within the property boundary, and the abandoned sewer line that transects the property.

Sampling and analysis of groundwater, subsurface soil, surface soil, surface water, and sediment determined the extent of contamination and the contaminants of potential concern for the Site. Subsequently, human health and ecological risk assessments were completed. These assessments determined that there is a Condition of No Significant Risk to human health, public welfare, safety, and the environment at the Site.

Since the Phase II Assessment has determined the extent of contamination from the identified releases at the Site, demonstrated there are no UCL exceedances, demonstrated that a condition of no significant risk has been achieved, and that the sources of contamination at the Site have been removed, Stone & Webster believes that no further action is required and that a response action outcome class A2 can be filed for this Site.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Comprehensive Site Assessment, Response Action Outcome	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

REVISED
DRAFT PHASE II COMPREHENSIVE SITE ASSESSMENT AND RESPONSE ACTION OUTCOME REPORT

CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS
RTN 4-1303

Prepared for:

U. S. Army Corps of Engineers
New England District, Corps of Engineers
Concord, Massachusetts

Prepared by:

Stone & Webster, Inc.
Stoughton, Massachusetts
Project No. 05000.33

CONTRACT NUMBER:
DACW33-94-D-0007
Delivery Order No. 33

FEBRUARY 2002

REVISED
DRAFT PHASE II COMPREHENSIVE SITE ASSESSMENT AND RESPONSE ACTION OUTCOME REPORT

CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS
RTN 4-1303

FEBRUARY 2002

Prepared By: Rose A Perry 2/12/02
Rose Perry — Date
Project Manager

Approved By: 2/12/02
Cosmo Gallinaro — Date
Licensed Site Professional

Approved By: 2/12/02
Cosmo Gallinaro — Date
Program Manager

REVISED DRAFT PHASE II COMPREHENSIVE SITE ASSESSMENT AND RESPONSE ACTION OUTCOME REPORT

CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

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1. INTRODUCTION

This Phase II Comprehensive Site Assessment Report (Phase II Report) has been prepared by Stone & Webster, Inc. (Stone & Webster) under Contract Number DACW33-94-D-0007 for the U.S. Army Corps of Engineers (USACE), New England District (NAE). This Phase II Report documents the performance of work described in the *Statement of Work for a Phase II Comprehensive Site Assessment, Cpl. Gordon Craig U.S. Army Reserve Center* dated September 9, 1997, as modified March 11, 1999 and February 6, 2001. The work described under this Scope of Work (SOW) falls under the Defense Environmental Restoration Program Installation Restoration Program (DERP-IRP). The project was conducted under the direction of USACE-NAE, 696 Virginia Road, Concord, Massachusetts, 01742-2751. The USACE-NAE Engineering Manager (EM) is Mr. Albert Lemire.

This Phase II Report was prepared to satisfy the requirements of the Massachusetts Contingency Plan (310 Code of Massachusetts Regulations (CMR) 40.0480). All work was conducted in an environmentally acceptable manner conforming to existing federal and state laws and regulations.

1.1 GENERAL SITE INFORMATION

1.1.1 Site Description

The Phase II Comprehensive Site Assessment encompasses the Cpl. Gordon Craig U.S. Army Reserve Center (the Site), located at 915 West Chestnut Street, Brockton, Plymouth County, Massachusetts, 02301-5542 (see Figures 1-1 and 1-2). The property is composed of a 14.5-acre parcel of land which is bounded to the south by West Chestnut Street; to the west by a roadway leading to the Veterans Administration hospital, to the east by a playground, and to the north by the Veterans Administration property.

The Site is located in a low-lying area with an intermittent stream and associated wetland flowing south to north along the western property limit, and a swale that flows south to north, located along the eastern property limit (see Figure 1-2). Ground surface elevations range between approximately 121 feet above mean sea level (msl) at the south end of the Site to approximately 108 feet msl at the northeast corner (USAEHA, 1992). The Site appears to slope radially from the south to the north and from the central north-south axis of the property to both the east and west (USAEHA, 1992).

According to the U.S. Geologic Survey (USGS) map of the Surficial Geology of the Brockton Quadrangle, the area near the Site is mapped as ground moraine, a dense deposit of glacial till (USAEHA, 1992). Till typically consists of an essentially unsorted and unstratified mixture of gravel, sand, silt, clay and boulders. Also mapped to the northeast and southwest of the Site are swamp deposits consisting of silt, clay, and peat with small amounts of sand from local streams. Bedrock is relatively shallow at the Site and consists of glauconitic sandstone.

The U.S. Army Reserve Center (USARC) acquired the Site in 1973 by land transfer from the Veterans Administration. Two buildings were constructed on the Site, a main building for training and administration (called the USAR Center), and a repair and maintenance building (see Figure 1-2). The USAR Center covers approximately 32,500 square feet and was dedicated in 1977. The maintenance shop, which covers approximately 3,000 square feet, is located just north of the USAR Center. In addition, there are three parking lots on the Site, two located to the east and west of the centrally located USAR Center, and a third military vehicle parking lot located to the north of the USAR Center.

According to personal communication with Robert Gagnon (facility manager) on November 27, 2001, there are no underground storage tanks (USTs) currently onsite. The history of USTs at the Site is discussed in Section 1.2.

There are several subsurface utilities onsite, including electric, telephone, gas, water, sanitary sewer, and storm drains. West of the maintenance shop, there are two outdoor grease racks and a vehicle wash rack. According to a 1974 Site Utility Plan, revised in 1976, the racks have floor drains that flow through a grease interceptor to the sanitary sewer (USACE, 1976). The grease racks and wash rack are no longer in use. A drain survey conducted by ENSR in April 1994 identified 12 building floor drains, 11 of which were either in use or potentially operational, and one that had been removed from service. The survey indicated that all the drains were connected to the sanitary sewer (ENSR, 1996).

The stormwater drainage system consists of a storm drain in front (south) of the maintenance shop, four trench drains across driveways and the loading dock area behind the USAR Center, and roof drains from the two buildings. The roof drains on the maintenance shop discharge to the ground surface behind the building. The trench drain across the eastern-most driveway drains to the swale on the eastern side of the property. The two trench drains across the western driveways drain into the intermittent stream on the west side of the property, as it enters the Site from under West Chestnut Street. The storm drain near the maintenance shop, the trench drain near the loading dock, and the roof drains from the USAR Center all feed into the storm drain system that discharges into the intermittent stream via an outfall pipe located approximately half way down the western side of the property (USACE, 1976).

Currently, the Site is being used as a training center for Army Reserves and for the repair of Army Reserve vehicles. Army Reserve vehicles are also stored on Site.

1.1.2 Release Tracking Number

The Massachusetts Department of Environmental Protection (MADEP) Release Tracking Number (RTN) associated with the Site is RTN 4-1303.

1.1.3 Geographical Information

A copy of the Massachusetts Geographical Information System (GIS) Site Scoring Map is found in Appendix A. The Universal Transverse Mercator (UTM) coordinates are N 6,657,825 m and E 330,150 m. According to Vista Information Solutions, Inc., the Site is located at latitude 42.055153 and longitude -71.050522.

1.1.4 Number of On-site Workers

The Site is presently used by the US Army as a Reserve Center for military reservist training and for maintaining military vehicles. The Site contains an office-type building (the USAR Center) and a maintenance shop that are surrounded by paved parking areas that are fenced. Currently there are approximately 12 full-time on-site workers in the USAR Center and approximately five full-time on-site workers in the maintenance shop.

1.1.5 Residential Population within One-Half Mile

Areas outside the fencing include a paved parking area, but otherwise are unpaved (grassy). The western side of the USARC property is bordered by an intermittent stream, and the eastern side of the USARC property is bordered by a playground. The residential population within a one-half mile radius of the Site

is approximately 1,347 people according to a population density report provided by Vista Information Solutions, Inc., using 1990 census information (refer to Appendix B).

1.1.6 Land Uses Surrounding the Site

The land surrounding the Site is primarily used for commercial and industrial purposes. The Site abuts the Veterans Administration Hospital to the north, a small recreational playground to the east, and commercial/industrial properties to the south and west.

1.1.7 Institutions within 500 Feet

An institution as defined in the Massachusetts Contingency Plan (MCP) is any publicly or privately owned hospital, health facility, orphanage, nursing home, convalescent home, educational facility, or correctional facility where such a facility in whole or in part provides overnight housing. The Veterans Administration Hospital abuts the northern boundary of the Site.

1.1.8 Natural Resources within 500 Feet

An intermittent stream and associated wetland are located along the western boundary of the Site. This stream flows north onto the Veterans Administration property. The intermittent stream runs in a riprap channel and through culverts under driveways in the commercial/industrial area south (upstream) of the Site, and enters the Site from a culvert running under West Chestnut Street. A small recreational playground abuts the eastern boundary of the Site. There are no other known natural resources within 500 feet of the Site.

1.2 SITE HISTORY

1.2.1 Ownership and Operations History

As stated in Section 1.1, USARC acquired the Site in 1973. Two buildings were constructed on the Site, the USAR Center being dedicated in 1977. Prior to 1973, the Site was reportedly undeveloped land that was part of the Veterans Administration hospital property. The Brockton town dump was located to the south, across Chestnut Street. Reportedly, area residents commonly dumped materials along the north side of Chestnut Street instead of entering the dump (USAEHA 1992). The specific locations, quantities, or types of materials dumped are unknown.

1.2.2 Release History, Oil and/or Hazardous Material (OHM) Use and Storage History, Waste Management History

The maintenance shop has five overhead doors and is designed for the routine maintenance and repair of miscellaneous military vehicles. Maintenance activities consist largely of automotive fluid changes, brake repair, and other minor maintenance activities. No body work or painting is conducted at the facility. A hazardous waste accumulation area is located at the eastern end of the maintenance shop. The area is clearly marked and hazardous wastes are accumulated in 55 gallon drums, which are stored in secondary containment on top of wooden pallets. The wastes accumulated in this area include transmission fluid, diesel fuel, antifreeze, oil, brake fluid, paint cans, and oily rags. Once the drums are full, they are transferred and stored in a portable hazardous waste accumulation shed located outside the building. According to personal communication with Robert Gagnon (facility manager) on November 27, 2001, drums are stored in the hazardous waste accumulation shed for very short periods of time before they are properly disposed of. There also are several portable storage sheds on-site used to store virgin hazardous materials.

According to personal communication with Robert Gagnon (facility manager) on November 27, 2001, there are no USTs currently onsite. A review of Fire Department records on December 5, 2001 showed a permit for a 1,000 gallon UST from 1986, a removal permit for a 1,000 gallon waste oil UST from 1991, UST closure reports prepared by ATEC Environmental Consultants (ATEC) for a 1,000 gallon waste oil UST (UST 069) and a 5,000 gallon fuel oil UST (UST 153), and tank disposal receipts for a 1,000 gallon UST and a 5,000 gallon UST.

ATEC conducted the two UST removals in 1991 (UST 069) and 1993 (UST 153). The former UST 153 was located approximately five feet northeast of the USAR Center (see Figure 1-2). Former UST 153 was a 5,000-gallon capacity UST used for the storage of No. 2 fuel oil. The U.S. Army Environmental Hygiene Agency (USAEHA) determined that the UST was leaking after a leak test performed in January 1993 revealed a leak rate of 70 gallons per day. As a result, the UST was removed by ATEC in September 1993. Groundwater was encountered at approximately nine feet below ground surface. A sheen and free-floating product was noted on the groundwater. During the UST removal, a remedial action consisting of the excavation of 178 tons of petroleum contaminated soil from the tank grave was completed. Upon completion of the excavation, six soil samples from the excavation walls were screened with a photoionization detector (PID) with results ranging between 2 and 45 mg/kg (ATEC, 1994). Analytical results for soil indicate total petroleum hydrocarbon (TPH) concentrations (by U.S. Environmental Protection Agency [USEPA] Method 418.1) ranging between non-detect (ND) and 1,400 mg/kg, volatile organic compound (VOC) concentrations (by USEPA 8260B) including acetone, ethylbenzene, and xylene ranging between ND and 110, 77, and 95 µg/kg respectively, and semivolatile organic compound (SVOC) concentrations (by USEPA 8270) including fluorene and phenanthrene ranging between ND and 660 and 1,140 µg/kg respectively. The excavation was lined with polyethylene plastic sheeting and then backfilled with clean fill following confirmatory sampling.

An abandoned sewer line (see Figure 1-2) was ruptured during the soil removal activity discharging water and free product (from the sewer line) into the excavation. CYN Oil removed and disposed of approximately 1,560 gallons of water and free product. A water sample was collected prior to removal from the excavation. Results indicated elevated total Halogens at 55 ppm (ATEC, 1994). The ATEC report is presented in Appendix C.

Further reconnaissance by Stone & Webster regarding the Site history indicated that the referenced sewer line is likely a portion of what remains of a city of Brockton force main that carried sewage from the east to sewage filtration beds west of the Site. According to conversations with the Brockton Engineering Supervisor, the sewer line/force main was apparently abandoned in the 1960s. The line is an 18-inch cast iron line installed in the 1890s. According to a ground penetrating radar (GPR) survey performed by Hager GeoScience in November 1999, the sewer line was present across the property except for the section in the tank grave area. The GPR report is further discussed in Section 2.0 and included as Appendix D.

1.2.3 Environmental Permits and Compliance History

The USARC facility holds a RCRA Small Quantity Generator permit, MA000027225. The facility is also in the process of filing an application for a National Pollutant Discharge Elimination System storm water permit for industrial facilities (S.Lombardi, personal communication, 2002).

1.2.4 Summary of Previous Investigations

Studies that have been performed at the Site include a site-wide Geohydrologic Investigation of the facility that was performed by the U.S. Army Environmental Hygiene Agency (USAEHA) in October 1992. This investigation included soil borings and monitoring well installation activities, and soil, groundwater, surface water, and sediment sampling.

Soil and Groundwater Sample Results

The areas investigated included a former aboveground gasoline fuel pod storage area (GFPSA), which was located in a fenced grassy area northeast of the USAR Center (see Figure 1-2). The quantity, capacity, dimensions, and construction of the GFPSA is unknown. Site personnel reportedly indicated that two 600-gallon fuel pods were stored in this area for less than one year, around 1988.

Petroleum contamination in soil and groundwater was identified during the USAEHA field investigation in October 1992. The highest level of soil contamination reported (TPH by USEPA 418.1 at 1,800 mg/kg and lead by USEPA 239.2 at 48 mg/kg) was from a surface soil sample collected approximately five feet north of the GFPSA. TPH concentrations were shown to drop off rapidly within a depth of only five feet. Following the discovery of low levels of VOCs by USEPA 524.2 (including sec-butylbenzene, isopropylbenzene, naphthalene, toluene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and m- & p-xylene) in one monitoring well, B5A (see Figure 1-2), a second monitoring well (B5B) was installed approximately five feet away. In addition, a detectable level of VOC (sec-butylbenzene) was observed in the groundwater collected from a monitoring well (B12) downgradient, approximately 75 feet away from B5A.

A follow-up groundwater sampling program was conducted by USAEHA in May 1993. Analytical results from monitoring well B5B show low levels of TPH (gasoline range at 0.83 mg/L and diesel range at 1.4 mg/L) and VOCs including naphthalene at 28 µg/L and 1,2,4-trimethylbenzene at 26 µg/L (USACE, 1997).

On May 16, 1997, the USACE collected a soil sample near monitoring well B5A as part of a risk screening program for the U.S. Army Reserve (USAR). A surface soil sample was collected between the depths of 0.2 and 0.8 feet below ground surface and analyzed for polycyclic aromatic hydrocarbons (PAHs) and lead. Results show positive detections for five PAHs at concentrations ranging between 150 and 350 µg/kg and the lead concentration at 106 mg/kg. A second surface soil sample was collected near monitoring well B6 (location of former UST 069) and was also analyzed for PAHs and lead. Results show positive detections for 10 PAHs with concentrations ranging between 70 and 150 µg/kg and lead at a concentration of 13.9 mg/kg (USACE, 1997).

The MCP Reportable Concentrations for soil and groundwater were not exceeded by any of these sample results.

Surface Water and Sediment Sample Results

An unnamed intermittent stream flows south to north along the western property limit, and a swale flows south to north along the eastern property limit (see Figure 1-2). Two surface water and sediment samples were collected from the intermittent stream during the USAEHA field investigation in October 1992. One sample was taken at the upstream (southern) limit of the stream onsite; the second sample was taken downstream of the storm water outfall. The swale was not sampled at the time of this investigation.

In the surface water samples, there were no positive detections of TPH (by USEPA 418.1), VOCs (by USEPA 524.2), SVOCs (by USEPA 8270), polychlorinated biphenyls (PCBs) (by USEPA 8082), or pesticides (by USEPA 8081). Barium, copper, mercury, lead, and zinc were detected in both the upstream and downstream water samples. In addition to these metals, the downstream sample contained arsenic, cadmium, nickel, and antimony. No oily sheen was present in the stream at the time of sampling. (USAEHA, 1992)

In sediment, TPH concentrations, by USEPA 418.1, ranged from 82 mg/kg to 200 mg/kg. Lead, by USEPA 239.2, was also detected at concentrations ranging from 27 mg/kg to 390 mg/kg. USAEHA concluded that elevated metals and TPH may be attributable to runoff from adjacent parking lots or a natural buildup of organic materials and metals in the slow flowing swamp (USAEHA).

1.3 RECORDS REVIEW AND EVALUATION

A data base search conducted by Vista Information Solutions, Inc., identified three state-listed sites, three leaking USTs, three registered USTs, one permitted solid waste landfill, incinerator, or transfer station, two Emergency Response Notification System of Spills (ERNS), and five state spills sites within a 1/8th-mile radius of the Site. Refer to Appendix E for the location and data base description of these sites.

The following are the three state equivalent CERCLIS sites located within 1/8th-mile of the Site:

Site name and RTN number	Address	Status and date
Mercury Company of Norwood 4-1217	10 Burke Drive Brockton, MA	RAO, A-2 9/30/94
US Army Reserve Center 4-1303 (The Site)	915 West Chestnut St. Brockton, MA	Tier 2 7/24/96
Property 4-6045	970 West Chestnut St. Brockton, MA	RAO, A-2 8/11/00

The two sites which have received an RAO status should not impact environmental conditions at the Site. The three leaking UST sites have been closed and should therefore not impact environmental conditions at the Site. The five state spill sites have been closed and should therefore not impact environmental conditions at the Site.

2. FIELD INVESTIGATION

The objective of the Phase II Comprehensive Site Investigation, as outlined by the USACE, is to determine the extent of petroleum hydrocarbon contamination that may exist near former UST 153 and in the GFPSA, as well as to determine if the intermittent stream on the west side of the property and the swale on the east side of the property are being influenced by petroleum contamination. In addition, Stone & Webster recommended, and the USACE agreed, that the abandoned sewer line be investigated as a fourth area of concern at the Site.

The Phase II Comprehensive Site Investigation included a ground penetrating radar survey, the advancement of several soil borings, the installation of groundwater monitoring wells, the collection and analysis of soil, sediment, surface water and groundwater samples, and a groundwater elevation survey. The Phase II Comprehensive Site Investigation was conducted in accordance with the Final Sampling and Analysis Plan (SAP), Phase II Comprehensive Site Investigation, Cpl. Gordon Craig U.S. Army Reserve Center, Brockton, Massachusetts, dated November 1999. Additional field sampling and analysis activities conducted in 2001 in support of the Phase II Comprehensive Site Investigation were in accordance with Addendum No. 1 to the SAP, dated May 2001. The sampling and analysis are described below, and the results are discussed in Section 4.0.

2.1 GPR SURVEY

A GPR survey of the abandoned sewer line was performed by Hager GeoScience on November 12, 1999. The GPR survey identified clear reflections of the abandoned sewer line across the property. The sewer line was encountered at varying depths across the property. The GPR survey did not encounter the sewer line in the UST excavation (UST 153) area. The GPR survey report is included as Appendix D. The abandoned sewer line is shown on Figures 1-2, 2-1, 2-2, and 2-3.

2.2 SOIL BORINGS AND SOIL SAMPLING

During November 1999, a total of 19 soil borings were advanced by New Hampshire Boring Company of Londonderry, New Hampshire. All borings were advanced under the oversight of a Stone & Webster Engineer/Geologist. Soil borings were advanced by using a 4.25-inch inside diameter hollow stem auger, and 2-inch outside diameter and 24-inch long split spoons were used to collect continuous soil samples. All soil samples were screened in the field for total VOCs using a MiniRae PID fitted with a 10.6 eV lamp. Refer to Appendix F for the soil boring logs. Soil boring advancement and soil sampling was focused on three general areas; the former UST 153; the former GFPSA; and the abandoned sewer line, which are described below. Surface soil sampling was conducted in the drainage swale, also described below.

2.2.1 Former UST 153

A total of six soil borings (BRSWSB01-BRSWSB06) were located in the general area of the former UST 153 to further evaluate the horizontal and vertical extent of contamination and potential contaminant migration. Refer to Figure 2-1 for boring locations. One soil boring (BRSWSB02) was completed as a groundwater monitoring well (BRSWMW13). Soil boring locations were selected based on access, underground utility information, previously interpolated groundwater flow direction, and past studies indicating areas of concern. The six soil borings were used to vertically characterize the Site geologic

strata, provide additional data regarding the nature and extent of contamination, and serve as monitoring well construction points.

Groundwater was encountered at approximately 3 ft. to 4 ft. below the ground surface (bgs) for these six borings. PID readings for each boring are shown in Table 2-1. A petroleum-like odor and petroleum stained soil was noted in soil between 6 ft. and 8 ft. bgs at soil boring BRSWSB02.

Refer to Appendix F for soil boring logs and Appendix G for monitoring well completion logs. One soil sample was collected at the groundwater interface from each of the six soil boring locations and submitted to an offsite USACE approved laboratory for analysis including; VOCs by USEPA Method 5035/8260B; SVOCs by USEPA Method 3520C/8270C; and RCRA-8 Metals in addition to antimony by USEPA Method 6010/7000 series. In addition, two soil samples (BRSWSB02 and BRSWSB05) were also submitted based on field screening results for extractable petroleum hydrocarbon (EPH) and volatile petroleum hydrocarbon (VPH) analysis by the MADEP Method.

2.2.2 Former GFPSA

A total of eight soil borings (BRSWSB07-BRSWSB14) were located in the general area of the former GFPSA to further evaluate the horizontal and vertical extent of contamination and potential contamination migration. One soil boring (BRSWSB14) was completed as a groundwater monitoring well (BRSWMW14). Soil boring locations were selected based on access, underground utility information, previously interpolated groundwater flow direction, and past studies indicating areas of concern. All eight soil borings were used to vertically characterize the Site geologic strata, provide additional data regarding the nature and extent of contamination, and serve as potential monitoring well construction points. Refer to Figure 2-1 for sampling locations.

Three of the eight soil borings (BRSWSB07, BRSWSB08, and BRSWSB13) were shallow borings, only being advanced to a depth of five feet. Groundwater was not encountered in these soil borings. No visual or olfactory evidence of petroleum product was noted during their advancement. PID readings for each boring are shown in Table 2-1. Refer to Appendix F for soil boring logs. One soil sample was collected from each boring based on field screening results and submitted to an offsite USACE approved laboratory for analysis including EPH and VPH analysis by the MADEP Method.

Four soil borings (BRSWSB09 - BRSWSB12) were advanced to the groundwater interface, which was encountered at approximately 6 ft. to 7 ft. bgs. BRSWSB14 served as an upgradient background soil sample and groundwater control point and was advanced to 15 ft bgs. No visual or olfactory evidence of petroleum product was noted during their advancement. PID readings for each boring are shown in Table 2-1. Refer to Appendix F for soil boring logs. Two soil samples were collected from each boring location (one sample collected from the groundwater interface and one sample collected based on field screening results) and submitted to an offsite USACE approved laboratory for analysis including EPH and VPH analysis by the MADEP Method.

2.2.3 Abandoned Sewer Line

A total of five soil borings (BRSWSB15-BRSWSB19) were located in the general area of the abandoned sewer line to evaluate possible petroleum product in the fill materials along the pipe line. One soil boring BRSWSB15 was completed as a groundwater monitoring well BRSWMW15. Soil boring locations were selected based on access, underground utility information, previously interpolated groundwater flow direction, and past studies indicating areas of concern. All five soil borings were used to vertically characterize the Site geologic strata, provide additional data regarding the nature and extent

of potential contamination, and serve as monitoring well construction points. Refer to Figure 2-2 for sampling locations.

Soil borings were advanced to a depth ranging from 8 to 20.5 ft. bgs, and groundwater was encountered at approximately 6 ft. bgs. No visual or olfactory evidence of petroleum product was noted during the advancement of the aforementioned borings. PID readings for each boring are shown in Table 2-1. One soil sample was collected at the groundwater interface from each of the five soil boring locations and submitted to an offsite USACE approved laboratory for analysis including: VOCs by USEPA Method 5035/8260B; EPH and VPH analysis by the MADEP Method; SVOCs by USEPA Method 3520C/8270C; and RCRA-8 Metals in addition to antimony by USEPA Method 6010/7000 series.

2.2.4 Drainage Swale

The Sampling and Analysis Plan proposed taking sediment and surface water samples from the drainage swale. Based on a site reconnaissance, a wetlands biologist determined that the drainage swale actually contained soil, not sediment. Shallow standing water (less than one-inch) was noted in isolated pockets along the drainage swale, however, sufficient water was not available to collect a sample. Vegetation is present in the swale.

As a result, a total of four surface soil samples (BRSWSD05-BRSWSD08) were collected along the length of the drainage swale as it transverses the east side of the Site to evaluate whether contamination has migrated from potential source areas into the soil. Refer to Figure 2-2 for sample locations.

Soil samples were collected in general accordance with the SAP (Stone & Webster, 1999). There were no visual or olfactory evidence of petroleum product or elevated PID readings in the surface soil samples collected during on-site investigation work.

Soil samples were submitted to an offsite USACE approved laboratory for analysis including: VOCs by USEPA Method 5035/8260B; SVOCs by USEPA Method 3520C/8270C; RCRA-8 Metals in addition to antimony by USEPA Method 6010/7000 series; and Total Organic Carbon (TOC) by USEPA Method 9060. In addition, BRSWSD07 was also analyzed for EPH and VPH by the MADEP Method.

2.3 Installation of Groundwater Monitoring Wells

A total of three groundwater monitoring wells (BRSWMW13, BRSWMW14, and BRSWMW15) were installed in their respective soil borings (BRSWSB02, BRSWSB14, and BRSWSB15). Refer to Figure 2-3 for monitoring well locations. The rationale for installing the three monitoring wells included the following: monitoring wells were used to further evaluate the direction of groundwater flow, to establish Site water quality conditions, and to determine the presence or absence of Light Non-Aqueous Phase Liquid (LNAPL) on the groundwater in these areas.

Each new monitoring well was constructed in general accordance with the SAP (Stone & Webster, 1999) and Massachusetts *DEP Standard References for Monitoring Wells* (Publication #WSC-310-91, MADEP 1991). All monitoring wells were constructed using Schedule 40, 2-inch inside diameter (ID) polyvinyl chloride (PVC) riser pipe, attached with threaded joints to Schedule 40, 2-inch ID, 0.010-inch slotted PVC well screen and fitted with a flush-mounted roadbox. Refer to Appendix F for soil boring logs and Appendix G for monitoring well completion logs. All groundwater monitoring wells were screened across the water table to further evaluate groundwater quality.

Following installation, the monitoring wells were developed in accordance with the SAP (Stone & Webster, 1999) where water was purged by pumping each monitoring well using a whale pump. Development of the monitoring well continued until: 1) pH, specific conductance, and turbidity were stable (within plus or minus 10 percent between three consecutive readings), and purge water was clear and free of fines to the unaided eye, or 2) two hours of development time had passed.

2.4 GROUNDWATER SAMPLING

Five monitoring wells, B1, B2, B3, B12, and BRSWMW14 (refer to Figure 2-3), were sampled using Low-Flow methodology as detailed in USEPA Region I Low Stress (low flow) Purging and Sampling Guidelines (USEPA, 1996a) and the SAP (Stone & Webster, 1999).

Six monitoring wells, B5A, B6, B7D, B8, BRSWMW13, and BRSWMW15, could not be sampled using the low-flow methodology (USEPA, 1996a) as a result of falling water levels at the lowest sustainable pumping rate. For each of these monitoring wells, the well was pumped dry, allowed to recharge, and then sampled.

A PID was used to screen ambient and monitoring well organic vapor levels prior to sampling. An oil/water interface probe was used to evaluate depth to water and thickness of any LNAPL (if present). Whale pumps and dedicated tubing were used to sample each monitoring well. Field measurements using a YSI 6920 (YSI Incorporated) were collected for pH, temperature, specific conductivity, dissolved oxygen, and oxidation-reduction potential from each monitoring well. Turbidity was collected separately using a Turbidimeter. Refer to Appendix H for the Groundwater Field Analysis Forms.

Groundwater samples collected from all 11 monitoring wells were sent to an off-site USACE approved laboratory for analysis including; VOCs by USEPA Method 5030B/8260B; SVOCs by USEPA Method 3520C/8270C; RCRA-8 Metals in addition to antimony by USEPA Method 6010/7000 series; and Hardness by USEPA 2340B or 2340C. In addition, groundwater from monitoring wells BRSWMW13 and B5A were also analyzed for EPH and VPH by the MADEP Method.

There was no visual or olfactory evidence of petroleum product, there were no elevated PID readings, and no LNAPL was detected in the 11 monitoring wells sampled.

2.5 GROUNDWATER ELEVATION SURVEY

On December 15, 1999, a groundwater elevation survey was conducted at three newly installed (BRSWMW13-BRSWMW15) and eight previously installed wells to determine and evaluate onsite groundwater flow direction. A total of 11 monitoring wells were monitored using an oil/water interface probe. Groundwater levels were recorded at all locations and no LNAPL layers were encountered during field survey activities. Refer to Table 2-2 for the groundwater elevations and Figure 2-3 for the interpolated groundwater contours.

2.6 SURFACE WATER AND SEDIMENT SAMPLING

A total of four collocated surface water and sediment samples (BRSWSD01/BRSWSW01-BRSWSD04/BRSWSW04) were collected along the length of the intermittent stream as it transverses the west side of the property to evaluate whether contamination has migrated from potential source areas into surface water and sediment. The sediment and surface water samples BRSWSD01/BRSWSW01 and

BRSWSD02/BRSWSW02 were located upgradient of the outfall pipe that discharges surface water runoff to the stream from the parking lots on-site. Sample BRSWSD03/BRSWSW03 was taken at the mouth of the outfall pipe, and sample BRSWSD04/BRSWSW04 was located downgradient of the outfall pipe. Refer to Figure 2-2 for sample locations.

Surface water and sediment samples were collected in general accordance with the SAP (Stone & Webster, 1999). There were no visual or olfactory evidence of petroleum or elevated PID readings in the surface water or sediment samples collected during on-site investigation work.

Sediment samples were submitted to an offsite USACE approved laboratory for analysis including; VOCs by USEPA Method 5035/8260B; SVOCs by USEPA Method 3520C/8270C; RCRA-8 Metals in addition to antimony by USEPA Method 6010/7000 series; and TOC by USEPA Method 9060. In addition, BRSWSD03 (located downgradient from the outfall pipe) was also analyzed for EPH and VPH by the MADEP Method.

Surface water samples were submitted to an offsite USACE approved laboratory for analysis including; VOCs by USEPA Method 5030B/8260B; SVOCs by USEPA Method 3520C/8270C; RCRA-8 Metals in addition to antimony by USEPA Method 6010/7000 series; and Hardness by USEPA 2340B or 2340C. In addition, BRSWSW03 (located downgradient from the outfall pipe) was also analyzed for EPH and VPH by the MADEP Method.

In order to gather more pertinent data for use in environmental risk characterization, additional sampling was conducted in the intermittent stream on June 27, 2001. A total of four collocated surface water and sediment samples (BRSWSD01R/BRSWSW01R - BRSWSD04R/BRSWSW04R) were collected from the same locations in the stream as the original samples. Sediment samples were submitted to an offsite USACE approved laboratory for analysis of Acid Volatile Sulfide/Simultaneously Extracted Metals (AVS/SEM) by USEPA's "Draft Analytical Method for Determination of Acid Volatile Sulfide in Sediment" (USEPA, 1991a). Surface water samples were submitted to an offsite USACE approved laboratory for analysis of dissolved metals (cadmium, lead, and selenium) by USEPA Method 6010B; and Hardness by USEPA 130.2. Surface water samples for dissolved metals analysis were filtered through a 0.45 micron filter in the field and preserved prior to shipment to the laboratory.

2.7 ELEVATION SURVEY

On December 15, 1999, a survey was conducted by TF Moran Inc., to record ground elevations at all sediment, surface water, newly advanced soil borings (associated with the abandoned sewer line), and all 11 monitoring well locations. For each monitoring well, ground surface, top of casing, and top of PVC elevations were measured. All elevations were tied to a known benchmark elevation based on National Geodetic Vertical Datum (NGVD) 1929. The on-site benchmark was corroborated by using a Global Positioning System (GPS). Data from this survey was used to both locate sampling points relative to the Site map and to evaluate groundwater elevation. For the remainder of the soil borings that are associated with the former UST 152 and the former GFPSA, locations were not surveyed due to the close proximity of the locations to an on-site landmark. These locations were marked off and were determined utilizing a field tape, site plan, and a fixed reference location (the northeast corner of the administration building) to be located on the Site map.

2.8 INVESTIGATION DERIVED WASTE STORAGE AND DISPOSAL

All Investigation Derived Waste (IDW) was screened with a PID using headspace measurements and visual and olfactory observations. The following describes the criteria used to determine the appropriate disposal of IDW.

- All drill cuttings with headspace measurements exceeding 10 ppm or suspected to be contaminated by visual or olfactory observations were containerized in 55-gallon Department of Transportation (DOT)-approved steel drums in accordance with the SAP (Stone & Webster, 1999). All drill cuttings with headspace measurements less than 10 ppm and having no visual or olfactory evidence of contamination were backfilled into the boring from which it came;
- All purge water from monitoring wells was containerized in 55-gallon DOT-approved steel drums in accordance with the SAP (Stone & Webster, 1999); and
- All decontamination fluids were containerized in 55-gallon DOT-approved steel drums.

All IDW was removed from the Site on March 6, 2000 by a qualified transportation and disposal contractor, General Chemical Corporation of Framingham, Massachusetts. All IDW materials were disposed of in accordance with local, state, and federal regulations. A copy of the waste manifest is included in Appendix I.

3. SITE GEOLOGY AND HYDROGEOLOGY

3.1 REGIONAL GEOLOGY

The bedrock underlying surficial deposits have been extensively mapped by Chute (1950, 1966, 1969) Hartshorn (1960, 1967), Koteff (1964) and Lyons (1969 and 1977) as units of the Narragansett basin in the Milford-Dedham Zone. The Milford-Dedham zone is an Avalonian terrane which includes sedimentary, volcanic, and intrusive rocks ranging from Proterozoic Y to Tertiary ages. The Narragansett Basin is comprised of Pennsylvanian fluviatile strata: sandstone, siltstone, conglomerate, shale, and coal. The stratigraphic units in the Narragansett Basin include the Purgatory Conglomerate, Dighton Conglomerate, Rhode Island Formation, Wamasutta Formation, and the Pondville Conglomerate. Limestone has been locally observed in the Wamasutta unit and is believed to be of Cambrian age (Goldsmith, 1991).

3.2 SITE GEOLOGY

Four distinct geologic units were encountered during previous and current Phase II subsurface investigations; they are (in stratigraphic succession from top to bottom):

- Fill - Gravelly Sand and Sand Fill.
- Fine Sand and Silt – Moderately sorted fine sand and silt.
- Glacial Till - discontinuous, poorly sorted, compacted, angular to subangular fine to coarse gravel clasts supported by a coarse- to fine-grained sand silt, and clay matrix. Locally grades to a fine sand, silt, and clay matrix.
- Bedrock – Glauconitic Sandstone with intermittent Limestone Beds.

3.2.1 Overburden

Fill covers much of the Site and was incorporated during localized building activities during 1977. Where present, fill ranges in thickness around the Site from approximately 3 to 10 feet. The glacial till which is the predominant overburden unit is comprised of poorly sorted, compacted, angular to subangular fine to coarse gravel clasts supported by a coarse- to fine-grained sand silt, and clay matrix. Locally the glacial till grades to a fine silty sand. The glacial till forms a veneer over the concealed bedrock.

3.2.2 Bedrock

Previous onsite soil boring investigations performed by the USAEHA revealed the presence of Glauconitic Sandstone and Limestone at depth. Bedrock descriptions are limited but reveal that the sandstone ranged from green to black in color and was encountered at boring locations B7D, B9, and B11. The Limestone was only encountered at one location, B9, and was gray in color.

3.3 REGIONAL HYDROGEOLOGY

The Site is located within the Taunton River Drainage Basin. The principal aquifer material of the basin is comprised of sand and gravel deposits within stratified drift (Simcox, 1990). Stratified drift deposits

cover roughly 62 percent of the land surface within the basin and are composed of ice-contact (kame), outwash, and lake bottom sediments, which were deposited in pre-glacial bedrock valleys and in water-filled depressions within the till surface during the retreat of the last glacier (Simcox, 1990). Stratified drift mainly comprises the central and southern portions of the basin while the remainder of the basin is comprised of low permeability clays, silts, and fine sands (Simcox, 1990). Volcanic and granitic rocks underlie the basin along the northern and southern margins while sandstone, shale, siltstone, and conglomerate underlie the basin interior (Goldsmith, 1991). The median annual precipitation for the Taunton River Basin is 48.95 inches per year, as reported by the National Weather Service web-site (www.nws.noaa.gov) normal, means, and extreme statistics for the years of 1920-1995.

3.4 SITE HYDROGEOLOGY

The Site is located in the north-central region of the Taunton River Drainage Basin within a localized low-lying area. The Site is bordered on the west by a intermittent stream and on the east by a drainage swale, both of which flow south to north (see Figure 1-2). In addition, the Site is bordered by a swampland along the northern property boundary. Ground surface elevations across the Site range from approximately 121 ft. above msl at the south end of the Site to approximately 108 ft. msl at the northeast corner (USAEHA, 1992). The Site appears to slope radially from the south to the north and from the central north-south axis of the property to both the east and west.

3.4.1 Groundwater Elevations

Groundwater flow directions were interpolated using groundwater elevations recorded during the groundwater survey performed on November 29, 1999. This groundwater elevation survey included monitoring wells B1, B2, B3, B5A, B6, B7D, B8, B12, and newly installed wells BRSWMW13, BRSWMW14, and BRSWMW15. The generalized groundwater contour map is presented on Figure 2-3.

Groundwater elevations ranged from approximately 111.47 ft. msl at monitoring well B7D to approximately 115.15 ft. msl at monitoring well B2. Groundwater flows north to northwest except where a local hydraulic conductivity low exists adjacent to monitoring well BRSWMW13. The surrounding substrate consists of organic clay and silts, which would effectively act as a restriction to groundwater flow, resulting in a bending of the groundwater flow path.

Horizontal groundwater gradient calculations are determined by calculating the change in hydraulic head over a given distance. The horizontal gradients were calculated between monitoring wells B7D and B2 located roughly in the northwest and southeast corners of the Site. The change in hydraulic head between the wells was 3.68 ft. over a horizontal distance of 740 ft. The horizontal gradient groundwater conditions measured on November 29, 1999 for the Site were determined to be 0.00497 feet/foot. Vertical gradient information regarding the Site is unattainable at this time due to similar well depths and construction across the Site.

3.4.2 Hydraulic Conductivity Testing

Hydraulic conductivity tests were performed at newly installed monitoring wells BRSWMW13, BRSWMW14, and BRSWMW15 between November 22 & 23, 1999 as part of this investigation. The method used to perform the tests and appropriate calculations are provided in Appendix J.

The hydraulic conductivity onsite was found to be consistent with hydraulic conductivity results reported in the 1992 USAEHA report. Hydraulic conductivity onsite ranges between approximately 4×10^{-5} ft/day (BRSWMW13) to 1.65×10^{-3} ft/day (BRSWMW14). These wells were screened in tightly packed silty

sands. The highest conductivity, at well BRSWMW14, was characteristic of a gravely, silty, sand which comprised the upper margin of the wells screened substrate. The lowest conductivity was observed at well BRSWMW13 where the well was screened in a tight silty fine sand substrate, which graded to a silt. Due to the nature of the native substrate and the relative bending of the groundwater flow path, the range is characteristic of the native aquifer material and not of the surrounding developed sand pack. These observed values were within ranges predicted by Rawls, Brakensiek, and Saxton (1982), for soils of this type, which vary from 10^{-3} to 10^{-5} ft/day depending on degrees of saturation.

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4. NATURE AND EXTENT OF CONTAMINATION

All 1999 soil, sediment, surface water, and groundwater samples were submitted to the USACE-approved laboratory AMRO Environmental Laboratories (AMRO), located in Merrimack, New Hampshire. The laboratory analytical results were validated by Kestrel Environmental Services (Kestrel), located in Freeport, Maine. Tables 4-1 through 4-4 provide a summary of the validated data for each media type that were collected in 1999 as part of this Phase II Investigation. Refer to Appendix K for the data validation package.

All 2001 sediment and surface water samples were submitted to Severn Trent Laboratories of Burlington, Vermont. The laboratory analytical results were validated by Validata Chemical Services, Inc. of Lilburn, Georgia. Summaries of the validated 2001 surface water and sediment sample results are included on Tables 4-3 and 4-4, respectively. Refer to Appendix L for the 2001 data validation package.

The results are discussed below by area of concern.

4.1 FORMER UST 153 RESULTS

Six soil borings (BRSWSB01-BRSWSB06) were installed in the former UST 153 area. Soil samples were collected and analyzed for VOCs, SVOCs, and RCRA-8 Metals. In addition, two soil samples (BRSWSB02 and BRSWSB05) were also analyzed for EPH and VPH by the MADEP Method. The only VOCs detected were acetone and methylene chloride (common laboratory contaminants). Of the SVOC analytes, four PAHs were detected in one sample, BRSWSB02(6-8). Barium, chromium, and lead were detected in all samples; arsenic was detected in four samples. No EPH or VPH were detected. Analytical results for soils are detailed in Table 4-1.

One soil boring (BRSWSB02) was completed as a groundwater monitoring well (BRSWMW13). A groundwater sample was collected and analyzed for VOCs, SVOCs, RCRA-8 Metals, EPH and VPH. One VOC (toluene), one SVOC (phenol), and two metals (chromium and lead) were detected. C19-C36 Aliphatics were also detected by the EPH analysis. No VPH was detected in this sample. Analytical results for the groundwater sample are detailed in Table 4-2.

4.2 FORMER GFPSA RESULTS

Eight soil borings (BRSWSB07-BRSWSB14) were installed in the general area of the former GFPSA. One soil sample from borings BRSWSB07, BRSWSB08, BRSWSB13 and two samples from borings BRSWSB09-BRSWSB12 were analyzed for EPH and VPH by the MADEP Method. From the EPH analysis, C11-C22 Aromatics were detected in one sample, BRSWSB07(0-3). Two EPH constituents, fluoranthene and pyrene, were detected in one sample, BRSWSB12(0-3). No VPH was detected. Analytical results from soil samples collected in this area are detailed in Table 4-1.

One soil boring (BRSWSB14) was completed as a groundwater monitoring well (BRSWMW14). A groundwater sample was collected and analyzed for VOCs, SVOCs, and RCRA-8 Metals. One

VOC (toluene) was detected. No SVOCs or metals were detected. Analytical results from the groundwater sample collected in this area are detailed in Table 4-2.

4.3 ABANDONED SEWER LINE RESULTS

Five soil borings (BRSWSB15-BRSWSB19) were installed in the general area of the abandoned sewer line. Soil samples were collected and analyzed for VOCs, SVOCs, RCRA-8 Metals and EPH and VPH. Of the VOCs, acetone and methylene chloride were detected in sample BRSWSB18(4-6), while 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 4-isopropyltoluene, ethylbenzene, isopropylbenzene, naphthalene, n-propylbenzene, o-xylene, m&p-xylene, and sec-butylbenzene were detected in sample BRSWSB19. Of the SVOCs, four PAHs were detected in sample BRSWSB19. Of the metals, barium, chromium, and lead were found in all samples. Antimony, arsenic, and cadmium were found in three, two, and one sample, respectively. VPH analysis revealed C9-C12 Aliphatics, C9-C10 Aromatics, and naphthalene in BRSWSB19. No EPH was detected. Analytical results from soil samples collected in this area are detailed in Table 4-1.

One soil boring (BRSWSB15) was completed as a groundwater monitoring well (BRSWMW15). A groundwater sample was collected and analyzed for VOCs, SVOCs, and RCRA-8 Metals. One VOC (toluene) and one metal (chromium) were detected. No SVOCs were detected. Analytical results from the groundwater sample collected in this area are detailed in Table 4-2.

4.4 DRAINAGE SWALE RESULTS

Four surface soil samples (BRSWSD05-BRSWSD08) were collected along the length of the drainage swale as it transverses the east side of the Site. Samples were analyzed for VOCs, SVOCs, RCRA-8 Metals, and TOC. In addition, BRSWSD07 was also analyzed for EPH and VPH. One VOC, acetone, was detected is all samples. Of the SVOCs, nine PAHs were detected in BRSWSD08, eight PAHs in BRSWSD05, five PAHs in BRSWSD06, and three PAHs in BRSWSD07. Seven metals were detected in all samples (except arsenic, detected in 3 out of 4). No EPH or VPH were detected. The analytical results from the soil samples are detailed in Table 4-1.

4.5 GROUNDWATER MONITORING WELL RESULTS

In addition to the three newly-installed wells already discussed, eight previously installed groundwater monitoring wells (B1, B2, B3, B12, B5A, B6, B7D, and B8) were sampled as part of this investigation. Groundwater samples were collected and analyzed for VOCs, SVOCs, RCRA-8 Metals and Hardness. In addition, groundwater from monitoring well B5A was also analyzed for EPH and VPH, where, based on previous results, the highest levels of hazardous materials were suspected. Of the VOCs, 1,2,4-trimethylbenzene, 4-isopropyltoluene, n-propylbenzene, and sec-butylbenzene were detected in one well, B5A. Methyl tert-butyl ether was detected in B12. Toluene was detected in six of the eight wells. For SVOCs, bis(2-ethylhexyl)phthalate was detected in wells B5A and B7D, and phenol was detected in six of the eight wells. EPH and VPH were detected in well B5A. Of the metals analyzed, barium was present in five wells, and chromium in two wells. Analytical results from groundwater samples are detailed in Table 4-2.

4.6 INTERMITTENT STREAM RESULTS

In 1999, four collocated surface water and sediment samples (BRSWSD01/BRSWSW01-BRSWSD04/BRSWSW04) were collected along the length of the intermittent stream as it transverses the west side of the Site. Surface water samples were analyzed for VOCs, SVOCs, RCRA-8 Metals, and Hardness. In addition, BRSWSW03 (located downgradient from the outfall pipe) was also analyzed for EPH and VPH. Of the VOCs, carbon disulfide was detected in one sample. One SVOC, bis(2-ethylhexyl)phthalate, a common laboratory contaminant, was detected in one sample. C19-C36 Aliphatics and C11-C22 Aromatics were detected in the one sample analyzed for EPH. No VPH was detected. Antimony, barium, and chromium were detected both upstream and downstream of the outfall pipe. Cadmium and lead were detected downstream of the discharge pipe. Selenium was detected in one sample upstream of the pipe. Hardness values ranged from 35 to 76 mg/l (as Ca-Mg). The analytical results from surface water samples are detailed in Table 4-3.

The 1999 sediment samples were analyzed for VOCs, SVOCs, RCRA-8 Metals, and TOC. In addition, BRSWSD03 (located downgradient from the outfall pipe) was also analyzed for EPH and VPH. Acetone was detected in three samples, and bis(2-ethylhexyl)phthalate was detected in two samples; both are common laboratory contaminants. Ten PAHs were detected in samples both upstream and downstream of the outfall pipe. The most upstream sample (BRSWSD01) had the highest PAH concentrations. C19-C36 Aliphatics, chrysene, and pyrene were detected in the one sample analyzed for EPH. No VPH was detected. Antimony, arsenic, barium, cadmium, chromium, lead, and mercury were detected in 3 or 4 samples each (both upstream and downstream). Silver was detected in one downstream sample. The analytical results from sediment samples are detailed in Table 4-4.

In 2001, four collocated surface water and sediment samples (BRSWSD01R/BRSWSW01R - BRSWSD04R/BRSWSW04R) were collected from the same locations in the stream as the original samples. Surface water samples were analyzed for dissolved metals (cadmium, lead, and selenium). Results showed cadmium detected in three samples, lead in three samples, and selenium in one sample. Hardness values ranged from 44 to 96 mg/l (as CaCO3). These analytical results are included in Table 4-3. Sediment samples were analyzed for AVS/SEM. These results are listed in Table 6-11, and discussed in detail in Section 6.

4.7 SUMMARY OF NATURE AND EXTENT OF CONTAMINATION

Based on the findings of this assessment, only one area of soil impacted by the leaking UST was detected on the property. In the area surrounding former UST 153, response actions completed during the removal of the UST were successful in reducing the impacted area to a 2-foot thickness surrounding boring BRSWSB02. The impacted area is estimated to extend around this boring approximately 7 feet.

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5. HUMAN HEALTH RISK CHARACTERIZATION

5.1 INTRODUCTION

A Method 3 Risk Assessment (RA) has been conducted in accordance with 310 CMR 40.0000 to characterize the potential human health risks at the USARC Site. This RA uses information compiled during the Geohydrologic Study (USAEHA, 1992) and Phase II Site Investigations to assess the potential human health, safety, and public welfare posed by oil or hazardous material (OHM) detected at the Site. The primary goal of this risk assessment is to characterize nature and magnitude of potential human health, safety, and public welfare associated with possible exposure to OHM at the Site. This information will be used to determine if additional response actions are required to achieve or maintain a condition of no significant risk.

Several important features and conclusions of the risk assessment are identified as follows:

- The Site is presently used by the US Army as a Reserve Center for military reservist training and for maintaining military vehicles. The Site contains an office-type building (the USAR Center) and a maintenance shop that are surrounded by paved parking areas that are fenced. Areas outside the fencing include a paved parking area, but otherwise are unpaved (grassy). The western side of the USARC property is bordered by a roadway to the Veterans Administration Hospital, and the eastern side of the USARC property is bordered by a playground. It is assumed that the current use will be maintained, although the risk assessment evaluates potential future unrestricted land use (i.e., assumes no Activity and Use Limitation).

- There is currently no use of Site groundwater, which is approximately 2-6 feet bgs. Drinking water is supplied by the City of Brockton from a remote source. There are no foreseeable future uses of groundwater within and immediately downgradient of the Site. Currently, groundwater located within 30 feet of the USAR Center (occupied structure) is classified as GW-2. In the future, groundwater would remain in Category GW-2 if applicable (i.e., if the groundwater is located within 30 feet of an occupied building and depth to groundwater is less than 15 feet) and Category GW-3.

- The human health risk assessment concludes that a Condition of No Significant Risk of harm to human health exists for the Current and assumed Future unrestricted land uses at the property.

- A condition of no significant risk of harm to safety exists.

- A condition of no significant risk of harm to public welfare exists.

5.1.1 Description of Risk Analysis and Risk Management

The risk analysis process can be divided into two components: risk assessment and risk management. The National Research Council (NAS, 1983) defines these as follows: *"Risk assessment is the use of the factual base to define the health effects of exposure to individuals or populations to hazardous materials and situations. Risk management is the process of weighing*

policy alternatives and selecting the most appropriate action, integrating the results of risk assessment with engineering data and with social, economic, and political concerns to reach a decision". It is important that these two processes remain separate and distinct so that the science of risk assessment is separate from the policy of risk management.

This section primarily addresses the process of risk assessment. Risk management is used only in the context of determining whether the levels of risk calculated in the risk assessment are "significant". The determination of significance is made by comparison of estimated Cumulative Receptor Site Risks to the Cumulative Receptor Site Risk Limits contained in the regulations and by comparison of exposure point concentrations to potentially applicable or suitably analogous standards. If potentially significant risks are identified, then additional response actions may be required to meet the requirements of the MCP.

The risk assessment process can be divided into four steps: hazard identification, dose-response assessment, exposure assessment, and risk characterization and uncertainty analysis. The **hazard identification** determines what substances are present at a site, whether a substance causes adverse effects, and identifies those effects. The **dose response assessment** describes the relationship between the level of exposure and the likelihood and/or severity of an adverse effect. The **exposure assessment** identifies potential routes of exposure, characterizes the populations exposed, and determines the frequency, duration, and extent of exposure. The last step, **risk characterization**, combines the information from the previous three steps to describe the type (e.g., carcinogenic and non-carcinogenic) and magnitude of potential risks to the exposed populations. It also identifies the uncertainty in the characterization of potential risks. Each of these steps is described in later sections of this document.

5.1.2 Purpose

The purpose of this section is to present a human health, safety, and public welfare risk assessment for the Cpl. Gordon Craig USARC in Brockton, Massachusetts. The risk assessment will determine whether possible exposure to OHM present at and migrating from the Site present a "significant" risk to human health, safety, and/or public welfare. The results of the risk assessment will be used in determining the need for further response actions to meet the requirements of MCP site closure.

5.1.3 Regulatory Context and Requirements

This Method 3 RA was prepared consistent with the MCP promulgated under Chapter 21E on October 3, 1988 (310 CMR 40.0000) and amended through October 31, 1999, and the "Guidance for Disposal Site Risk Characterization" (MADEP, 1995a). Supplemental guidance was provided by "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final" (USEPA, 1989a), the "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors" (USEPA, 1991b), and the "Draft Commercial/Industrial Shortform Exposure Scenarios" (MADEP, 1996a).

5.1.4 Identification of the Extent of Release of OHM

Media sampled during the Phase I and II investigations include soil and groundwater at the Site, and surface water and sediment in the unnamed stream on the west side of the property. The limits of the Site, based on the data collected in the Geohydrologic Study and Phase II Site Investigation (SI) include soil and groundwater located on the USARC property, soils in the drainage swale that borders the eastern property boundary, and surface water and sediment in the on-site stream.

5.1.5 Identification of Current and Reasonably Foreseeable Uses of the Site and Surrounding Environment

The Site is located at the southwest side of the City of Brockton, on the north side of West Chestnut Street. The immediate vicinity is surrounded by residential, municipal, industrial and commercial properties. A playground is located adjacent to the eastern property boundary. The major features of the Site include the USAR Center (a 150 ft. by 150 ft. structure), a maintenance shop, a paved military vehicle parking lot, and two paved non-military vehicle parking lots on either side of the USAR Center. An intermittent stream is located on the USARC property, west of the parking lots (Figure 1-2).

The USAR Center, a portion of the eastern parking lot, and the military vehicle parking lot are fenced. The property immediately surrounding the USAR Center is landscaped, otherwise property within the fenced areas is paved. A grass-lined drainage swale is located east of the fenced portion of the property, between the USAR Center and the playground. The drainage swale contains standing water only during storm events. The north and northeastern portions of the property, outside the fenced areas, are unmowed grass. The area in the vicinity of the stream at the western portion of the property is grass and brush covered. The stream is shallow and several feet wide, and contains stationary or slowly moving water.

The USARC is used by the military as a reserve center. The facility is used for office work (daily), military vehicle maintenance, USAR drills, and meetings.

Underground utilities are located beneath the Site. There are no on-going construction activities at the property.

There is currently no use of Site groundwater, which is approximately 2-6 feet bgs. Drinking water is supplied by the City of Brockton from a remote source.

Future use of the property is assumed to continue as a USARC. However, future residential land use with no Activity and Use Limitations is evaluated in this risk characterization. There is no foreseeable future use of groundwater within and immediately downgradient of the Site. Currently, groundwater located within 30 feet of the USAR Center is classified as GW-2. In the future, groundwater would remain in Category GW-2 if applicable (i.e., if the groundwater is located within 30 feet of an occupied building and depth to groundwater is less than 15 feet) and Category GW-3.

5.1.6 Conceptual Site Model

Based on the Phase II SI and previous investigations of the releases of OHM and the fate and transport of OHM at the Site and in the surrounding environment, a conceptual site model has been developed. The conceptual site model identifies potential source areas from which OHM may have been released and also identifies the migration pathways through which OHM may have been transported and/or translocated to other environmental media where possible exposure may occur.

Sources

The primary source of OHM release is attributable to a leaking UST that contained diesel/# 2 fuel oil, and above-ground fuel pods that were used to store and dispense gasoline. The UST was found to be leaking at a rate of 70 gallons per day before its removal in the early 1990s. Gasoline spills associated with dispensing of fuel from the fuel pods historically occurred.

Migration Pathways and Potential Exposure Media

The soil and groundwater data collected during the Phase II indicate that petroleum-related OHM, including TPH, trimethylbenzenes, ethylbenzene, xylenes, and butylbenzenes have leached and infiltrated into subsurface soil in the vicinity of the former UST and fuel pod areas. These OHM have subsequently migrated in groundwater along the soil/groundwater interface.

The former sewer line that transects the Site (Figure 1-2) was investigated in the Phase II SI as a possible conduit for migration of site-related OHM to surface water in the stream. The soil and groundwater sampling performed in the Phase II SI revealed low levels of some VOCs in soil and groundwater immediately downgradient of the petroleum source areas. However, no petroleum-related OHM were detected in soil and groundwater sampling points further downgradient of the source area. Therefore, there is no complete migration pathway between the source area and the on-site stream.

The stormwater drainage system consists of a storm drain in front (south) of the maintenance shop, four trench drains across driveways and the loading dock area behind the USAR Center, and roof drains from the two buildings. The roof drains on the maintenance shop discharge to the ground surface behind the building. The trench drain across the eastern-most driveway drains to the swale on the eastern side of the property. The two trench drains across the western driveways drain into the intermittent stream on the west side of the property, as it enters the Site from under West Chestnut Street. The storm drain near the maintenance shop, the trench drain near the loading dock, and the roof drains from the USAR Center all feed into the storm drain system that discharges into the intermittent stream via an outfall pipe located approximately half way down the western side of the property (USACE, 1976). Therefore, a potentially complete migration pathways exist only for overland flow of stormwater runoff to surface water and sediment in the on-site intermittent stream, and soil in the drainage swale.

Under the existing site use as a USARC, USARC personnel, landscape workers, and trespassers could be exposed to OHM that are located in unpaved surface soils, such as those in the drainage swale and around the edges of the parking lots. With the exception of possible exposures associated with short-term utility repair, direct contact exposures to subsurface soils would not occur under the existing land use. However, under an assumed unrestricted future land use, surface and subsurface soils throughout the Site could be contacted.

Volatile OHM in groundwater (e.g., trimethylbenzene, toluene) may volatilize from the groundwater into soil gas. OHM in soil gas could be drawn into overlying buildings through convection. If this occurred, occupants of the USAR Center or occupants of future buildings constructed at the Site could be exposed to vapors to indoor air.

The on-site intermittent stream does not present an aesthetically pleasing place to swim, nor does it contain water that is deep enough to permit swimming. However, the stream may be an attractive place for children to investigate and play. If children play in the stream, they may be exposed to OHM in surface water and sediment. The stream does not provide habitat for fish, so exposure to fish tissue associated with angling at the Site is not a concern.

5.1.7 Selection of Method for Conducting This Risk Assessment

Three risk assessment methods are described in the MCP. Method 1 risk assessments involve comparisons of soil and groundwater concentrations to published, generic risk-based cleanup standards. Method 2 risk assessments evaluate potential risks using site-specific risk-based cleanup standards for individual chemicals, possibly in conjunction with Method 1 standards for other chemicals. Both Methods 1 and 2 are chemical-specific assessment/management approaches that are not applicable for evaluation of Sites that contain media other than soil and groundwater. Method 3 risk assessments evaluate the cumulative cancer and non-cancer risks associated with possible exposures at a site and also consider applicable or suitably analogous public health standards. The Method 3 approach is a cumulative risk approach rather than a chemical-specific approach. Method 3 has been selected as the method to evaluate potential human health risk at the Site because OHM have been detected in soil, groundwater, surface water, and sediment.

5.2 HAZARD IDENTIFICATION

The hazard identification process identifies the OHM present at a site, summarizes the analytical data that have been collected, and describes the potential health effects that may be associated with possible exposure to these OHM. In addition, the rationale for inclusion of analytes as OHM of potential concern (OHMPC) is also described.

5.2.1 Presentation of Analytical Data

The majority of analytical data are for samples collected during the Phase II site investigation and analyzed for volatiles, semivolatiles, RCRA 8 metals, and petroleum-related parameters (TPH, VPH, and EPH). Analytical data consisting of TPH analyses and RCRA 8 metals analyses are also available for samples collected at the USARC during the Phase I Investigation. The Phase I investigation focused sampling activities on identifying several possible disposal areas at the property. The Phase II SI focused on additional characterization of the extent of petroleum release in the vicinity of the former UST and fuel pods, and subsequent migration to soils and groundwater along the abandoned sewer line beneath the property, and potential migration to the on-site stream and drainage swale. Most existing groundwater wells were also re-sampled during the Phase II SI.

5.2.2 Selection of Analytical Data for the Risk Assessments

For the human health risk assessment, all Phase I and Phase II soil samples collected between 0 and 15 feet bgs were selected (no soils from depths greater than 15 ft bgs were collected at the Site). Samples collected from the drainage swale were considered as soil for this risk characterization because the drainage swale is normally dry (contains standing water only during and immediately after storm events). Samples selected for use and evaluation in the human health risk assessment are identified in Appendix M.

Groundwater samples beneath and potentially downgradient of the Site have been considered in the human health risk evaluation. Groundwater samples used in the risk assessment are identified in Appendix M. Because the Phase I groundwater samples were collected in 1992, they are not considered representative of current groundwater conditions. Therefore, only the most recent groundwater analytical result for each analytical parameter was evaluated in the risk characterization. In general, most groundwater data used in the risk assessment are from Phase II sampling activities. Figures 2-1, 2-2, and 2-3 show the soil and groundwater sampling locations.

Surface water and sediment samples collected from the on-site stream were evaluated in the risk characterization. The data sets include two surface water and sediment sample pairs collected in the Phase I investigation, and four surface water and sediment sample pairs collected in the Phase II investigation. Samples selected for use and evaluation in the human health risk assessment are identified in Appendix M. Figure 2-2 shows the surface water and sediment sampling locations.

Tables 5-1 through 5-4 present data summaries for the OHM (VOCs, semivolatiles, inorganics, and/or petroleum-related parameters) detected in soil, groundwater, surface water, and sediment at the Site. The frequency of detection, range of detected concentrations, arithmetic mean of all samples with one-half the sample quantitation limit (SQL) assigned to non-detects, and background concentration (where available) are presented for each constituent. The following sections present data summaries.

Soil Data Summaries

Summary statistics for Site soils 0-15 ft bgs are presented in Table 5-1. VOCs (particularly substituted benzene compounds), PAHs, antimony, arsenic, barium, cadmium, chromium, lead, mercury, TPH, EPH, and VPH compounds were detected in soils 0-15 ft bgs.

Groundwater Data Summaries

Parameters detected in groundwater at the Site include VOCs (particularly substituted benzenes), naphthalene, phenol, barium, chromium, lead, mercury, thallium, zinc, and EPH and VPH compounds (Table 5-2). The majority of organic OHM was detected in groundwater in the vicinity of the former UST.

Surface Water Data Summaries

Parameters detected in surface water at the Site include inorganics and EPH compounds (Table 5-3).

Sediment Data Summaries

Parameters detected in sediment at the Site include PAHs, inorganics, TPH, and EPH compounds (Table 5-4).

5.2.3 Selection of Oil or Hazardous Materials of Potential Concern (OHMPC)

Selection of OHMPC was conducted in a manner consistent with the MCP. In general, all detected analytes have been retained as OHMPCs unless they meet certain criteria. MADEP guidance (1995a) lists several reasons why an individual chemical may be eliminated from the quantitative risk characterization, including:

- the chemicals are laboratory artifacts;
- reported levels are consistent with background and there is no evidence that their presence is related to disposal at the site; or
- chemicals are present at low frequency of detection and low concentration and there is no history of past use and no evidence of current use of the OHM at the site.

The following text presents specific criteria that are used to exclude chemicals from the list of OHMPC consistent with MADEP guidance.

Background Concentrations. Background data published by the MADEP were used for inorganic parameters (MADEP, 1994; 1995a). In accordance with MADEP risk characterization guidance (MADEP, 1995a), maximum detected site concentrations are compared to MADEP published background concentrations. Maximum detected site concentrations that do not exceed the MADEP published background concentrations are considered to be consistent with background. OHM that are consistent with background are not retained as OHM of potential concern and are, by definition, associated with a condition of No Significant Risk.

Low Frequency of Detection and Low Concentration. Each analyte detected less than three times for a particular medium (with a minimum of ten samples) was not retained as an OHMPC if the maximum reported concentration of that analyte was less than twice the SQL reported by the laboratory (this is the method detection limit adjusted for dilution and/or moisture content considerations). If one or both of these criteria were not met, the "low frequency of detection and low concentration" criterion was not considered applicable.

Soil

Site soil data and soil OHMPCs are selected in Table 5-1. Although some VOCs (e.g., ethylbenzene, o-xylene) and petroleum compounds were detected at low frequency and concentration, they were retained as OHMPC because their presence in soil is interpreted to be associated with the historical releases of petroleum at the Site.

Groundwater

Site groundwater data and groundwater OHMPCs are selected in Table 5-2. All VOCs were retained as OHMPC because their presence in groundwater in interpreted to be related to the former releases of petroleum at the Site.

Surface water

Site surface water data and OHMPCs are selected in Table 5-3. To be conservative, all detected OHM were retained as OHMPCs.

Sediment

Site sediment data and OHMPCs are selected in Table 5-4. To be conservative, all detected OHM were retained as OHMPCs.

5.2.4 Dose-Response Assessment

The purpose of the dose-response assessment is to characterize the relationship between the dose of OHM administered or received and the incidence of adverse health effects in the exposed population. From this quantitative dose-response relationship, toxicity values (e.g., slope factors, reference dose values, or reference concentrations) are derived that can be used to estimate the likelihood of adverse effects as a function of human exposure to an agent. These toxicity values are

used in the risk characterization process to estimate the potential for adverse effects occurring in humans at different exposure levels.

The dose-response relationship(s) for each chemical that has been selected as an OHMPC is presented in this section. The dose-response information may be divided into two major categories:

- Toxicity information associated with threshold (non-carcinogenic) health effects.
- Toxicity information concerning carcinogenicity, either from human epidemiologic data or from laboratory studies.

All the chemicals selected as an OHMPC are evaluated for potential *non-carcinogenic* health effects. In addition, any substance considered to be a *known*, *probable*, or *possible* human carcinogen is also evaluated for its potential carcinogenic effects. The classification of a chemical as a carcinogen does not preclude an evaluation of that same chemical for potential non-carcinogenic health risks, as all potentially carcinogenic chemicals may also exert non-carcinogenic health effects.

5.2.4.1 Dose-Response Assessment for Carcinogenic Effects

It has been generally assumed historically that carcinogenic effects are non-threshold effects. This means that any dose, no matter how small, is assumed to pose a finite probability of generating a response. Thus, no dose of a carcinogen is thought to be risk-free. For carcinogenic effects, USEPA uses a two-part evaluation in which the substance is first assigned a weight-of-evidence classification, and then a slope factor (SF) or unit risk (UR) is calculated to reflect the carcinogenic potency.

The weight-of-evidence evaluation involves determining the likelihood that the agent is a human carcinogen. USEPA has developed a system for characterizing the overall weight of evidence for a chemical's carcinogenicity based on the availability of animal, human, and other supportive data (USEPA, 1989a). The weight-of-evidence classification rates the likelihood that an agent is a human carcinogen. It qualitatively affects the interpretation of potential health risks. Three major factors are considered in characterizing the overall weight-of-evidence for carcinogenicity: (1) the quality of evidence from human studies, (2) the quality of evidence from animal studies, and (3) other supportive information, such as mutagenicity data and structure-activity data. USEPA's final classification of the overall weight-of-evidence has the following five categories:

Group A - Human Carcinogen. This category indicates there is sufficient evidence from epidemiological studies to support a causal association between an agent and human cancer.

Group B - Probable Human Carcinogen. This category generally indicates there is at least limited evidence from epidemiologic studies of carcinogenicity to humans (Group B1) or that, in the absence of data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

Group C - Possible Human Carcinogen. This category indicates that there is limited evidence of carcinogenicity in animals in the absence of data on humans.

Group D - Not Classified. This category indicates that the evidence for carcinogenicity in animals is inadequate.

Group E - No Evidence of Carcinogenicity to Humans. This category indicates that there is evidence of noncarcinogenicity in at least two adequate animal tests in different species or in both epidemiologic and animal studies.

The ability of a chemical to increase the incidence of cancer in a target population is described by one of two values: the **carcinogenic SF** or the **UR**. Cancer SFs or URs are typically calculated for chemicals in Groups A, B1, and B2. Cancer dose-response values for chemicals in Group C are calculated on a case-by-case basis.

The cancer SF for a chemical is derived by the USEPA's Cancer Risk Assessment Verification Endeavor (CRAVE). Using data derived from animal studies, the SF is an estimate of the upper 95% Confidence Limit of the slope of the dose-response curve extrapolated to low doses.

For some chemicals, human epidemiologic data is the basis of an estimate of the carcinogenic potency, although the most common basis of these values is an animal study. The SF is given in units of $(mg/kg/day)^{-1}$ and is based upon the concept of a lifetime average daily dose. Oral SFs are used to estimate the risks associated with exposure to carcinogens via ingestion. No SFs are available for the dermal route of exposure. Oral SFs are used as surrogates to estimate cancer risks associated with dermal exposure to OHMPCs.

The UR is the upper 95% Confidence Limit of the mean incremental lifetime cancer risk estimated to result from lifetime exposure to an agent if it is in the air at a concentration of 1 mg/m^3.

$$\text{Air Unit Risk} = \text{risk per } \mu g/m^3$$

Inhalation URs are used in this assessment to estimate the incremental risks associated with inhaling carcinogenic OHMPCs in particulate dust emissions (potential utility and construction worker exposures to soils).

The dose-response data used in this RA for carcinogenic effects, including SF or UR values, are presented in Appendix N to this report for potential oral and inhalation exposures.

5.2.4.2 Dose-Response Assessment for Noncarcinogenic Effects

In contrast to carcinogens, noncarcinogens are believed to have threshold exposure levels below which adverse effects are not expected. USEPA has derived standards and guidelines based on acceptable levels of exposure for such compounds. Noncarcinogenic effects of concern on which many of the standards and guidelines are based include liver toxicity, reproductive effects, neurotoxicity, teratogenicity, and other chronic toxicities. Various criteria have been developed from experiments that can be used to estimate the dose-response relationship of noncarcinogens. Some of the same uncertainties involved in deriving cancer risk estimates (namely, selection of an appropriate data set and extrapolation of high-dose animal data to low-dose human exposure) are also involved in deriving noncarcinogenic dose-response criteria. Dose-response values used most often to evaluate noncarcinogenic effects are reference doses (RfDs).

The RfD, expressed in units of mg/kg/day, is defined as an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious

effects during a lifetime (USEPA, 1989a). When available, the RfD is the dose-response criterion most appropriate for quantitatively estimating noncarcinogenic effects. The RfD is derived from the following equation:

$$\text{RfD (mg/kg/day)} = \frac{\text{NOAEL or LOAEL}}{\text{UF and/or MF}}$$

The No Observable Adverse Effect Level (NOAEL) represents the dose of a chemical at which there are no statistically or biologically significant differences in the frequency of an adverse effect between the exposed population and its appropriate control. The Lowest Observable Adverse Effect Level (LOAEL) represents the lowest dose at which a statistically significant difference in the frequency of an effect is noted. Both the NOAEL and the LOAEL are reported in terms of mg/kg/day. An uncertainty factor (UF) of ten per type of uncertainty is used to account for interspecies and intraspecies differences, severity of the adverse effect, whether the dose was an NOAEL or an LOAEL, and the adequacy of the data. The magnitude of the UF will therefore vary from chemical to chemical, ranging from 10 to 10,000. A modifying factor (MF), ranging from less than 0 to 10 may also be added to reflect qualitative uncertainties not explicitly addressed in the UFs. The toxicity endpoint upon which the RfD is derived and the UF and/or MF used in the calculation are presented in the dose-response tables.

No RfDs are available for the dermal route of exposure. Risks associated with dermal exposure are evaluated using oral RfDs.

The Reference Concentration (RfC, in units of mg/m^3) is analogous to the RfD and is developed through a similar process. However, unlike RfDs, which represent a dosage (in mg/kg/day) at which adverse or deleterious effects are unlikely, RfCs represent air concentrations (in mg/m^3) at which adverse or deleterious effects are unlikely (i.e., an air concentration corresponding to a Hazard Index (HI) = 1.0). Non-carcinogenic risks due to inhalation exposures are estimated by comparing the environmental air concentration to the inhalation RfC. RfCs may be converted to a corresponding inhaled dose for an adult (an inhalation RfD, in units of mg/kg-day) by dividing by 70 kg, and multiplying by an inhalation rate of 20 m^3/day. Because USEPA cautions that the appropriateness of doing this conversion must be evaluated on a case-by-case basis, RfCs have been used to estimate inhalation non-cancer risks (as opposed to converting RfCs to RfDs for the purposes of estimating inhalation risks). Use of RfCs as opposed to derived RfDs is likely to reduce the uncertainty of the risk estimates generated for the inhalation exposure pathway.

The use of chronic RfDs and RfCs to evaluate the potential for adverse health effects resulting from substantially less-than-lifetime exposures may be overly protective. Subchronic Reference Doses and Subchronic Reference Concentrations (RfD_ss/RfC_ss) have been developed for many chemicals to evaluate the potential noncarcinogenic effects of limited duration exposures. RfD_ss/RfC_ss are similar to chronic RfDs/RfCs; the distinction is the length of exposure duration. When available, RfD_ss/RfC_ss are used in this risk assessment to evaluate noncarcinogenic effects to a construction worker and a child participant in the summer recreational program, which are receptors that are potentially exposed to OHM for an exposure period of one six months and two weeks, respectively. When RfD_ss/RfC_ss are unavailable, chronic RfDs/RfCs are used to evaluate noncarcinogenic effects for these receptors.

The dose-response data for noncarcinogenic effects (RfDs or RfCs) and their critical toxic effects are presented in Appendix N for possible oral and inhalation exposures, for both chronic and subchronic effects.

Evaluation of Chromium in Site Media
The most common forms of chromium in environmental media are chromium III (trivalent chromium) and chromium VI (hexavalent chromium). Chromium was detected in Site media however, no speciation analyses were performed. To provide a conservative assessment of toxicity and health risks associated with potential exposures to chromium, chromium data were evaluated as hexavalent chromium in this risk assessment.

Exposures to hexavalent chromium have been associated with carcinogenic effects via inhalation, chronic non-cancer health effects via ingestion, dermal contact, and inhalation, and allergic contact dermatitis via direct dermal contact with hexavalent-chromium containing materials. In this risk characterization, the inhalation unit risk of 0.012 per ug/m^3 (USEPA, 2000 [IRIS]) has been applied to estimated average lifetime air concentrations to characterize potential carcinogenic effects for inhalation of soil particulates. The chronic oral RfD of 0.003 mg/kg/day (USEPA, 2000) and the subchronic oral RfD of 0.02 mg/kg/day (USEPA, 1997) has been applied to the estimated daily doses in order to characterize potential non-cancer risks for ingestion and dermal contact with soil. Hexavalent chromium RfCs are published for chromium particulates and chromic acid mists. The chronic RfC for chromium particulates of 0.0001 mg/m^3 (USEPA, 2000) has been applied to the estimated daily air concentrations to characterize potential non-carcinogenic risks for inhalation of soil particulates.

Allergic contact dermatitis is an acute Type-IV allergic response that may occur in individuals who are allergic to chromium, have been previously sensitized, and contact soil containing hexavalent chromium. MADEP has developed a threshold concentration for identifying hexavalent chromium concentrations that could be concern for allergic contact dermatitis. The threshold concentration (200 mg/kg hexavalent chromium) is applicable for evaluating single point concentrations, because a single dermal contact with hexavalent chromium could theoretically elicit an allergic response. The MADEP threshold concentration is a conservative value that is based on an elicitation threshold that is designed to protect 99.9% of the population, and an assumption that hexavalent chromium in soil is 100% bioaccessible. The MADEP threshold concentration of 200 mg/kg has been used in this risk characterization as a screening tool to identify hexavalent chromium concentrations that could pose an allergic contact dermatitis risk.

5.2.4.3 Sources of Dose-Response Values

The main source of dose-response values is the USEPA Integrated Risk Information System (IRIS), which is a data base established by USEPA containing all validated data on many toxic substances found at hazardous waste sites. This data base was used to identify the SFs and RfDs applied in this risk assessment. Where no information was found in IRIS, USEPA Health Effects Assessment Summary Tables (HEAST) were used. When toxicity values from IRIS or HEAST were not available, alternative toxicity values available from USEPA or MADEP sources were used. The hierarchy of sources used to obtain dose response data for carcinogenic and non-carcinogenic effects, per MADEP guidance (1995a), is as follows:

SFs and URs:

1) IRIS; current as of April 2000 (USEPA, 2000)
2) HEAST; current as of fiscal year 1997 (USEPA, 1997)
3) California Environmental Protection Agency (CAEPA, 1994)

RfDs and RfCs:

1) IRIS; current as of April 2000 (USEPA, 2000)
2) HEAST; current as of fiscal year 1997 (USEPA, 1997)
3) Toxicity values developed by MADEP, Office of Research and Standards (ORS) (MADEP, 1992; 1994)
4) Agency for Toxic Substances and Disease Registry (ATSDR) Toxicity Profile Documents (various dates)
5) Allowable threshold concentrations (ATCs) developed by MADEP (MADEP, 1995b)
6) Dose-response values used to develop drinking water standards and guidelines or back-calculated from drinking water standards and guidelines (USEPA, 1996b)

RfDs and RfCs are selected in order of preference from the sources listed above. RfDs and RfCs are published in IRIS and HEAST, and by MADEP ORS. For some chemicals, ATSDR publishes minimal risk levels (MRLs) for threshold effects via the oral or inhalation exposure route. MRLs are derived using the modified risk assessment methodology that the USEPA uses to derive RfDs and RfCs. MRLs may be used as surrogate RfDs and RfCs when these values are not available in IRIS, HEAST or MADEP sources.

In accordance with MADEP Risk Characterization Guidance (MADEP, 1995a), ATCs may be derived from threshold effects exposure limits (TELs), which represent 20% of the allowable dose. Therefore, ATCs are developed by multiplying the TEL by five, as described in MADEP (MADEP, 1995b). ATCs may be used as surrogate RfCs when RfCs are not available in IRIS, HEAST, MADEP ORS sources, or ATSDR documents. If no dose-response values are available in these sources, RfDs may be developed from drinking water standards and guidelines provided in USEPA's "Drinking Water Regulations and Health Advisories" (USEPA, 1996b).

5.2.5 Descriptive Toxicity Summaries For OHM of Potential Concern

Brief toxicity profiles for selected OHMPCs are presented in Appendix O to this report.

5.3 Exposure Assessment

As defined by the USEPA (USEPA, 1992a), exposure to a chemical is the contact of that chemical with the outer boundary of the body (i.e., skin and openings such as mouth, nostrils, or punctures and lesions). An exposure assessment is the quantitative or qualitative evaluation of that contact. It describes the intensity, frequency, and duration of contact, as well as the rates at which the chemical crosses the boundary (chemical intake or uptake rates), the route by which it crosses the boundary, and the resulting amount of chemical that actually crosses the boundary (a dose) and the amount absorbed (internal dose).

This exposure assessment consists of several components, including identification of: current and future land use and limitations on use; potential human receptors; exposure points; exposure routes;

soil and groundwater MCP categories; exposure point concentrations; and daily doses or average exposure concentrations.

5.3.1 Description of Current and Foreseeable Future Site Uses

The USARC consists of an office-type building (the USAR Center), three paved parking areas, and a maintenance shop. The buildings, the military parking area, and a portion of the eastern paved parking area are fenced. Areas outside the paved parking areas are grass and/or brush covered. A drainage swale is located on the eastern side of the property, and a stream is located on the western side of the property. The USARC is used by the US Army for office work, Army Reserve drills, and vehicle maintenance. With the exception of possible emergency utility repair, there are no on-going or planned construction or excavation activities at the property.

There is currently no use of Site groundwater, which is approximately 2-10 ft. bgs. Drinking water is supplied by the City of Brockton. Groundwater underlying the Site is currently classified as category GW-2/GW-3. None of the conditions listed at 310 CMR 40.09324(4) are met for classification as GW-1.

This risk assessment evaluates unrestricted future land use of the USARC property. Under the assumption of unrestricted land use, there are no limitations on land uses and activities. There is no foreseeable future use of groundwater.

5.3.1.1 Limitations on Future Activities and Uses

No limitations on future activities and land and groundwater use have been incorporated into the exposure assessment for the Site.

5.3.2 Identification of Potential Human Receptors, Exposure Points, and Exposure Routes

An exposure pathway describes the course a chemical takes from the source to the exposed individual. Exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of human exposure.

Exposure pathways generally consist of four elements: (1) a source and mechanism of chemical release, (2) a retention or transport medium, (3) a point of potential human contact with the contaminated medium (known as the exposure point), and (4) an exposure route at the contact point (USEPA, 1989a).

5.3.2.1 Identification of Potential Human Receptors

Human receptors are the theoretical individuals who might be exposed to site OHM and for whom potential risks (carcinogenic and non-carcinogenic) are estimated in the Risk Characterization section. Receptors are identified based on the current and foreseeable future site land uses. Receptors are chosen in order to cover the entire range of potential exposures (exposure media and exposure routes) and to identify the exposure parameters for a theoretical maximally exposed individual in the receptor group. The exposure assessment targets average exposure for the maximally exposed individual (MADEP, 1995a).

The MCP requires that all exposure pathways for each potential receptor be identified. Exposure pathways are identified by considering the activities performed by each potential receptor (e.g.,

office work inside a building; excavating soil), the location of site-related OHM (e.g., surface soil, groundwater), and the fate and transport characteristics of those OHM (e.g., volatile, leachable). From this information, exposure points and exposure routes may be identified.

The exposure pathways for the human receptors who could be potentially exposed to OHM at or resulting from the Site under **current land use** are identified in Table 5-5 and listed below; only those exposure pathways that are or might be complete are evaluated quantitatively in this risk assessment.

- USARC personnel (Army Reservist)
  - potential exposure to vapors migrating from groundwater to indoor air at the USAR Center

- Landscape worker
  - potential exposure to unpaved soil 0-3 feet bgs inside fenced area via ingestion, dermal, and inhalation pathways

- USAR Center visitor
  - potential exposure to vapors migrating from groundwater to indoor air at the USAR Center

- Utility worker
  - potential exposure to soil 0-6 feet bgs via ingestion, dermal, and inhalation pathways

- Trespasser (ages 6 through 17)
  - potential exposure to unpaved soil 0-3 feet bgs outside fenced area via ingestion, dermal, and inhalation pathways
  - potential exposure to surface water and sediment in the on-site stream via ingestion and dermal pathways

As discussed in Exposure Profiles (below), from the list of potential receptors, only the "most exposed" individuals are selected for quantitative evaluation in the risk assessment; evaluation of the "most exposed" individuals provides a conservative assessment for other, less exposed, individuals.

The *additional* exposure pathways for the human receptors who could be potentially exposed to OHM at or resulting from the Site under **future land use** are identified in Table 5-6 and listed below; only those exposure pathways that are or might be complete are evaluated quantitatively in this risk assessment.

- Construction worker
  - potential exposure to soil 0-15 feet bgs via the ingestion, dermal, and inhalation pathways (assumes that soils between 3 ft bgs and 15 ft bgs may be brought to the surface and made accessible)

- Resident (child and adult)
  - potential exposure to soil 0-15 feet bgs via the ingestion, dermal, and inhalation pathways

- potential exposure to vapors migrating from groundwater to indoor air future residential dwellings
- potential exposure to surface water and sediment in the on-site stream via ingestion and dermal pathways

5.3.2.2 Soil and Groundwater Categorization

In accordance with 310 CMR 40.0930, soil and groundwater are categorized using the MCP Subpart I criteria as part of a Method 3 Risk Characterization. Groundwater categories are used to identify applicable or suitably analogous standards when the Method 3 process is used to characterize risk. The soil and groundwater categories are also used to guide the development of exposure profiles for the risk assessment. Additionally, the groundwater and soil categories selected for a Site are considered in determining the need for an Activity and Use Limitation (AUL) as part of a Response Action Outcome (RAO) in accordance with 310 CMR 40.1012 and 310 CMR 40.1070 through 40.1089.

Three soil exposure categories have been identified in the MCP (310 CMR 40.0933). Soil is classified into either category S-1, S-2, or S-3 based on site, receptor, and exposure information. While only one category is applicable to a specified volume of soil, soils in different areas of a site may be classified in different categories, depending on their exposure potential. Category S-1 soils are associated with the highest potential for exposure, while category S-3 soils have the lowest potential for exposure. The potential for exposure to soil is described by a qualitative analysis of the accessibility of the soil in combination with information concerning frequency and intensity of exposure for site activities and uses. Potential exposures to children, adults, and environmental receptors are to be considered in identifying categories.

Based on the classification scheme described in 310 CMR 40.0933(4), (5), (6) and (7), the following soil categorization applies to the Site under the **current land use** conditions:

Surface soil (0-3 foot bgs interval) beneath pavement and subsurface soil (3-15 foot bgs interval) within the fenced area of the Site are classified as S-3 for the following reasons:

- surface soil is "potentially accessible" because OHM is located in samples between 0 and 3 feet bgs and is covered with pavement;
- subsurface soil is "potentially accessible" because OHM is present in samples between 3 and 15 feet bgs and is covered with pavement;
- adults only are present; access by children is restricted by a fence and deterred by the military activity during work hours and weekends;
- adults are present at high frequency, but exposure to soil is expected to be of low intensity (because of pavement);
- adult utility workers may be present; exposure to soils 0-3 ft bgs is expected to be at low frequency and high intensity.

Unpaved surface soil (0-3 foot bgs interval) within the fenced area of the Site (i.e., unpaved soils in the landscaped areas) is classified as S-2 for the following reasons:

- surface soil is "accessible" because OHM is located in samples between 0 and 3 feet bgs and is not covered with pavement;

- adults only are present; access by children is restricted by a fence and deterred by the military activity during work hours and weekends;
- USARC personnel are present at high frequency, but exposure to soil is expected to be of low intensity (because there would be little activity at the landscaped areas around the building);
- adult utility workers may be present; exposure to soils 0-3 ft bgs is expected to be at low frequency and high intensity;
- adult landscape workers may be present; exposure to soils 0-3 ft bgs is expected to be at low frequency and high intensity.

Unpaved surface soil (0-3 foot bgs interval) outside the fenced area of the Site is classified as S-1 for the following reasons:

- surface soil is "accessible" because OHM is located in samples between 0 and 3 feet bgs and is not covered with pavement;
- children are present at low frequency, but exposure is expected to be of high intensity;
- adult USARC personnel are present at low frequency, and exposure is expected to be of low intensity;
- adult utility workers may be present; exposure to soils 0-3 ft bgs is expected to be at low frequency and high intensity

Unpaved subsurface soil (3-15 foot bgs interval) outside the fenced area of the Site is classified as S-2 for the following reasons:

- subsurface soil is "potentially accessible" because OHM is located in samples between 3 and 15 feet bgs and is not covered with pavement;
- children are present at low frequency, but exposure is expected to be of high intensity;
- adult USARC personnel are present at low frequency, and exposure is expected to be of low intensity;
- adult utility workers may be present; exposure to soils 0-6 ft bgs is expected to be at low frequency and high intensity

All soils at the Site that are greater than 15 feet bgs or are beneath a building are classified as "isolated" and are therefore classified as S-3 soils for current and future land uses.

Based on the classification scheme described in 310 CMR 40.0933(4), (5), (6) and (7), the following soil categorization applies to the Site under the **future land use** conditions:

Surface soil (0-3 foot bgs interval) is classified as S-1 for the following reasons:

- surface soil is "accessible" because OHM is located in samples between 0 and 3 feet bgs and is assumed to not be covered with pavement;

- adults and children may be present at high frequency, and exposure is expected to be of high intensity;

- adult construction workers may be present; exposure to soils 0-3 ft bgs is expected to be at low frequency and high intensity

Subsurface soil (3-15 foot bgs interval) is classified as S-1 for the following reasons:

- subsurface soil is "potentially accessible" because OHM is located in samples between 3 and 15 feet bgs and is assumed to not be covered with pavement;

- adults and children may be present at high frequency, and exposure is expected to be of high intensity;

- adult construction workers may be present; exposure to soils 3-15 ft bgs is expected to be at low frequency and high intensity

Three groundwater categories are described in 310 CMR 40.0932. Groundwater category GW-1 applies to groundwater that is or may reasonably be expected to be used as a source of potable water or is in close proximity to a public or private water supply. Groundwater that is within 30 feet of an occupied existing structure and has an average annual depth to the water table of less than or equal to 15 feet, is in category GW-2. Groundwater in category GW-2 is considered a potential source of vapors to indoor air. All groundwater under evaluation is classified as category GW-3. Groundwater in category GW-3 is considered a potential source of discharge to surface water. More than one groundwater category may be determined to be applicable.

The groundwater at and downgradient of the Site is not categorized as GW-1 because, per 310 CMR 40.0932 and 310 CMR 40.0006, the area is within neither a Current Drinking Water Source Area nor a Potential Drinking Water Source Area. The groundwater beneath and downgradient of the Site is not within a Current Drinking Water Source Area because it is not within the Zone II of a public water supply, it is not within an Interim Wellhead Protection Area for a public water supply, it is not within the Zone A of a Class A surface water body used as a public water supply, and it is not within 500 feet of a private water supply well. The Site is not within an area designated by a municipality specifically for the protection of groundwater quality to ensure its availability for use as a source of potable water supply, is not 500 feet or more from a public water supply distribution pipeline, and it is not within a Potentially Productive Aquifer.

Groundwater at the Site is not and is not expected to be used as a source of potable water, and it is not in close proximity to a public or private water supply.

Site groundwater located within 30 feet of the USAR Center is classified as GW-2 because the average depth to groundwater is less than 15 feet. OHM migration from the groundwater to indoor air is considered a potential exposure pathway under current conditions.

Vapor migration from groundwater to indoor air could potentially occur in the future if buildings are constructed and occupied in proximity to groundwater that contains site-related VOCs. Although the MCP and associated guidance do not require it, this risk assessment assumes that occupied residential dwellings could be present on the USARC property in the future. Therefore, it is presumed that groundwater within the Site boundaries could be classified as GW-2 in the future. It should be noted that site-related VOCs are not present in groundwater at all locations within the Site boundaries or within the GW-2 area.

Site groundwater is considered to be a potential source of discharge to the on-site stream and other surface water. Groundwater category GW-3 is applicable to all groundwater beneath this Site.

5.3.2.3 Identification of Exposure Points and Exposure Routes

As defined in the MCP, an exposure point is the location of potential contact between a human or environmental receptor and a release of OHM. An exposure point may describe an area or zone as well as a single point. Exposure routes include ingestion, dermal contact, and inhalation. Potential exposure points and exposure routes were identified for unpaved surface soil, soil 0-15 feet bgs, and groundwater.

The identification of exposure points has been accomplished by first identifying any hot spots in each medium, identifying any differential opportunity for site access between current and future land uses, and by identifying any differential opportunity for access to released OHM among the different portions of the site. Per MCP requirements, hot spots may be considered separate exposure points.

Hot Spot Analysis

Consistent with the MCP (310 CMR 40.0924) and the Guidance For Disposal Site Risk Characterization (MADEP, 1995a), discrete areas that meet the MCP definition of a hot spot (310 CMR 40.0006) may be evaluated as individual exposure points for the purposes of comparisons to Upper Concentration Limits (UCLs) and human health exposure assessment. A hot spot is identified based on concentrations of OHM within a contaminated area and the spatial pattern of the concentrations. In all cases, a discrete area where the average concentration of an OHM is greater than 100 times the average concentration in the immediate surrounding area shall be considered a hot spot. Discrete areas where the concentration difference is greater than 10 but less than 100 would be considered a hot spot unless there is no evidence that the discrete area would be associated with greater exposure potential than the surrounding area. In addition, a discrete area where the average thickness of non-aqueous phase liquid (NAPL) is greater than ten-times the average thickness in the surrounding area is a hot spot.

At this Site, no NAPL has been identified. Therefore, this hot spot analysis evaluates potential hot spots in soil, groundwater, surface water, and sediment.

The hot spot analysis is documented in Appendix P. One hot spot was identified in soil. No hot spots were identified in groundwater, surface water, and sediment.

In soil, a single hot spot characterized by elevated concentrations of TPH (1,800 mg/kg), antimony (20 mg/kg), and petroleum-related VOCs (trimethylbenzene, isopropyltoluene, and butylbenzene) was identified in the former UST area. The extent of the hot spot is defined by sample locations BRSWSB15, BRSWSB19, and B5-SS-1 (1-6).

Soil Exposure Points

Potential soil exposure points include hot spots and areas outside hot spots, as well as soils that are unpaved and soils that are paved.

Under current land use at the Site, exposures to soil would only potentially occur at areas that are not paved. These areas include soils outside the fenced area, where trespassers might be exposed, and soils associated with the landscaped areas within the fenced portion of the Site, where landscapers and, to a minimal extent, USARC personnel might be exposed. In accordance with the MCP, soils between the ground surface and three feet below the ground surface are considered accessible under the existing land use. Therefore, the soil exposure points for current land use include unpaved soils 0-3 ft bgs outside the fenced area, and unpaved soils 0-3 ft bgs within the fenced area (i.e., the landscaped area around the building). Neither of these exposure points include the soil hot spot. In reality, only soils in the top six inches would potentially be contacted under present land use conditions; soils between six inches and three feet below ground surface would only be contacted if the soil was dug up.

Potential exposures under the future land use are assumed to occur to soils 0-15 ft bgs throughout the Site. Under the assumed future residential land use, existing pavement may be removed, buildings may be removed and new buildings may be constructed, and soils between 0 and 15 ft bgs may be relocated to the surface. Therefore, construction workers and residents may contact soils 0-15 ft bgs throughout the Site. Because these soils include the soil hot spot, there are two soil exposure points for the future land use: soils 0-15 ft bgs outside the soil hot spot, and soils within the soil hot spot.

Under both current and future land uses, utility workers are assumed to be exposed to paved and unpaved soils 0-6 feet bgs. In reality, potential exposures under current land use would only occur at soils located near existing utilities that could require emergency repair (e.g., water lines, power lines, sewer lines, gas lines, and telephone and cable TV lines).

A discussion of the mechanisms by which receptors could be exposed at each of the exposure points, and the methods used to quantify receptor exposures at the various exposure points, are discussed in subsection 5.3.3. The soil samples included in each of the soil exposure points are provided in Appendix M. The methods used to identify exposure point concentrations are discussed in subsection 5.3.4.

Groundwater Exposure Points

Since the only potentially complete exposure pathway to groundwater is associated with vapor migration to indoor air, the only groundwater exposure points are locations where volatile OHM were detected. Migration of vapors to indoor air is a potential concern under the existing land use because VOCs were detected in groundwater at monitoring wells near the USAR Center (particularly in the vicinity of the former UST). Therefore, under current land use, the groundwater exposure point for this exposure pathway is groundwater located beneath and within 30 feet of the USAR Center.

In the future, structures could be constructed and occupied at other areas of the Site. Therefore, other areas where volatile OHM were detected in groundwater represent potential exposure points under the future land use. The groundwater associated with the Site is, therefore, considered to be the groundwater exposure point for future land use conditions.

Surface Water Exposure Points

Since there are no hot spots in surface water, the surface water exposure point is defined by the reach of the stream that runs through the Site.

Sediment Exposure Points

Since there are no hot spots in sediment, the sediment exposure point is defined by the reach of the stream that runs through the Site.

5.3.3 Development of Exposure Profiles

Exposure profiles identifying potential receptors, potential exposure points, exposure medium and route, frequency of exposure, duration of the exposure event, and duration of the exposure period are summarized in Tables 5-7 through 5-10 for current use and foreseeable future use. The exposure profiles are consistent with the current and assumed future uses of the Site.

5.3.3.1 Current Use Exposure Profiles

The following exposure profiles describe potential receptors and the specific exposure parameters that were used to estimate possible exposure under current Site use.

USARC Personnel. To provide a conservative assessment, it is assumed that a US Army Reservist is employed at the USARC and is exposed to volatile OHM that may migrate from groundwater to indoor air at the USAR Center. Exposure to volatile OHM via inhalation is assumed to occur 8 hours per day, 236 days per year (5 work days per week, minus vacations and holidays) over a 27 year period (MADEP, 1996a). It is likely that actual occupancy of the USAR Center by any single individual would be substantially less under the current land use. However, this provides an assessment of potential risks that is protective for most any conceivable current or future commercial use of the USARC buildings. Additional exposure parameters are provided in Table 5-7. It is assumed that this person would have minimal, if any, contact with the soil in the landscaped areas around the building. Evaluation of future residential land use of the Site provides a conservative assessment of any exposures that a current employee may have to the soil.

Trespasser. It is assumed that an older child (ages 7 through 17) is exposed to unpaved soils outside the fenced portion of the Site (incidental ingestion, dermal contact, and dust inhalation), as well as to OHMPCs in surface water and sediment in the on-site stream, while trespassing or visiting the Site. Children younger than age 7 are not likely to be unsupervised by an adult and, therefore, are not evaluated. It is conservatively assumed that children visit/trespass the Site three days per week, and are potentially exposed to soils during months when the ground is not frozen or snow-covered (i.e., April through November), (equal to 106 days per year), and to surface water and sediment during summer months (June – August) when the water is not cold (39 days per year). It is assumed that each exposure event occurs over a two-hour period. Exposure parameter values (e.g., ingestion rate, and skin surface area) are documented in Table 5-8.

5.3.3.2 Future Use Exposure Profiles

The following exposure profiles describe potential receptors and the specific exposure parameters that were used to estimate possible exposure under future Site use.

Construction Worker. A construction worker could potentially be exposed to soils 0-15 feet bgs at the Site during excavation activities. Potential routes of exposure for soil are ingestion of and dermal contact with the soil and inhalation of dust. Dermal contact with groundwater is unlikely to occur due to the normal work gear that construction workers would wear (e.g., gloves and boots) while performing excavation-related activities. Ingestion of groundwater does not occur. The assumed exposure frequency for all possible routes of exposures is 8-hours per day, five days per workweek. The assumed duration of the exposure period is 26 weeks for all possible exposures (MADEP, 1996a). Additional exposure parameters (e.g., soil ingestion rate, dermal contact parameters) are provided in Table 5-9.

The construction worker scenario provides a conservative assessment of potential current land use exposures to a landscape worker because a landscape worker would only be exposed approximately one day per week during spring, summer, and early fall. Likewise, the construction worker scenario provides a conservative evaluation of potential risks to a utility worker, as a utility worker would only be potentially exposed to soils one or two days.

Resident. Under the assumed future unrestricted land use, exposures are evaluated for both child and adult residents. Per MADEP risk characterization guidance, exposures to soils via incidental ingestion, dermal contact, and dust inhalation are assumed to occur 153 days per year (during months when the ground is not frozen or snow-covered). Children (ages 1-5) are evaluated for exposures over a five-year period, and adults are evaluated for exposures over a 25-year period, for a total residential exposure period of 30 years. It is assumed that residents could be exposed to vapors that may migrate from groundwater to indoor air. Inhalation of volatile OHM in indoor air is assumed to occur 24 hours per day, 350 days per year, over a 30-year period. Finally, it is assumed that children could be exposed to surface water and sediment in the stream. Exposure is assumed to occur three days per week during summer months (June – August) when the water is not cold (39 days per year). It is not likely that an adult would wade in the Site stream. Therefore, potential surface water and sediment exposures to adult residents are not evaluated. Additional exposure parameters (e.g., soil ingestion rate, dermal contact parameters) are provided in Table 5-10.

5.3.4 Identification and Estimation of Exposure Point Concentrations

Exposure Point Concentrations (EPCs) are identified for each exposure point and exposure scenario described previously. EPCs for soil, surface water, and sediment ingestion and dermal contact exposure routes are based on measured concentration data. Air EPCs for soil particulate inhalation, and groundwater vapor inhalation are modeled from measured soil and groundwater concentration data, as described in subsection 5.3.5.

Per 310 CMR 40.0926(3), the concentration used to represent each OHM should be a conservative estimate of the arithmetic average concentration. As defined in the MCP (310 CMR 40.0926(3)(b)), upper percentile or maximum concentrations should be used to provide a conservative estimate of the mean when a simple arithmetic average is likely to underestimate the true mean, including data with a high degree of variability. In this assessment, the variability of concentrations in each exposure point was reviewed to determine if the simple arithmetic average concentration provided a conservative estimate of the mean. The following approach was used:

- The maximum detected concentration was used as the exposure point concentration for OHM that were detected in only one sample;
- For OHM detected in more than one sample, the maximum concentration was used as the EPC if there was more than a 10-fold difference between the minimum and maximum detected concentrations.
- For OHM detected in more than one sample, the arithmetic mean concentration was used as the EPC if there was not more than a 10-fold difference between the minimum and maximum detected concentrations, or consideration of the sampling density and data quality objectives indicated that the arithmetic mean concentration provided a conservative estimate of the mean concentration.

This approach was used for each of the exposure media evaluated in this risk characterization.

To streamline the risk characterization, separate data sets and exposure point concentrations were not developed for the soil hot spot exposure point and soils 0-15 ft bgs that are outside the soil hot spot (applicable to evaluation of possible future land use exposures only). Instead, a single data set of soils 0-15 ft bgs that encompass both the hot spot and non-hot spot areas was developed. The EPCs of OHM associated with the soil hot spot (e.g., TPH, antimony, trimethylbenzene) were identified as the maximum detected concentrations. The EPCs for OHM that are not associated with the soil hot spot were the arithmetic mean or maximum detected concentrations, as determined in accordance with the procedure identified above. This approach facilitates evaluation of risks associated with potential exposures to the soil hot spot and potential exposures to soils outside the hot spot. The approach yields the same risk estimates as would be obtained by calculating and then summing separate risks for hot spot and non-hot spot areas, and provides a more conservative assessment of risks than would be obtained for each exposure point (hot spot and non-hot spot) individually.

The EPC used to evaluate allergic contact dermatitis from possible exposures to hexavalent chromium is the maximum detected hexavalent chromium concentration.

EPCs for the exposure points are presented in Tables 5-11 through 5-15. For EPCs based on the arithmetic mean concentrations, arithmetic mean concentrations were calculated using a concentration equal to one-half of the SQL for non-detects. Concentrations in duplicate samples were averaged and the result treated as one data point in the calculation of the EPC. The samples included in each exposure point and used to calculate the EPCs are provided in Appendix M.

5.3.5 Estimation of Average Daily Doses (ADDs)

The average daily dose (ADD) is the amount of OHM absorbed into the body. When appropriate, it is the product of the average daily exposure and a relative absorption factor (RAF). For evaluating inhalation exposure to OHM, average concentrations of OHM in air are compared to toxicity values in units of concentration instead of calculating ADDs.

A Lifetime Average Daily Dose (LADD) is calculated in order to estimate carcinogenic risk. The Averaging Period (AP) over which the total intake of OHM is averaged is 75 years for carcinogenic effects (MADEP, 1992).

For noncarcinogenic effects, depending on the duration of the exposure period, an Average Daily Dose, Chronic (ADD_c) for long-term exposure (seven years or longer), Average Daily Dose,

Subchronic (ADD_s) for exposure periods from a month up to seven years, or Average Daily Dose, Acute (ADD_a) for exposures of one day or less may be calculated. ADD_s (other than for volatile inhalation) has been calculated for the utility worker and construction worker receptors as the exposure durations are one day and six months, respectively. ADD_c has been calculated for the trespasser and onsite worker.

The general form of the ADD equation is:

$$ADD = \frac{(Total\ Amount\ of\ OHM\ Intake)}{(Body\ Weight_{avg})\,(Averaging\ Period)}$$

5.3.5.1 Possible Soil and Sediment Exposures

The ADD received by a receptor via direct contact with soil or sediment containing OHM (ADD_{soil}) is the sum of the ADDs for both exposure via the routes of dermal contact with the contaminated soil and ingestion of that soil. Possible soil-related inhalation exposures are evaluated via average exposures rather than doses. Thus,

$$ADD_{soil} = ADD_{dermalabsorption} + ADD_{ingestion}$$

The ADD due to dermal contact with OHM-contaminated soil or sediment ($ADD_{dermal\ absorption}$) may be calculated:

$$ADD_{dermal\ absorption} = \frac{[OHM]_{soil} * SA * AF * RAF * EF * ED * EP * C}{BW * AP}$$

Where:

$ADD_{dermal\ absorption}$	=	Average daily dose of OHM received through dermal contact with soil during the period of exposure (dimensions: mass/mass×time, typical units: mg/kg×day).
$[OHM]_{soil}$	=	Representative concentration of OHM in the soil at the exposure point during the period of exposure (dimensions: mg/kg)
SA	=	Skin surface area in contact with the soil on days exposed (dimensions: cm^2/day)
AF	=	Mass of soil adhered to the unit surface area of skin exposed (dimensions: mg/cm^2)
RAF	=	Relative Absorption Factor (unitless)
EF	=	Exposure Frequency: the number of exposure events during the exposure period divided by the number of days in the exposure period (dimensions: events/day)
ED	=	Exposure Duration: the typical duration of exposure at an exposure point during each exposure event (dimensions: time/event)

EP	=	Exposure Period: the period of time over which exposure may occur (dimension: time)
BW	=	Body Weight of the receptor of concern during the averaging period (dimension: kg)
AP	=	Averaging Period (dimension: time)
C	=	Appropriate units conversion factor(s)

The ADD due to the incidental ingestion of OHM contaminated soil or sediment ($ADD_{ingestion}$) may be calculated:

$$ADD_{ingestion} = \frac{[OHM]_{soil} * IR * RAF * EF * ED * EP * C}{BW * AP}$$

Where:

$ADD_{ingestion}$	=	Average daily dose of OHM received through the ingestion of soil during the period of exposure (dimensions: mass/mass×time, typical units: mg/kg×day).
$[OHM]_{soil}$	=	Exposure point concentration of the OHM in soil (dimensions: mass/mass, typical units: mg/kg).
IR	=	Daily soil ingestion rate on days exposed during the exposure period (dimensions: mass/time, typical units: mg/day)
RAF	=	Relative Absorption Factor (dimensionless).
EF	=	Number of exposure events during the exposure period divided by the number of days in the exposure period (dimensions: events/time, typical units: events/day).
ED	=	Exposure Duration: the typical duration of exposure at an exposure point during each exposure event (dimensions: time/event)
EP	=	Duration of the exposure period (dimensions: time, typical units: years).
C	=	Appropriate units conversion factor(s)
BW	=	Body weight of the receptor of concern during the averaging period (dimensions: mass, typical units: kg).
AP	=	Averaging Period (dimension: time, typical units: years).

5.3.5.2 Possible Inhalation Exposures

Receptors at the Site, under certain conditions, have the potential to be exposed via inhalation to OHM adsorbed to wind-eroded particles or dust produced during excavation, and/or to vapors that may migrate from groundwater to indoor air.

The methodology for evaluating inhalation exposures differs from that used for other exposure pathways in that the toxicity values used are reference concentrations (RfCs) and unit risks (URs) instead of reference doses (RfDs) and slope factors (SFs). Because concentration and not dose is the basis for these toxicity values, body weight (BW), respiration rate (VR), and relative absorption factors (RAFs) are not used in calculating potential risk estimates for carcinogenic and noncarcinogenic chemicals. Therefore, an average air concentration, rather than an ADD, is calculated.

The general equation for estimating the average air concentration due to inhalation of dust from soil or vapors from groundwater is as follows:

$$Average\ Concentration_{air} = \frac{[OHM]_{air} x\ EF\ x\ EP\ X\ ED}{AP\ x\ CF}$$

Where:

$[OHM]_{air}$	=	Representative concentration of OHM in the air at the Exposure Point during the period of exposure (dimensions: mass/volume)
EF	=	Number of exposure events during the exposure period divided by the number of days in the exposure period (dimensions: events/time, typical units: events/day).
ED	=	Average duration of each exposure event (dimensions: time/event, typical units: day/event).
EP	=	Duration of the exposure period (dimensions: time, typical units: years).
AP	=	Averaging Period (dimension: time)
CF	=	Appropriate units conversion factor(s)

Migration of vapors from groundwater to indoor air and associated indoor air EPCs were calculated using a screening-level fate and transport model developed by MADEP for developing Method 1 GW-2 groundwater standards. The fate and transport model used by MADEP is a simplified version of the Johnson and Ettinger Model recommended by USEPA for estimation of vapor migration to indoor air. The MADEP vapor migration model is appropriate for estimating vapor emissions to structures with basements and low building ventilation rates (e.g., residential dwellings). Therefore, the model provides a conservative estimation of indoor air concentrations at commercial buildings, which have a higher air exchange rate and do not have basements, such as the type at the Site.

OHM concentrations in air were estimated for volatiles using the equation shown below and as presented in MADEP (1994).

$$[OHM]air = [OHM]gw * \alpha * d * H * C$$

[OHM]air	=	The estimated indoor air concentration ($\mu g/m^3$)
[OHM]gw	=	The groundwater concentration of the OHM ($\mu g/L$; site-specific)
α	=	Attenuation factor which relates indoor air concentration to the concentration in soil gas directly above the groundwater source (0.0005, dimensionless)
d	=	Modification factor to convert theoretical groundwater: soil gas equilibrium concentrations to realistic environmental concentrations (0.1, dimensionless [MADEP, 1994])
H	=	Henry's Law Constant (dimensionless; chemical-specific)
C	=	Conversion factor (1000 L/m^3)

Tables 5, 8 and 11 in Appendix Q provide documentation of the air EPC calculations, as well as documentation of the cancer and non-cancer risk calculations for indoor building occupants.

Particulate concentrations in air were estimated by multiplying the soil EPCs by inhalable particulate levels in air (PM10 concentrations) published by MADEP (MADEP, 1995b). Calculations are documented in Appendix Q.

5.3.5.3 Possible Surface Water Exposures

The ADD received by a receptor via direct contact with surface water containing OHM (ADD_{sw}) is the sum of the ADDs for incidental ingestion of the contaminated surface water and absorption via dermal contact with the water. Thus,

$$ADD_{sw} = ADD_{dermal} + ADD_{ingestion}$$

The ADD due to ingestion of and dermal contact with OHM-contaminated surface water (ADD_{sw}) may be calculated as follows:

$$\textit{Ingestion:} \quad ADD_{swi} = \frac{[OHM]_{sw} \times VI \times RAF \times CF \times D_1\text{-}I \times D_2 \times F}{BW_{avg} \times AP}$$

$$\textit{Dermal Contact:} \quad ADD_{swd} = \frac{[OHM]_{sw} \times SA \times Kp \times CF \times D_1\text{-}D \times D_2 \times F}{BW_{avg} \times AP}$$

Where:

$[OHM]_{sw}$	=	Representative concentration of OHM in the surface water at the Exposure Point during the period of exposure (dimensions: mass/volume)
VI	=	Daily volume of water ingested by the receptor of concern. (dimension: volume/time)
SA	=	Skin surface area in contact with the surface water during the period of exposure (dimension: area)
Kp	=	Permeability Constant (dimensions: volume/time x area)
RAF	=	Relative Absorption Factor (dimensionless)
F	=	Number of exposure events during the exposure period divided by the number of days in the exposure period (dimensions: events/time)
$D_{1\text{-}I}$	=	Average duration of each ingestion exposure event (dimensions: time/event)
$D_{1\text{-}D}$	=	Average duration of each dermal exposure event (dimensions: time/event)
D_2	=	Duration of the exposure period (dimension: time)

BW_{avg}	=	Average body weight of the receptor of concern during the averaging period (dimension: mass)
AP	=	Averaging Period (dimension: time)
C	=	Appropriate units conversion factor(s)

5.3.5.4 Adjustments for Absorption Efficiency

RAFs are used when calculating ADDs to take into account any differences in the absorption for a particular medium and exposure pathway compared to the absorption in the study which the toxicity value is based (often a diet or gavage study using pure product in a solvent or oil carrier).

Appendix N presents the RAFs used in this assessment as well as the basis for these values.

Once the exposure assessment is completed, the risk characterization activities are conducted as described in the following sections.

5.4 HUMAN HEALTH RISK CHARACTERIZATION

In this section, potential risks to human health associated with possible exposure to OHM at the Site are characterized. Risk is a function both of exposure and toxicity. The magnitude of risk depends on the nature, duration, and frequency of exposure to OHM, and the dose-response characteristics of each particular OHM. Information presented in the Exposure Assessment section of this report, combined with the dose-response toxicity data presented in the Dose-Response Assessment of this report, are the basis for this risk characterization. Per the requirements of the MCP at 310 CMR 40.0993(6), risk of harm to human health is characterized by:

1. Comparing Cumulative Receptor Cancer Risk to the Cumulative Receptor Cancer Risk Limit (1E-05) for current and future land use;
2. Comparing Cumulative Receptor Non-cancer Risk to the Cumulative Receptor Non-cancer Risk Limit (Hazard Index of 1) for current and future land use; and
3. Comparing exposure point concentrations to applicable or suitably analogous public health standards.

5.4.1 Potential Cumulative Receptor Risks

The technical approach used to generate the potential carcinogenic and noncarcinogenic risks at this Site are presented in the following subsections.

Cumulative Receptor Cancer Risk

For possible oral and dermal exposure to soil and groundwater, carcinogenic risk estimates for known or probable human carcinogens are calculated by multiplying the cancer slope factor (CSF) of the chemical (expressed as $(mg/kg\text{-}day)^{-1}$) by the lifetime average daily dose (LADD, expressed as mg/kg-day). The product of these two values is an estimate of the excess lifetime cancer risk (ELCR), which is defined as the excess probability that an individual will develop cancer over a lifetime due to exposure to the chemical of potential concern. This incremental lifetime risk is over and above what is considered an individual's background chances of

developing cancer. In the U.S., approximately one in three people develop cancer during their lifetime (American Cancer Society, 1997).

For inhalation exposures to soil particulates, both air EPCs and carcinogenic toxicity values are expressed in units of concentration (EPCs - ug/m^3; Unit Risk [UR_{inh}] - 1/ug/m^3). Since the toxicity value is based on concentration and not dose, ELCRs were directly calculated without the need to calculate LADDs. The cancer dose-response tables are presented in Appendix N for oral and inhalation dose-response values, respectively.

The method used to estimate potential carcinogenic risks is based on USEPA's linearized, multistage model of carcinogenic dose-response. This model assumes that no threshold exposure level exists below which exposure to a carcinogen can be considered safe or risk-free. Therefore, any dose is assumed to result in a finite increment to an individual's lifetime risk of developing cancer.

The Cumulative Receptor Cancer Risk (CRCR) is calculated by estimating the potential cancer risk for each potentially carcinogenic OHMPC in each medium/potential exposure pathway associated with each receptor for current and future land use. For a given receptor and land use all of the cancer risks are summed to yield the CRCR.

The ELCR for each chemical in each medium is calculated as follows:

For ingestion and dermal exposures,

$$ELCR_i = LADD_i \times CSF_i \quad \text{or} \quad ELCR_i = LAC_i \times UR_i$$

Where:

$ELCR_i$	=	Excess Lifetime Cancer Risk associated with the exposure to chemical in each exposure route for the relevant medium.
$LADD_i$	=	Lifetime Average Daily Dose of substance i in each medium received by the theoretical individual.
CSF_i	=	EPA's published cancer slope value for substance i in the appropriate medium.
LAC_i	=	The Lifetime Average Concentration of substance i in air.
UR_i	=	EPA's published carcinogenic Unit Risk for substance i in air.

The CRCR for a given medium (e.g., soil) and exposure route (ingestion, dermal contact, inhalation) is the sum of the cancer risks for the OHMPCs included in that potential exposure route. The CRCR is the sum of all cancer risks for all OHMPCs in all media and potential exposure routes associated with that receptor for a given land use. In this assessment, risk calculation spreadsheets in Appendix Q document potential risks for each OHMPC in each medium and potential exposure route. Table 5-16 summarizes the cancer risks for each receptor for potential current and future land use, respectively. This table presents total potential risk for each exposure route for each medium, the total potential risk for each medium, and the CRCR for each receptor.

In the risk characterization, each CRCR is compared to the MCP Cumulative Receptor Cancer Risk Limit of 1E-05.

Cumulative Receptor Non-Cancer Risk

Noncarcinogenic effects associated with possible OHM exposure include a variety of effects on various tissues and organ systems. These effects are considered to have a threshold value below which toxicant exposure results in no adverse effects.

For ingestion and dermal exposure to soil, noncarcinogenic potential risk estimates are generated by comparing the average daily dose (ADD) for each OHM to the most applicable dose-response value (RfD). The non-cancer dose-response values used in this risk assessment are listed in Appendix N and in the risk calculation spreadsheets in Appendix Q. The ratio of the estimated body dose levels to these dose-response values is used to evaluate risk. For each individual chemical, this ratio is referred to as the hazard quotient (HQ).

To evaluate inhalation exposures, average concentrations are calculated and are compared to inhalation toxicity values (RfCs), which are in units of concentration (ug/m^3).

The HQ is calculated for each chemical, via ingestion or dermal contact, as:

$$HQ = ADD_i/RfD_i$$

and for inhalation exposure,

$$HQ = AC_i/RfC_i$$

Where:

ADD_i	=	The average daily dose of substance i via the particular exposure route
RfD_i	=	The allowable daily dose for exposure to substance.
AC_i	=	The average concentration of substance i in air
RfC_i	=	The Reference Concentration for substance i in air

For a mixture of chemicals, a screening hazard index (HI) is estimated by summing the individual HQs for all OHMPCs in the media and potential routes of exposure. This approach assumes that multiple subthreshold exposures may result in adverse effects even if no single chemical exceeds its reference level.

Because of the assumption of dose additivity, the use of the HI is most appropriate if chemicals in the mixture are expected to exert similar toxic effects by the same mechanism. Therefore, summing the HQs of a mixture of compounds that are not expected to induce the same effects could overestimate the total risk. Therefore, if the screening HI is greater than 1, the OHMPC should be divided into groups based on the toxic endpoint or target organ on which the toxicity value (usually RfD) is based. Separate HIs would then be calculated for each group of OHMPC and those HIs would be compared to the Cumulative Receptor Non-cancer Risk Limit.

The following sections describe the potential risk estimates calculated for the various exposure scenarios under current and potential future land use conditions. The HQs and HI values are documented in spreadsheets in Appendix Q and are summarized in Table 5-16 for current and potential future land use.

5.4.2 Comparison of Exposure Point Concentrations to Applicable and Suitably Analogous Standards

Potentially applicable standards would include drinking water standards, but they are clearly not applicable or suitably analogous for groundwater at this Site (which is not Category GW-1). Ambient Water Quality Criteria (AWQC) for the protection of human health are not considered applicable or suitably analogous for the surface water at this Site, since the on-site stream is not a public recreational surface water body.

5.4.3 Human Health Risk Characterization Results

In the following sections, potential receptors groups for current and future land uses are identified. A summary of potential Cumulative Receptor Cancer and Non-Cancer Risks for current and future land is also presented.

5.4.3.1 Summary of Risks for Receptors Under Current Land Uses

Health risks are calculated for the following potentially exposed receptor groups for current and continuing future land uses. Risks are presented in Table 5-16; calculations are documented in Appendix Q.

- USARC personnel
- Trespasser (older child)

As shown in Table 5-16, under current land use, potential Cumulative Receptor Cancer risks and potential Cumulative Non-Cancer Risks for all receptors are equal to or below the corresponding MCP risk limits. Cancer risks for the older child trespasser ranged from 2E-08 for potential soil exposures to 4E-07 for potential surface water exposures; the total cancer risk among all exposure media is 7E-07. The total non-cancer HI for the older child trespasser is 0.2. Cancer risks were not quantified for the commercial/industrial worker because no potentially carcinogenic OHM were identified for the exposure pathway of concern (i.e., vapor migration from groundwater to indoor air). The non-cancer HI for the commercial/industrial worker is 0.003.

5.4.3.2 Summary of Risks for Receptors Under Potential Future Land Uses

The additional human receptors who could potentially be exposed to OHM at or resulting from the Site under future uses are listed below. Risks are presented in Table 5-16; calculations are documented in Appendix Q.

- Construction worker
- Resident (child ages 1 through 5 and adult; assumes unrestricted land use)

As presented in Table 5-16, cumulative cancer and non-cancer risks for future unrestricted use (i.e, residential use) do not exceed the MCP cumulative cancer and non-cancer risk limits. Cumulative future cancer and/or non-cancer risks for the construction worker are below the MCP cumulative receptor risk limits.

The total cancer risk for the child resident for potential exposure to soils (0-15 ft bgs), surface water, and sediment is 8E-07. The total cancer risk for the adult resident for potential exposures to soil (0-15 ft bgs) is 5E-07. The cumulative resident cancer risk (for child and adult receptors combined) is 1E-06. The non-cancer HI for the child resident is 1. This HI is primarily associated with potential exposures to soils 0-15 ft bgs. The non-cancer HI for the adult resident is 0.4.

The total cancer risk for the construction worker is 1E-08, and the total non-cancer HI is 0.5. These risks are below the MCP cumulative receptor risk limits.

Potential allergic contact dermatitis risks associated with direct dermal contact with soil containing chromium were characterized by comparing chromium soil EPCs to the MADEP allergic contact dermatitis threshold concentration of 200 mg/kg. This threshold concentration is applicable for evaluating hexavalent chromium. However, because chromium speciation data are not available for this Site, the total chromium data are compared to the MADEP threshold concentration. Because allergic contact dermatitis is an acute health effect that can be caused by a one-time exposure (contact) with soil, each soil sample with a chromium concentration greater than 200 mg/kg represents soil that could trigger an allergic reaction in an individual who is allergic to hexavalent chromium and has been previously sensitized. A review of the soil data for chromium indicates that the maximum detected soil concentration is 30 mg/kg, which is below the MADEP threshold concentration of 200 mg/kg for concern about allergic contact dermatitis. This indicates that receptors that may potentially be exposed to soil at the Site would not be at risk for allergic contact dermatitis from chromium.

5.4.4 Characterization of Risk of Harm to Safety and Public Welfare

According to 310 CMR 40.0994, a Method 3 public welfare risk characterization shall consist of two major components:

1. A consideration of such factors as the existence of nuisance conditions, loss of Property value, the unilateral restriction of the use of another person's Property, and any monetary or non-pecuniary costs not otherwise considered in the characterization of risk of harm to health, safety, and the environment but which may accrue due to the degradation of public or private resources directly attributable to the release of the oil and/or hazardous material, and

2. Comparison of the concentrations of oil and/or hazardous material to the UCLs in soil and groundwater as described in 310 CMR 40.0996.

There are currently no nuisance conditions identified at the Site. There has not been any unilateral restriction on another person's Property.

Concentrations of OHM in soil and groundwater have been compared to promulgated UCLs. Tables 5-17 and 5-18 compare EPCs of OHM at each exposure point with UCLs for soil and groundwater. No soil or groundwater EPC exceeded UCLs.

If NAPL with thickness equal to or greater than 1/2 inch is present in any environmental medium, according to 310 CMR 40.0996, that is a level which exceeds UCLs. At this Site, there

has been no NAPL identified. Because there are no exceedances of UCLs at the Site, a condition of no significant risk of harm to public welfare exists.

Potential risks to safety are evaluated, per 310 CMR 40.0960, by comparing current and reasonably foreseeable conditions to applicable or suitably analogous safety standards and by determining if conditions related to a release of OHM at the Site currently or in the reasonably foreseeable future might pose a threat of bodily injury to people. There are no applicable or suitably analogous safety standards for media at this Site. There are no uncontrolled or rusted drums, containers, open pits, or other dangerous structures onsite. There are no uncontained materials that would exhibit characteristics of corrosivity, reactivity, or flammability as defined in 310 CMR 40.0347. There is currently no threat of explosion or direct contact with releases from this Site that is likely to endanger public safety or welfare. A condition of no significant risk of harm to safety does exist for the Site.

5.5 UNCERTAINTY ANALYSIS

This section identifies and discusses uncertainties in the risk assessment. These uncertainties are identified in order to place the results in a context or perspective. Unlike some other assessments, risk assessments rely not just on measured or certain facts, but also on assumptions and estimates, and also policy decisions, in the face of limited or non-existent data. Historically, risk assessments have used highly conservative assumptions in the place of unavailable data, with the net result often being a substantial overestimation of potential risks. This approach was considered the "protective" approach, in that it would overestimate rather than underestimate potential risks. This uncertainty discussion is not intended to identify "problems" with the risk assessment, only to point out how decisions made in the face of uncertainty may have affected the results and conclusions of the assessment. It should be emphasized that the potential risks estimated here are based on numerous assumptions. Each of these assumptions is associated with some uncertainty. Several types of uncertainties should be considered in any human health risk evaluation:

- uncertainties in the nature and extent of release of OHM;
- uncertainties associated with estimating the frequency, duration, and magnitude of possible exposure;
- uncertainties associated with assigning exposure parameters to a heterogeneous population that includes both men and women and young and old (e.g., body weight and ventilation rates);
- uncertainties in estimating carcinogenic slope factors and/or noncarcinogenic measures of toxicity (e.g., RfDs or RfCs); and
- uncertainties about possible synergistic or antagonistic chemical interactions of a chemical mixture.

The standard of care for environmental risk assessments for addressing many of these uncertainties is to use upper-bound (90th or 95th percentile) estimates of input values, such as exposure parameters and toxicity values. When considered together, the total receptor risk reflects an estimate that is greater than the 99th percentile. Thus it is probable that the potential risks presented in this document are upper-bound estimates of actual risks and the actual risks at the Site are likely to be lower than estimated in the risk characterization.

The uncertainties associated with estimating possible exposure result from the variance in sampling and analytical techniques, and from quantifying parameters that are not directly observed (e.g., frequency and duration of exposure). Because some of these parameters are functions of the behavior patterns and personal habits of the exposed populations, no single value can be assumed to be representative of all possible exposure conditions. However, we have incorporated assumptions or procedures in the risk assessment that are conservative and should result in an overestimate of risk.

There are uncertainties in the four areas of risk assessment: hazard identification, toxicity assessment, exposure assessment, and risk characterization. Uncertainties for each of these areas are summarized in Table 5-19.

5.6 RISK CHARACTERIZATION CONCLUSIONS

The risk characterization has evaluated potential risks associated with possible exposures to OHM at the Site.

The assessment of risk of harm to human health indicates that for **current land use** and current Site conditions, no cumulative receptor cancer or non-cancer risks exceed the Cumulative Receptor Cancer Risk Limit of $1x10^{-5}$ or the Cumulative Receptor Non-Cancer Risk Limit of a hazard index of 1.

Under possible **future land use** conditions, the assessment of risk of harm to human health indicates that cancer and non-cancer risks are at or below the MCP Cumulative Receptor Cancer Risk Limit (1×10^{-5}) and the Cumulative Receptor Non-Cancer Risk Limit (hazard index = 1).

The results of the public welfare risk characterization indicate that a condition of no significant risk of harm to public welfare does exist for the Site because there are no nuisance conditions and there are no UCL exceedances.

The results of the safety risk characterization indicate that a condition of no significant risk of harm to safety has been achieved for the Site.

In summary, the results of the human health risk characterization indicate that there is a Condition of No Significant Risk to human health, public welfare, and safety at the Site for both current land use and for unrestricted future land use.

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6. ENVIRONMENTAL RISK CHARACTERIZATION

6.1 INTRODUCTION

The primary goal of Environmental Risk Characterization is to provide the information necessary to form an ecological basis for risk managers to make decisions regarding the need for remediation and to identify appropriate response actions.

The objective of an MCP Environmental Risk Characterization (ERC) is to characterize the risk of harm to habitats and biota exposed to OHM at or from a disposal site. The MCP specifies two components of an ERC: (1) combining site-specific information on contaminant distribution, contaminant toxicity, and receptor exposure in a site-specific assessment of the risk of harm to habitats and biota from the OHM at or from the site; and (2) comparing contaminant concentrations in environmental media to Applicable or Suitably Analogous Standards specified in the MCP. The second component is discussed further in Section 6.7. All other sections of this ERC address the site-specific characterization of risk to biota and habitats posed by OHM at (or from) the Site.

The MCP establishes a two-tiered process for conducting an ERC. Stage I Environmental Screening determines which exposure pathways require further assessment to characterize risk. If the risk of harm from any exposure pathway cannot be ruled out in Stage I, and no "apparent harm" exists, a Stage II Environmental Risk Characterization must be done for that pathway. Stage II Environmental Risk Characterizations employ quantitative methods to evaluate the risk of harm to ecological receptors.

This ERC was prepared in accordance with the Environmental Risk Characterization section (Section 9) of the "Guidance for Disposal Site Risk Characterization" (MADEP, 1996b), hereinafter referred to as MADEP Guidance. This guidance draws heavily from the USEPA's Framework for Ecological Risk Assessment (USEPA 1992b) and from other USEPA guidance (USEPA 1989b, and USEPA Region I 1989), with the intent of supplementing USEPA guidance to clarify its applicability at 21E sites regulated under the MCP.

In addition to the above, the following documents, which provide risk assessment guidance and/or technical information, were used:

- USEPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final*, dated 5 June 1997.
- *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual*, EPA/540/1-89/001, December 1989;
- *Supplemental Risk Assessment Guidance for the Superfund Program*, USEPA, OSWER 9285.7-081 Vol. 1, No. 1, May 1992;
- *Guidelines for Ecological Risk Assessment*, EPA/630/R-95/002F, April 1998;
- Intermittent "ECO Update" Bulletins of USEPA;
- USEPA Region 1 Risk Updates;
- *The Massachusetts Contingency Plan.* 310 CMR 40.0000. MADEP, Bureau of Waste Site Cleanup, dated October 29, 1999.

6.2 ECOLOGICAL DESCRIPTION OF THE SITE

The Site is 14.5 acres in size. It consists of buildings, paved parking lots, and open areas, including a stream. The buildings and parking lots cover the majority of the Site. The buildings include an office-type building (the USAR Center) and a maintenance shop, which is located just north of the USAR Center. There are three parking lots on the Site, two located to the east and west of the centrally located USAR Center, and a third military vehicle parking lot located to the north of the maintenance shop. The maintenance shop, part of the east parking lot, and the military vehicle parking lot are enclosed by a fence (see Figure 1-2).

Just beyond the paved parking areas west of the USAR Center, there is an approximately 150-foot wide strip of vegetation, consisting of herbs, shrubs, and trees. An unnamed intermittent stream flows from south to north through this vegetated strip, for a distance of approximately 650 feet across the property. The stream is not depicted on the U.S. Geological Survey topographic map of the area (1987 Brockton, Massachusetts quadrangle). There is a wetland, designated as shrub swamp by Mass GIS, associated with the stream. The stream is culverted under West Chestnut Street, which bounds the Site to the south. A road to the Veterans Administration Hospital bounds the Site to the west of the stream.

Within the property boundaries to the east of the east parking lot, there is a narrow strip of shrubs and small trees. A drainage swale carries stormwater south to north through this strip. The eastern side of the USARC property is bordered by a playground. The Site is bounded to the north by a wetland which drains to a pond on the Veterans Administration property.

The intermittent stream was observed by a Stone & Webster fisheries biologist on December 12, 2001. The culverts under West Chestnut Street were observed to be half clogged with silt. A minimal flow (at most a few gallons per minute) was exiting the culverts into the stream on the west side of the parking lot at the Site. Water in the stream on site consisted of shallow puddled areas.

Stone & Webster observed that the stream was recently dredged, and likely relocated in places; the original substrate was observed to be piled mostly on the eastern bank of the stream, but some spoil was also deposited on the western bank. One stretch of the stream appeared to be a newly dug channel approximately 3 feet wide, with the original course blocked by dredged material. Refuse such as old tires, bottles, and cups were noted in the original streambed. The stream then flows through a stand of cattails, then enters a wooded area and widens to up to 12 feet. The stream, even at this widest point, was still very shallow to the point that the flow was not contiguous. In places between the puddles, the flow was through the substrate. The stream in the wooded area did not appear to be recently dredged as did most of the rest of the stream observed that day.

The stream then leaves the USARC property and continues to flow north on the Veterans Administration property. There are also indications on the VA property that sediment, rocks and tree stumps were recently removed from the stream on the VA property. Where the stream leaves the woods on the VA property, it takes a slight turn to the west and passes through a concrete culvert. The culvert invert, especially on the downstream end, was at a higher elevation than the stream. Based on the above observations, it is concluded that the stream on site does not sustain a flow that is capable of producing aquatic habitat to support year-round populations of

fish. The hydraulic jump at the downstream end of the culvert on the VA property eliminates the possibility that fish from downstream portions of the watershed could swim upstream to the Site even if there were higher spring season flows to provide aquatic habitat suitable for fish.

6.3 ANALYTICAL DATA USED IN THE ERC

Only validated data were used in this ERC. Tables 6-1, 6-2, and 6-3 present data summaries for the OHM detected in surface soil, surface water, and sediment, respectively. The frequency of detection, range of detected concentrations, arithmetic mean, and background concentration (where available) are presented for each constituent. All compounds that were detected at least once within a medium data set are included in the summary table for that particular medium. For duplicate sample results, the average of the two values was used for the data set. Data labeled with "R" represent rejected values which were not considered in the summary statistics. Nondetected analytes were represented by one-half of the SQL in the estimation of the arithmetic mean. When one-half the SQL was higher than the highest detected concentration for any compound, that sample was eliminated from the data set. The specific samples used in this ERC are detailed below.

Drainage Swale Soil

For surface soil, Phase II soil samples collected between 0 and 1 foot bgs were selected. Samples collected from the drainage swale were considered as soil for this risk characterization because the drainage swale is normally dry (contains standing water only during and immediately after storm events). Samples selected for use and evaluation in the ERC include BRSWSD07 and BRSWSD08. Sample locations BRSWSD05 and BRSWSD06 were selected as background locations based on the groundwater flow direction, and on the fate and transport characteristics of the COPCs from potential source areas (see Section 7).

Parameters detected in Site surface soils include one VOC, PAHs, antimony, arsenic, barium, cadmium, chromium, lead, and mercury.

Stream Surface Water and Sediment

Surface water and sediment samples collected from the on-site stream were evaluated in the risk characterization. The data sets include three surface water and sediment sample pairs collected in the Phase II investigation, including BRSWSD/SW02, BRSWSD/SW03, and BRSWSD/SW04. Sample location BRSWSD/SW01, also collected in the Phase II investigation, was selected as a background location, based on the groundwater flow direction, and on the fate and transport characteristics of the COPCs from potential source areas (see Section 7). Figure 2-2 shows the surface water and sediment sampling locations.

Parameters detected in surface water at the Site include one VOC, one SVOC, EPH compounds, and inorganics. Parameters detected in sediment at the Site include one VOC, SVOCs, PAHs, inorganics, and EPH compounds.

6.4 BACKGROUND SCREENING

In accordance with MADEP Guidance, detected concentrations in each media of concern were compared with background levels prior to Stage I Environmental Screening.

Surface Soil - Site-specific background surface soil data were collected from two locations in the drainage swale (BRSWSD05 and BRSWSD06). The maximum detected Site concentrations were compared to the maximum background concentrations, as shown on Table 6-1. Also shown on Table 6-1 are background levels published by the MADEP for inorganic parameters (MADEP, 1995a), and MADEP draft proposed background levels for PAHs (MADEP, 2001). In accordance with MADEP risk characterization guidance (MADEP, 1995a), maximum detected site concentrations that do not exceed the site-specific background or the MADEP published background concentrations are considered to be consistent with background. OHM that are consistent with background are, by definition, associated with a condition of No Significant Risk of Harm for MCP purposes. As can be seen in Table 6-1, all the analytes detected in the drainage swale soils are below site-specific background concentrations, except for antimony. However, antimony is below the published MADEP level. Therefore, surface soil is not evaluated further in this ERC.

Surface Water and Sediment – One site-specific surface water and sediment background sample pair was collected (BRSW/SD01). The maximum detected Site surface water concentrations were compared to the background surface water concentrations, as shown in Table 6-2. Except for dissolved concentrations of lead, all other analytes were either not detected or not analyzed for in the background sample. Therefore, all the detected Site concentrations are assumed to exceed background, and will be carried forward into Stage I screening.

The maximum detected Site sediment concentrations were compared to the background concentrations, as shown in Table 6-3. Acetone, bis(2-ethylhexyl)phthalate, and eight metals exceeded background concentrations, therefore these analytes will be carried forward into Stage I screening.

6.5 STAGE I ENVIRONMENTAL SCREENING

The objective of Stage I Environmental Screening is to identify those exposure pathways which do not require further quantitative assessment and those that do. A pathway can be eliminated from the Stage II quantitative assessment if: (1) significant risk is readily apparent; (2) the exposure pathway is incomplete; or (3) the exposure pathway is complete but the exposure is so minimal that it clearly does not pose a significant risk.

In Stage I, any complete exposure pathways associated with "readily apparent harm" are identified. Conditions that constitute "readily apparent harm" include visibly stressed biota, contaminant concentrations that exceed environmental standards and visible oil or tar distributed over an area of soil greater than two acres or over an area of sediment greater than 1,000 square feet (310 CMR 40.0995(3)(b)1.).

In Stage I, the available evidence is evaluated to determine whether plants and/or animals are currently exposed, or could potentially be exposed, to contamination at or from the Site. An exposure pathway is a link between a contaminant source and receptors such as plants and animals. The term "complete exposure pathway" means that the contamination is *actually* reaching plants or animals, or is likely to do so in the future. If a potential exposure pathway is not complete and is not likely to be complete in the future, hypothetical risks postulated for that pathway do not have to be considered further and do not have to be carried through the ERC process.

Each complete exposure pathway is evaluated in Stage I to determine whether it is potentially significant. If a significant risk of harm can readily be ruled out, it is not considered further in the risk characterization.

Stage I screening involves two steps: (1) exposure pathway identification and (2) effects-based screening.

6.5.1 Identification of Complete Exposure Pathways

One of the objectives of the Phase II Comprehensive Site Investigation was to determine if the swale on the east side of the property and the stream on the west side of the property are being influenced by petroleum contamination. Through background screening conducted in Section 6.4, it has been shown that the drainage swale soils are below background values. The following paragraphs discuss potential exposure pathways to the intermittent stream.

The primary source of OHM release is attributable to a leaking UST that contained diesel/# 2 fuel oil, and above-ground fuel pods that were used to store and dispense gasoline. The UST was found to be leaking at a rate of 70 gallons per day before its removal in the early 1990s. Gasoline spills associated with dispensing of fuel from the fuel pods historically occurred.

The soil and groundwater data indicate that petroleum-related OHM, including TPH, trimethylbenzenes, ethylbenzene, xylenes, and butylbenzenes have leached and infiltrated into subsurface soil in the vicinity of the former UST and fuel pod areas. These OHM have subsequently migrated in groundwater along the soil/groundwater interface. The former sewer line that transects the Site (Figure 1-2) was investigated in the Phase II SI as a possible conduit for migration of site-related OHM to surface water in the stream. The soil and groundwater sampling performed in the Phase II revealed low levels of some VOCs in soil and groundwater immediately downgradient of the petroleum source areas. However, no petroleum-related OHM were detected in soil and groundwater sampling points further downgradient of the source area. Therefore, there is no complete migration pathway between these source areas and the on-site stream via groundwater discharging to surface water.

Another potential contaminant migration pathway to the stream is the runoff of historic spills from the fuel pod area to the stormwater drainage system. The stormwater drainage system consists of a storm drain in front (south) of the maintenance shop, four trench drains across driveways and the loading dock area behind the USAR Center, and roof drains from the two buildings. The roof drains on the maintenance shop discharge to the ground surface behind the building. The trench drain across the eastern-most driveway drains to the swale on the eastern side of the property. The two trench drains across the western driveways drain into the intermittent stream on the west side of the property, as it enters the Site from under West Chestnut Street. The storm drain near the maintenance shop, the trench drain near the loading dock, and the roof drains from the USAR Center all feed into the storm drain system that discharges into the intermittent stream via an outfall pipe located approximately half way down the western side of the property (USACE, 1976).

Per MADEP Guidance, the mere presence of contaminants is generally sufficient to demonstrate the presence of a complete exposure pathway for aquatic organisms, if surface water or benthic organisms are present. Although habitat quality is considered minimal in the intermittent stream,

to be conservative, surface water and/or benthic organisms are assumed present, and, since chemicals were found at levels that exceeded background values, a complete exposure pathway exists.

There are no conditions that constitute readily apparent harm associated with the aquatic exposure pathways.

6.5.2 Effects-Based Screening

In this step, each complete exposure pathway is evaluated to determine whether the exposures are likely to be significant. If significant exposures are determined to be unlikely for any pathway, that pathway can be eliminated from further consideration in the risk assessment

6.5.2.1 Surface Water Screening

The need to quantify effects from surface water exposures can be ruled out if the surface water concentrations of all contaminants of concern are lower than the chronic AWQC published by USEPA, and are not likely to exceed these values in the future. In the absence of AWQC, the literature was consulted to identify a chronic lowest observed effect level (LOEL) appropriate for screening purposes.

Table 6-4 presents the surface water screening values used in this ERC. The following hierarchy was used to select surface water screening values:

(1) if a USEPA chronic freshwater AWQC (USEPA, 1999a; USEPA, 2001) or proposed AWQC (Buchman, 1999) was available, if was used preferentially;

(2) if a chronic LOEL from USEPA's Quality Criteria for Water (1989 with updates), as specified in the MADEP Guidance, was available, it was used; and

(3) if none of the above sources provided a screening value for a particular analyte, a secondary chronic value from the Oak Ridge National Laboratories (ORNL) database (Suter and Tsao, 1996) was used. This is a Tier II value developed so that aquatic benchmarks could be established with fewer data than are required for Water Quality Criteria.

Some inorganic screening values are dependent on the hardness of the water. For the purpose of adjusting hardness-dependent screening values, the site-specific average hardness value of 47 mg/L was used for the data collected in 1999, and the site-specific average hardness value of 67 mg/L was used for 2001 data. Adjusted screening values are included in Table 6-4.

To provide a conservative assessment of toxicity and health risks associated with potential exposures to chromium, chromium data were evaluated as hexavalent chromium in this risk assessment. There are no AWQC or LOELs available for C19-C36 aliphatics or C11-C22 aromatics.

The maximum detected concentration of each analyte in surface water was compared to its corresponding screening value. As can be seen in Table 6-4, the maximum concentrations of the total RCRA metals barium, cadmium, and lead exceed their screening values. It should be noted, however, that the AWQC for cadmium and lead are expressed in terms of dissolved (filtered) metals. The analytical results are for total (unfiltered) metals. For this reason, additional surface

water samples were collected from the same sample locations and analyzed for dissolved parameters. The maximum dissolved concentrations of cadmium and lead also exceeded the AWQC. The results are presented in Table 6-4.

As the results of Stage I screening show, the surface water pathway will need evaluation under a Stage II ERC.

6.5.2.2 Sediment Screening

The need to quantify risks from sediment exposure can generally be ruled out if the sediment concentration of all contaminants of concern are lower than the MCP-recommended screening values.

Table 6-5 presents the sediment screening values used in this ERC. The following hierarchy was used to select sediment screening values from the values currently recommended by MADEP Guidance:

(1) if a USEPA sediment quality criteria (SQC) (USEPA, 1993b-f) was available, it was used preferentially; and

(2) if a freshwater sediment screening value was available (e.g., a lowest effect level from the Ontario Ministry of the Environment (OMOE) (Persaud, et al., 1993), it was used.

The maximum detected concentration of each analyte in sediment was compared to its corresponding screening value. As can be seen in Table 6-5, the maximum concentrations of arsenic, cadmium, chromium, and lead exceed the current recommended screening values. Sediment screening values were not available for acetone, bis(2-ethylhexyl)phthalate, C19-C36 aliphatics, antimony, barium, and silver.

As the results of Stage I screening show, the sediment pathway will need evaluation under a Stage II ERC.

6.6 STAGE II ENVIRONMENTAL RISK CHARACTERIZATION

In the *Framework for Ecological Risk Assessment*, USEPA breaks the assessment process down into three major components: (1) Problem Formulation, (2) Analysis and (3) Risk Characterization. Within the staged process described in the MCP, these are the basic components of a Stage II ERC. Each is described in the sections that follow.

6.6.1 Problem Formulation

The first phase in a quantitative Stage II ERC is problem formulation. Problem formulation involves the collection and analysis of information needed to determine the appropriate scope and focus of the investigation. The outcomes of the problem formulation step are the selection of the specific effects (assessment endpoints) that will be quantified in the risk characterization and the identification of the specific measurement endpoints that will best represent those effects. Problem formulation includes:

1. describing the fate and transport characteristics of the contaminants of concern,
2. identifying exposure pathways and receptors of concern,
3. evaluating the potential toxicological effects of the contaminants on the receptors,

4. using the information cited in (1) through (3) to develop a conceptual model that represents pathways by which contaminants move through the environment to exposure points and through the food web to higher level consumers, and
5. using the conceptual model to select the specific effects on specific organisms (assessment endpoints) that the risk characterization will evaluate.

6.6.1.1 Contaminants of Potential Concern

As determined by the Stage I screening, barium, cadmium, and lead are COPCs in surface water. There are no surface water screening values available for C19-C36 aliphatics or C11-C22 aromatics, however, since there are no ecological toxicity data available for either as well, environmental risk cannot be determined for these groups of chemicals.

In sediment, arsenic, cadmium, chromium, and lead are COPCs. Sediment screening values are not available for acetone, bis(2-ethylhexyl)phthalate, C19-C36 aliphatics, antimony, barium, and silver. To be conservative, antimony, barium, and silver also will be considered sediment COPCs for Stage II. Acetone and bis(2-ethylhexyl)phthalate are common laboratory contaminants, and therefore are not considered further. Since there is no ecological toxicity data available for C19-C36 aliphatics, environmental risk cannot be determined for this group of chemicals.

6.6.1.2 Fate and Transport

Fate and transport of the COPCs at the Site is discussed in Section 7.

6.6.1.3 Exposure Pathways and Receptors of Concern

As the results of Stage I screening show, the surface water and sediment exposure pathways are the pathways of concern for evaluation under a Stage II ERC. This is based on the conservative assumption that, although habitat quality is considered minimal in the intermittent stream, aquatic and/or benthic organisms are present at some time during the year.

The receptors chosen for evaluation in this assessment were selected based on their sensitivity to the stressors identified during field investigations as well as their representation of the trophic levels considered ecologically relevant at this Site. The objective when selecting these receptors was to quantify risks to the species which utilize the Site as habitat and to provide a general characterization of risks to the environment posed by contamination at the Site.

Consultation with state and federal resource agencies has shown that there are no state-listed threatened or endangered species or other species of special concern or exemplary natural communities in the vicinity of the property (MDFW, 2001). There are no federally-listed or proposed threatened or endangered species known to occur in the project area, with the exception of occasional transient bald eagles (*Haliaeetus leucocephalus*) (USDOI, 2001). There are no Areas of Critical Environmental Concern in the vicinity of the property (MDEM, 2000).

Vertebrate wildlife species potentially associated with the stream were conservatively chosen as receptors for this ERC. This choice may be considered overly conservative, however, for the following reasons:

- the reach of stream potentially impacted by source areas is small (320 feet),
- the carrying capacity of this area is small,
- population effects would not be seen in such a small area, and

- there are no rare wildlife species present where protection of the individual would be a concern.

Vertebrate wildlife receptor species were selected based on ecological habitats and cover types available at the Site. The following representative wildlife species were selected for evaluation.

Star-nosed Mole (*Condylura cristata*)

The star-nosed mole is the representative small mammalian carnivore. The mole is common to uncommon in New England, and prefers low wet ground near bodies of water, swamps, and wet meadows. The diet of the mole includes primarily earthworms and many aquatic invertebrates, as well as small amounts of vegetation. Due to the nature of their foraging habits and tunnel-building, the mole has the potential to take in a relatively large amount of sediment. The mole was selected to represent mammalian species that would receive high doses of COPCs as a result of their small body size.

Marsh Wren (*Cistothorus palustris*)

The marsh wren is the representative avian carnivore. The marsh wren is a relatively small wren whose breeding range includes all of New England except northern Maine; they winter in the southern United States into Mexico. Marsh wren prefer large fresh or brackish marshes with abundant tall herbaceous vegetation such as cattails, shores or sluggish rivers, and inland ponds. Marsh wrens consume aquatic invertebrates, other insects, and spiders, which they glean from the water surface, on stems and leaves of emergent vegetation, and marsh floors. The wren was selected to represent avian species that would receive high doses as a result of their small body size.

In accordance with MADEP Guidance, the individual population of invertebrates potentially present in the intermittent stream was not considered to be a meaningful receptor for the following reasons:

- the population is not a critical component of the prey base (no fish present), and
- there are no rare invertebrate species where protection of the individual would be a concern.

6.6.1.4 Toxicity Profiles

Brief toxicity profiles for selected COPCs are presented in Appendix R to this report.

6.6.1.5 Conceptual Site Model

Ecological receptors at the Site include vertebrate wildlife associated with the intermittent stream. The exposure pathway proposed for this ERC is a conservative assumption based on the environmental setting and potential habitat at the Site. The exposure pathway for vertebrate wildlife receptors has been identified in a conceptual site model (Figure 6-1). The model indicates that contaminants may migrate from primary sources of contaminants to sediment and surface water. Sediment and surface water were identified as the primary media of concern to the ecological receptors. Potential routes of exposure leading to receptors are explained as follows:

Vertebrate Wildlife. The exposure routes evaluated for wildlife include ingestion of surface water, sediment, and food items that may contain accumulated chemicals from the sediment. Dermal contact results in limited adsorption of COPCs compared to absorption of ingested COPCs, therefore this route of exposure was not considered to contribute significant risk. Inhalation generally is considered an insignificant route of exposure to receptors, and was not evaluated.

6.6.1.6 Endpoint Selection

For MCP ERCs, assessment endpoints are the specific effects that are evaluated quantitatively in the risk characterization. Assessment endpoints were selected based on the important ecosystems, communities, and/or species potentially present at the Site. Measurement endpoints are the ecological characteristics that are measured to approximate or represent assessment endpoints. The following assessment and measurements endpoints were selected for this ERC:

Vertebrate Wildlife. The assessment endpoint selected for vertebrate wildlife is adverse effects on the maintenance of wildlife populations and communities within the habitats present at the Site. Because no historic long-term wildlife population data are available at the Site, a direct measurement of this assessment endpoint is not possible. Therefore, the measurement endpoint is the comparison of potential dietary exposures, calculated using concentrations of contaminants in the sediment and surface water, to the results of laboratory toxicity studies in the literature that relate the dose of a compound in an oral exposure with an adverse response to growth, reproduction, or survival of a test population (avian or mammalian species). The derivation of the wildlife toxicity reference values used is discussed in Section 6.6.2.2.3.

6.6.2 Analysis

The Analysis phase of ecological risk assessment consists of Exposure Assessment and Toxicity (or Effects) Assessment.

6.6.2.1 Exposure Assessment

Exposure assessment is the process of estimating or measuring the amount of a COPC in environmental media (surface water, sediment) to which an ecological receptor may be exposed via the evaluated exposure routes. The following paragraph discusses how chemical exposures were estimated for the vertebrate wildlife receptors.

To evaluate exposures to vertebrate wildlife, representative wildlife species were selected for evaluation in simple food chain models which estimate exposures to wildlife species respective to their position in the food chain. Wildlife species are assumed to be potentially exposed to COPCs in surface water and sediment by incidental ingestion of these media, and by ingestion of prey which have bioaccumulated chemicals from sediment. To estimate this exposure, mean and maximum Total Potential Dietary Exposures were estimated for each species, as follows.

Mean and maximum EPCs were calculated for all analytes selected as final COPCs. In accordance with USEPA Region 1 guidance, the lesser of the maximum detected concentration or the 95% UCL was selected as the maximum EPC for the sediment and surface water data sets. Since the 95% UCL is calculated only for sample sets with 10 or more points, and the sediment and surface water data sets have less than 10 samples each, the maximum detected concentration was used as the maximum EPC. The arithmetic average concentration was used as the mean EPC. Surface water EPCs are listed in Table 6-2, and sediment EPCs are listed in Table 6-3.

The actual amount of an EPC taken in by a wildlife species as the result of indirect or direct ingestion is dependent upon a number of factors. The Total Potential Dietary Exposure calculation considered the following:

- Biota-Sediment Accumulation Factors (BSAF) in prey items,
- the relative amount of different food items or sediment in its diet,

- ingestion rates,
- species-specific area use factors (AUFs),
- exposure duration, and
- body weight.

The steps of the Total Potential Dietary Exposure calculation are outlined on Figures 6-2A through 6-2C. The first step, as shown on Figure 6-2A, was to calculate estimated food compound concentrations. Food items for wildlife species evaluated in the food web exposure models include invertebrates. Tissue concentrations of COPCs in invertebrate prey items were estimated using BSAFs listed in Table 6-6.

The next step, as shown on Figure 6-2B, was to calculate the exposure from each item (sediment, surface water, food items) in the receptor's diet. The exposure assumptions used in these equations (body weight, relative consumption of food items, food and water ingestion rates, exposure duration, and home range) are provided in Table 6-7 for the selected wildlife receptor species. AUFs, which are defined as the ratio of the receptor's home range to the site surface area, are listed in Table 6-7. The values in Table 6-7 were obtained primarily from the USEPA Wildlife Exposure Factors Handbook (USEPA, 1993g). The values in this Handbook represent a compilation from various field and laboratory studies. Where more than one study presented values for a particular exposure factor, the value chosen was taken from the most appropriate field study available in terms of similarity to habitat and/or proximity to the Site.

The final step of the Total Potential Dietary Exposure calculation, as shown on Figure 6-2C, was to sum the exposures from the food items in the diets of each receptor species. For the mole and wren, the Total Potential Dietary Exposure was the sum of the exposures from ingesting invertebrate prey, surface water, and sediment. The Total Potential Dietary Exposure calculations for the mole and wren are presented in Appendix S.

6.6.2.2 Ecological Effects Assessment

The ecological effects assessment describes the potential adverse effects to ecological receptors associated with the identified COPCs and reflects the type of assessment endpoints selected. The methods used for identifying and characterizing ecological effects for vertebrate wildlife receptors are described below. Generally, potential ecological effects resulting from exposure to COPCs include mortality and effects on growth and development.

To evaluate potential risks to vertebrate wildlife receptors, Toxicity Reference Values (TRVs) were used for each COPC for each avian and mammalian receptor. The TRV relates the dose of a respective COPC from oral exposure with an adverse effect. The TRV reflects the assessment endpoint chosen as the basis for establishing risk. If no toxicity information is available for a COPC, and it was not possible to identify TRVs, risks associated with the estimated exposure for the respective COPCs cannot be quantitatively evaluated.

Wildlife TRVs are presented in Table 6-8. TRVs were derived using the methodology in Sample et al. (1996), where experimentally derived test doses (NOAELs) were used to estimate TRVs for wildlife by adjusting the dose according to the differences in body size between the test species and the wildlife species. In other words, the test dose was multiplied by a body weight scaling factor. Scaling factors are included on Table 6-8. In accordance with Sample et al. (1996), a

scaling factor of 1 was applied for avian wildlife species. Scaling factors for mammalian wildlife species were derived from the following equation from Sample et al. (1996):

$$\left[\frac{bw_t}{bw_w}\right]^{1/4}$$

where bw_t = body weight of the mammalian test species, and
bw_w = body weight of the mammalian wildlife species.

Body weights of the mammalian test species are from the studies referenced in Table 6-9; body weights of the mammalian wildlife species are as listed in Table 6-7. Test doses were taken or derived from the references listed in Table 6-9.

6.6.3 Risk Characterization

In the Risk Characterization phase, the Exposure Assessment and Effects Assessment results of the Analysis phase were evaluated to determine whether they support a conclusion of *no significant risk*. Significant risk is defined as the potential of attaining each assessment endpoint. This was done by comparing the exposure concentrations to the toxicity levels (effects levels).

6.6.3.1 Vertebrate Wildlife

Risks for the representative vertebrate wildlife species associated with ingestion and bioaccumulation of COPCs in surface water and sediment were quantitatively evaluated using HQs, which were calculated for each COPC by dividing the Total Potential Dietary Exposures resulting from exposures to mean and maximum EPCs by the species- and compound-specific TRVs. The resulting HQs are summarized in Table 6-10.

Total potential daily doses for the mole and wren, based on mean and maximum EPCs, did not exceed any TRVs (i.e., all HQs are less than 1). Food web model exposure calculations for the mole and wren are presented in Appendix S.

6.6.3.2 Evaluation of AVS and SEM Data

In order to assess whether or not inorganic substances in sediments are bioavailable, acid volatile sulfide (AVS) and simultaneously extracted metal (SEM) data were collected at the Site and analyzed in accordance with USEPA Draft Method EPA821/R-91-100. Divalent metals in sediments will bind to available AVS in order of increasing solubility. For the five metals for which this method applies, copper, lead, cadmium, zinc, and nickel will bind to available AVS and be sequentially converted to copper sulfide, lead sulfide, cadmium sulfide, zinc sulfide, and nickel sulfide (i.e., in the order of increasing solubility). This reaction takes place as long as sulfides, particularly AVS, are available. When the molar sum of divalent cations (i.e., copper, lead, cadmium, zinc, and nickel, or the SEM) is less than the molar concentration of available AVS, these metals will exist as metal sulfides. Such metal sulfides are insoluble and are not present in sediment pore water. Therefore, sediments with higher concentrations of AVS than SEM will tend to exhibit low metals toxicity. Conversely, when the molar sum of the SEM is greater than the molar AVS concentrations, the portion of the SEM in excess of the AVS concentration can potentially exist as free metals, and thus can potentially be bioavailable and toxic.

When multiple metals are present, it is necessary to evaluate the metals in terms of their solubility products. For example, if sediments are contaminated with copper, lead, and cadmium, it is possible that AVS could limit the bioavailability of one or all of these metals. In the presence of sulfide ions, copper is less soluble than lead, which is less soluble than cadmium.

Therefore, copper has the highest affinity for AVS and will preferentially bind to available AVS to form solid phase, non-toxic copper sulfide. If sufficient AVS is available, all of the copper in the system will be tightly bound as copper sulfide. If excess AVS is still available when all the copper is sulfide-bound, then lead will bind to the remaining sulfide ions; if excess AVS is still available, then cadmium ions will bind to the remaining sulfide ions. When the molar concentration of copper, lead, and cadmium ions exceeds the molar concentration of sulfide ions, the metals will no longer be present as sulfide-bound insoluble complexes. If this situation occurs, sediment toxicity is possible, depending upon the presence and role of other binding phases in the sediment (TOC, grain size).

The SEM and AVS data obtained from the background and site sediment samples are summarized in Table 6-11. These data indicate that, at 1 out of 4 locations (BRSWSD02R), SEM is less than AVS (i.e., SEM:AVS <1), indicating that these metals are not available to the environment at this location. At 3 out of 4 sampling locations, SEM exceeds AVS (i.e, SEM:AVS >1), meaning that metal toxicity could potentially occur. However, at one of these locations (BRSWSD01R), the absolute differences between SEM and AVS concentrations is very small (0.075 umoles/g), so the amount of metal not bound to sulfides may not be significant. The two sampling locations downstream of the stormwater outfall had large SEM:AVS ratios (>4), indicating with greater likelihood that these metals may be available to the environment at these locations.

6.6.3.3 Uncertainties

Uncertainty is inherent in risk assessment and limits the applicability of the results. The lack of site-, species-, and COPC- specific data is common, leading to situations where assumptions and substitutions must be made in order to arrive at a reasonable estimate of risk. Use of these assumptions and substitutions lead to uncertainties in the conclusions of the risk assessment. Stone & Webster has made every attempt to minimize uncertainty and avoid applying generic, overly conservative factors to risk calculations. The uncertainties associated with this ERC, and their likely effect on the risk estimate, are discussed below.

Stage I Screening

- Applicability of generic screening values to species and Site conditions assessed at this Site introduced uncertainty to this assessment.

Stage II - Problem Formulation

- Two receptor species were chosen to represent the ecological population at the Site. The results of risk assessment for these species were used to represent risk to the faunal community. This introduces uncertainty to the conclusions of this assessment. The effect of this uncertainty cannot be determined.

Exposure Assessment

- EPCs were conservative estimates of the concentrations which receptors may contact at the Site and did not consider natural degradation of COPCs in the environment over time. This assumption likely resulted in overestimation of risk.

- Dietary exposures were estimated for the receptors based on several assumptions including non-site-specific dietary compositions, and conservative estimates of food and water intake rates. These conservative assumptions likely resulted in the overestimation of risk.
- Site-specific BSAFs were not available; therefore, values for these factors were derived from the available literature. The effect of this uncertainty on the risk estimates cannot be precisely determined.

Effects Assessment

- Due to the lack of available toxicity information (i.e., effect levels), risks to the marsh wren associated with antimony were not assessed.
- Toxicity values or effect levels used in this ecological risk assessment were based on NOAELs as reported in Sample et al (1996). These effect levels represent studies of mice and rats. Species-specific NOAELs were adjusted by Sample et al to represent effect levels for the receptor species. These factors introduce uncertainty into this assessment, but the extent and direction of this uncertainty was not determined.
- Use of NOAELs may overestimate effects since this measurement endpoint does not reflect any observed impacts. Lowest observed adverse effect levels (LOAELs) may be orders of magnitude above observed literature-based NOAELs, yet NOAELs were selected for use in the ERC.

6.7 Comparison of Exposure Point Concentrations to Applicable and Suitably Analogous Standards

A level of no significant risk of harm to the environment has not been achieved if concentrations of OHM at or from the Site exceed or are likely to exceed any applicable or suitably analogous standards.

6.7.1 Massachusetts Wetlands Regulations

According to the MADEP Guidance, wetlands alterations resulting from contamination represents a violation of the Wetlands Protection Act, and would in effect constitute an exceedance of an applicable or suitably analogous standard. Wetlands alterations indicative of Significant Risk of Harm include:

- contamination of inland wetlands resource areas which destroys or otherwise impairs any portion of Bordering Vegetated Wetland;
- contamination of inland wetlands resource areas within a Bank or Land Under a Water Body or Waterway which impairs ground water and surface water quality, or the capacity of such areas to provide breeding habitat, escape cover and food for fisheries;
- contamination of wetlands resource areas which has an adverse effect on rare species, vernal pool habitat, or an Area of Critical Environmental Concern (ACEC).

There is no visual evidence that the wetland bordering the stream has been impaired by contamination at or from the Site. There are no rare species, vernal pools, or ACECs within the project area.

6.8 ENVIRONMENTAL RISK CHARACTERIZATION SUMMARY AND CONCLUSIONS

As discussed in Section 5, the National Research Council (NAS, 1983) makes the following distinction between risk assessment and risk management: *"Risk assessment is the use of the factual base to define the health effects of exposure to individuals or populations to hazardous materials and situations. Risk management is the process of weighing policy alternatives and selecting the most appropriate action, integrating the results of risk assessment with engineering data and with social, economic, and political concerns to reach a decision".* It is important that these two processes remain separate and distinct so that the science of risk assessment is separate from the policy of risk management.

This ERC primarily addresses the process of risk assessment. Risk management is used only in the context of determining whether the levels of risk calculated in the risk assessment are "significant". The MCP (310 CMR 40.0995) states that four criteria must all be met in order to demonstrate that a condition of "no significant risk of harm to the environment" exists or has been achieved:

1. there is no physical evidence of a continuing release of oil and/or hazardous material at or from the disposal site to surface waters and/or wetlands which significantly affects environmental receptors; and

2. there is no evidence of biologically significant harm known or believed to be associated with current or foreseeable future exposure of wildlife, fish, shellfish or other aquatic biota to oil and/or hazardous material at or from the site; and

3. concentrations of oil and/or hazardous material at or from the disposal site do not and are not likely to exceed Massachusetts Surface Water Quality Standards as promulgated at 314 CMR 4.00 (and as amended) at current and reasonably foreseeable exposure points; and

4. there is no indication of the potential for biologically significant harm to environmental receptors, considering their location and the fate and transport characteristics of the OHM at or from the site, currently or for any foreseeable period of time.

With these points in mind, the results of the ERC conducted at the Cpl. Gordon Craig U.S. Army Reserve Center are summarized below.

There is no physical evidence of a continuing release of oil and/or hazardous material at or from the Site to surface waters and/or wetlands. The total potential daily doses for the representative vertebrate wildlife species, based on mean and maximum EPCs, did not exceed any TRVs (i.e., all HQs are less than 1). Therefore, there is no evidence of risk of biologically significant harm or the potential for biologically significant harm associated with current or foreseeable future exposure of wildlife to oil and/or hazardous material at or from the Site.

Based on the above, it is concluded that a condition of no significant risk of harm to the environment exists at the Site.

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7. ENVIRONMENTAL FATE AND TRANSPORT OF OIL AND/OR HAZARDOUS MATERIAL

7.1 INTRODUCTION

The previous two sections of this report present the results from the Human Health and Environmental risk assessment for the Site. Based on the risk assessments, COPCs were identified. This section discusses how the contaminant concentration may change with time and how the contaminants may move in the environment. Table 7-1 presents a list of the COPCs qualitatively evaluated in this Fate and Transport section.

7.2 CONTAMINANT TRANSPORT PATHWAYS

The contaminants identified at the Site have the potential to migrate through two principal migration pathways, groundwater and vapor transport, with secondary transport via surface water. The rate of groundwater flow, the direction of groundwater flow, the physical properties of the contaminant and the subsurface soil conditions control the contaminant fate in groundwater. The volatility of the compounds, the depth to groundwater, the vapor-soil interactions, and the vapor permeability of the building control vapor transport. Similarly, the stream bed characteristics (slope, roughness) and surface water flow velocity control transport of contaminants sorbed to sediments.

7.3 FATE AND TRANSPORT PROCESSES

The following section provides a brief review of the major contaminant fate and transport properties and processes that influence the mobility of contaminants in the environment. When released into the environment, most organic chemicals undergo a variety of reactions or processes that affect their transport potential and final fate. For example, given a significant amount of time, all petroleum compounds will break down into carbon dioxide and water (mineralization). Whereas, metals have a more limited set of processes that they undergo. Processes that may be important to the Site include the following:

- Solution/Dissolution
- Sorption
- Physical Transport Mechanisms
- Volatilization

7.3.1 Solution/Dissolution

Solution is the partitioning of a chemical between the non-aqueous and dissolved phases. The degree to which a compound is soluble (i.e., solubility) is a function of various factors including salinity, temperature, dissolved organic carbon, oxidation state, polarity, and other factors. Solubility of organic compounds varies from sparingly soluble to infinitely soluble (Lyman et al., 1982). Compounds considered to be very water-soluble generally have water solubilities greater than 1,000 mg/L. Compounds are considered to have moderate water solubilities if their solubilities are between 100 and 1,000 mg/L. Low water solubilities are generally less than 100 mg/L. The solubility data for the COPCs evaluated in this section are presented in Table 7-2.

Based on the solubility data presented in Table 7-2, VOCs, notably acetone, methyl tert-butyl ether (MTBE), methylene chloride, and carbon disulfide, are the most water soluble of the COPCs, and in general VOCs are the most soluble of the COPCs. With the exception of phenol, and to some limited extent naphthalene, the SVOCs and EPH carbon fractions/EPH target compounds typically have low water solubility. With the exception of mercury, metals have low water solubility and tend not to be found in groundwater as dissolved species.

Based on the residual concentrations of COPCs in the soil and groundwater, the solution/dissolution process is not likely to be a significant transport mechanism.

7.3.2 Sorption/Retardation

Sorption is defined as the interaction of an organic or inorganic contaminant with a solid (Piwoni and Keeley, 1996). Sorption processes can be classified as adsorption (adhesion to the solid's surface) and absorption (penetration into the solid). The discussion below covers only the adsorption processes, since absorption can only occur when the aquifer particles are porous so that the solute can diffuse into the particle and be sorbed onto the interior surfaces. Due to the fine-grained nature of the sediments encountered, this process is not an appropriate fate and transport process for the Site.

Adsorption mechanisms are typically the dominant processes causing retention of large molecular weight organic molecules and inorganic compounds. Adsorption may be a significant process in the fate and transport of contaminants, because it can retard the transport of COPCs and in some situations act as a residual source of contamination, thereby extending the period of contamination. Also, transformation reactions such as biodegradation are affected by the degree of adsorption.

Adsorption is defined as the interaction of a solute with sorption sites on a solid surface and is a function of various properties of a given contaminant and the nature of the aqueous and solid media. Contaminant properties that influence sorption for the COPCs include the amount of organic carbon in decimal percent (fraction of organic carbon (f_{oc})) present in the soil/sediment, water solubility, and the soil-water partition coefficient (K_{oc}). Organic carbon data was obtained during the sediment sampling program from the intermittent stream. Including a field duplicate sample, the minimum and maximum % TOC were 0.44% and 3.64%, respectively, with an average concentration based on five data points of 1.25% TOC.

The partitioning ability of the chemical to be sorbed to the host media (soil) or to be released to the pore water (groundwater) is directly related to the chemical's K_{oc} and the soil/sediment f_{oc}. The distribution coefficient for organic chemicals, K_d, is calculated using the following equation: $K_d = f_{oc} * K_{oc}$. The soil-water partitioning coefficient for inorganic compounds is more complex and is affected by numerous geochemical parameters and processes, including pH, sorption to clays, organic matter, iron oxides, and other soil constituents; oxidation-reduction conditions, major ion chemistry, and the chemical form of the metal. The number of significant influencing parameters, and differences in experimental methods, results in as much as seven orders of magnitude variability in measured metal K_d values reported in the literature.

Table 7-3 includes the K_{oc} and the calculated K_d based on an f_{oc} of 0.44% or in decimal percent, 0.0044 for organic compounds. The lower range was chosen as a point of comparison for inorganic compounds, since the source of the K_d data for inorganic compounds, provided in

Table 7-3, corresponds to an upper level value used to model inorganic compounds using the MINTEQ model.

Based on the K_{oc}, f_{oc} and K_d values presented in Table 7-3, the VOCs, notably acetone, MTBE, methylene chloride, and phenol, have an affinity for the water phase, whereas the SVOCs, namely the heavy molecular weight PAHs and the individual EPH carbon range fractions, have an affinity to be sorbed to soils.

With respect to inorganics, K_d values vary widely. Metals tend to be less mobile than the VOCs, but more mobile than the SVOCs, principally the PAHs. Of the metals determined to be COPCs, barium and selenium showed the greatest potential for being present in an aqueous matrix.

The retardation factor of a compound can be determined based on the distribution coefficient, K_d, of a compound, the net effective porosity of the soil, and the soil bulk density. Based on a silty sand matrix representative of the aquifer matrix, a dry bulk density of 1.47 g/mL and an estimated net effective porosity of 16 percent (Fetter, 1994), the retardation factor for each compound was determined. Retardation factors are presented in Table 7-4 and determined as follows:

$$Rf = 1 + (P_b/n) \times K_d$$

Where:

Rf	=	retardation factor, unitless
P_b	=	dry bulk density, g/mL
n	=	net effective porosity, as void fraction
K_d	=	K_{oc} *f_{oc} (for organic compounds solely), mL/g
f_{oc}	=	fraction of organic carbon, decimal percent
K_{oc}	=	partitioning coefficient, mL/g

As indicated by the calculated retardation values, acetone, MTBE, and phenol would likely travel at approximately the same rate of flow as groundwater, and are not significantly retarded. Other compounds such as toluene, ethylbenzene, and xylene would be retarded by as much as 13.5 times that of static groundwater flow. In general, the SVOCs (including the PAHs) and metals, with the exception of phenol, naphthalene, and barium, tend to be significantly retarded in comparison to the VOCs, and therefore would likely not migrate through the unsaturated zone to the water table. The more mobile contaminants may leach to the underlying saturated zone and be transported with groundwater, however, based on the residual concentrations of COPCs in the soil and groundwater, the sorption/retardation process is not likely to be a significant fate and transport mechanism.

7.3.3 Physical Transport Mechanisms

Other physical transport mechanisms that may be important to the site include the following:

- molecular diffusion (diffusion),
- advection,
- dispersion,
- physical transport

Diffusion is a physical process that occurs in subsurface environments. Diffusion will occur in any environment that has a concentration gradient. The magnitude of the gradient determines the rate of the reaction. Under normal conditions, areas of higher concentration move to areas of lower concentration since the system wants to be in equilibrium. The difference between the high and low concentration is related to the concentration gradient. This process tends to spread the contamination outward in all directions from the source. Based on the residual concentration of COPCs in the soil and groundwater, diffusion is not likely to be a significant physical transport mechanism.

Advection is a process where dissolved contaminants are carried along with bulk groundwater flow. Many different advection transport models are used to describe the flows of groundwater and contaminants through subsurface media. Factors affecting the advective transport include contaminant concentration, hydraulic gradient, hydraulic conductivity, and effective porosity (Fetter, 1993). The one-dimensional mass flux due to advection can be calculated using the variables identified. Advection is not a significant transport mechanism for this site since retardation and dilution (via precipitation and flow path) will continue to minimize migration of or reduce the COPC's concentration.

The mixing of contaminants through soil pore spaces in the subsurface is called mechanical dispersion. There are three ideas associated with this type of fluid transport (Fetter, 1993). Fluid will move faster through the center of pores than along the edges. Some fluid molecules may travel along longer flow paths than others to go the same linear distance. Fluid will flow faster through larger pores than smaller ones.

Considering the situations discussed above, not all fluid is traveling at the same velocity, allowing mixing along the flow path, thereby causing some degree of dilution. Dispersion can occur in the longitudinal or transverse direction. Many equations can be developed representing dispersion coefficients.

Dispersion may play a significant role in spreading the contamination laterally in the groundwater media. Site contaminants likely to disperse and spread in groundwater are ones with low K_{oc} and K_d values, namely VOCs and SVOCs, naphthalene and phenol. Due to the low hydraulic conductivity of the aquifer matrix, COPCs in groundwater are not anticipated to spread laterally or vertically due principally to the hydraulic conductivity of site sediments. As such, dispersion is not considered a significant fate and transport process.

Transport of COPCs sorbed to sediments within the intermittent stream is not expected to be a significant fate and transport process due to the observed stream flow required for a particle to be "lifted" from the stream bed and transported downstream. Based on stream flow velocity, and the physical requirements needed for physical transport, migration of COPCs in sediment is not considered significant.

7.3.4 Volatilization

Volatilization is a physical process that depends on the thermodynamic properties of a chemical and the effects of environmental factors. VOCs have been identified in areas proximate to the USAR Center.

Volatilization of VOCs may occur from groundwater into soil gas within the vadose zone. The rate of volatilization depends upon temperature, vapor pressure, and the difference in concentration between the liquid and vapor phases. The emissions from a source can be estimated with the use of Henry's Law constants, equilibrium chemistry, and other site-specific factors. Henry's Law is used for dilute solutions and represents the ratio of the concentration in the gas to the liquid concentration. Table 7-5 lists the vapor pressures and Henry's Law constants for the detected constituents at the site.

From the information presented in Table 7-5, the higher the Henry's Law constant the greater likelihood that the compound will be present in the gas phase surrounding the liquid. Temperature and the chemical composition of water significantly affect Henry's Law constants.

Henry's Law is proportionally related to the vapor pressure and molecular weight of the compound and inversely proportional to the compound solubility. As depicted in Table 7-5, SVOCs tend to have low Henry's Law constants, and metals are considered to be non-volatile. The VPH carbon fractions, notably the C5-C8 aliphatic compounds and the C9-C12 aliphatic compounds, in addition to the EPH carbon fraction C9-C18 aliphatic compounds, tend to have high Henrys' Law constants relative to the other VOCs. This is predominantly due to the fact that the VOCs have an affinity to water as noted by their water solubility. Since the Site is predominantly paved and groundwater is not in contact with the surface air, volatilization from site COPCs is not expected to be a major transport process.

At sites where the depth to groundwater is shallower than fifteen feet and the groundwater is impacted by VOCs, indoor air may be impacted through volatilization of the VOCs from groundwater into soil gas followed by soil gas transport into the building structure. As described above, the factor describing volatilization from groundwater to soil gas is Henry's Law Constant. The factor describing the transport from soil gas to indoor air is the attenuation factor. As part of the risk assessment, this transport process was evaluated and determined not to pose a risk to occupants of an indoor structure.

In summary, residual concentrations of the COPCs are expected to either degrade or mineralize to less harmless substances or remain in the general area of the release. The Fate and Transport evaluation has revealed that COPCs are not expected to significantly impact soil, groundwater, surface water, ambient air, or indoor air at the Site.

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8. FEASIBILITY TO BACKGROUND

Residual contaminants from the former leaking UST and the GFPSA remain at the Site. Based on the nature of the release, petroleum contaminants from the release will biodegrade and are not expected to be persistent in the environment. Additionally, any further remediation activities would have to be conducted in accordance with the Federal procurement process. The remediation of the property to a condition of background using the Federal procurement process would be costly and time consuming. Since the Site has achieved a condition of no significant risk, the cost benefit and timeliness of restoring the Site to background is not practical or warranted.

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9. CONCLUSIONS AND RECOMMENDATIONS

The Phase II Investigation assessed four areas at the Site including: (1) former UST 153; (2) the former gasoline fuel storage pod area (GFPSA); (3) the intermittent stream and drainage swale within the property boundary; and (4) the abandoned (by the City of Brockton) sewer line that transects the subject property in an effort to determine the extent of contamination and whether the Site presents a significant risk.

In order to achieve these goals, a total of 19 soil borings were drilled and sampled to determine the extent of soil contamination due to a release from former UST 153 and the GFPSA. A total of 11 monitoring wells were sampled to determine the extent of groundwater contamination from former UST 153 or the GFPSA. Additionally, four surface soil samples were collected along the length of the drainage swale and four surface water and sediment samples were collected along the length of the intermittent stream as it transverses the west side of the Site. Based on this sampling program, the extent of contamination and a list of the contaminants of potential concern (COPCs) for the Site were determined. Subsequent to the determination of the extent of contamination and COPCs, human health and ecological risk assessments were completed.

A human-health risk assessment was conducted using the soil, groundwater, surface water and sediment samples collected during this investigation. Using these data, it has been determined that there is a Condition of No Significant Risk to human health, public welfare, and safety at the Site for both current land use and for unrestricted future land use.

An Environmental Risk Characterization was conducted for the Site, assessing surface soil, surface water, and sediment exposure pathways. A conclusion of No Significant Risk to the environment has been made for both current and reasonably foreseeable future site conditions.

The Phase II Assessment has determined the extent of contamination from the identified releases at the Site, demonstrated there are no UCL exceedances, demonstrated that a condition of no significant risk has been achieved and that the sources of contamination at the Site have been removed. Based on these data, Stone & Webster believes that no further action is required and that a response action outcome (RAO) class A2 can now be filed for this Site.

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10. LIMITATIONS

The observations made and results presented in this report are believed to be representative of conditions at the time of Stone & Webster's assessment. Any additional information regarding Site conditions or past/current Site use should be brought to Stone & Webster's attention so it may be addressed and incorporated in the Site study. This information could potentially result in modification of Stone & Webster's conclusions and recommendations. This report was prepared, in part, by relying on information provided by others. Although Stone & Webster attempted to verify such information through independent observation, the complete verification is not possible. Stone & Webster is not responsible for the accuracy and veracity of information provided to us by outside parties with respect to the Site.

This report presents the opinions of Stone & Webster, Inc., with respect to the environmental conditions of the Site. The determination of compliance of present or former operators of the Site with federal or state environmental regulations is beyond the scope of Stone & Webster services. The opinions rendered herein are based solely upon the Site conditions at the time of our investigation and are not intended to imply a warranty or a guarantee.

The findings and recommendations contained in this Phase II Report are based in part upon the data obtained from a limited number of soil, sediment, surface water, and groundwater samples. Site sampling and chemical analyses were limited by the scope of Stone & Webster's services. Chemical analyses were performed for certain parameters during this assessment. However, additional chemical constituents not searched for during the study may be present at the Site. Chemical conditions reported reflect conditions only at the locations tested at the time of testing and within the limitations of the methods used. Such conditions can vary rapidly from area to area and from time to time. No warranty is expressed or implied that chemical conditions other than those reported do not exist within the Site.

This report was prepared for the use of the U.S. Army Corps of Engineers, New England District; other parties can not rely on the information contained in this report without the express written consent of Stone & Webster.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AC	Average concentration
ADD	Average daily dose
AMRO	AMRO Environmental Laboratories
AP	Averaging period
ARAR	Applicable or relevant and appropriate requirement
ATC	Allowable threshold concentration
ATEC	ATEC Environmental Consultants
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	Area use factor
AUL	Activity and use limitation
AVS	Acid volatile sulfide
AWQC	Ambient Water Quality Criteria
BAF	Bioaccumulation factor
bgs	Below ground surface
BSAF	Biota-sediment accumulation factor
BW	Body weight
CAEPA	California Environmental Protection Agency
COPC	Chemical of potential concern
CMR	Code of Massachusetts Regulation
CRAVE	Cancer Risk Assessment Verification Endeavor
CRCR	Cumulative receptor cancer risk
CSF	Cancer slope factor
DEP	Department of Environmental Protection
DERP- IRP	Defense Environmental Restoration Program Installation Restoration Program
DOT	Department of Transportation
ED	Exposure duration
EF	Exposure frequency
ELCR	Estimated lifetime cancer risk
EM	Engineering Manager
EP	Exposure period
EPC	Exposure point concentration
EPH	Extractable petroleum hydrocarbons
ERC	Environmental Risk Characterization
ER-L	Effect range-low
ft.	Foot

GLOSSARY OF ABBREVIATIONS AND ACRONYMS (Cont.)

GFPSA	Gasoline fuel pod storage area
GIS	Geographic Information System
GPR	Ground Penetrating Radar
GPS	Geographic Positioning System
HEAST	Health Effects Assessment Summary Tables
HI	Hazard index
HQ	Hazard quotient
ID	Inside diameter
IDW	Investigation-derived waste
IR	Ingestion rate
IRIS	Integrated Risk Information System
kg	Kilograms
LAC	Lifetime average concentration
LADD	Lifetime average daily dose
LNAPL	Light non-aqueous phase liquid
LOAEL	Lowest observable adverse effect level
MADEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MF	Modifying factor
mg	Milligrams
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MRL	Minimal risk level
MTBE	Methyl tert-butyl ether
NAE	New England District
NAPL	Non-aqueous phase liquid
ND	Non-detect
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanographic and Atmospheric Administration
NOAEL	No observable adverse effect level
OHM	Oil or hazardous material
OHMPC	Oil or hazardous materials of potential concern
OMOE	Ontario Ministry of the Environmental
ORNL	Oak Ridge National Laboratory
ORS	Office of Research and Standards
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyl
PEC	Probable effect concentration

GLOSSARY OF ABBREVIATIONS AND ACRONYMS (Cont.)

PID	Photoionization detector
ppm	Part per million
PVC	Polyvinyl chloride
RA	Risk assessment
RAF	Relative absorption factor
RAO	Response Action Outcome
RCRA	Resource Conservation and Recovery Act
RFC	Reference concentration
RFD	Reference dose
RTN	Release tracking number
RUF	Root uptake factor
SAP	Sampling and Analysis Plan
SEM	Simultaneously extracted metals
SF	Slope factor
SI	Site investigation
SOW	Scope of Work
SQC	Sediment quality criteria
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
TEC	Threshold effect concentration
TEL	Threshold effects exposure limits
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
TRV	Toxicity reference value
UCL	Upper concentration limit
UF	Uncertainty factor
µg	Micrograms
µg/kg	Micrograms per kilogram
µg/l	Micrograms per liter
UR	Unit risk
USACE	United States Army Corp of Engineers
USAEHA	United States Army Environmental Hygiene Agency
USAR	United States Army Reserve
USAR Center	USAR Center office building
USARC	United States Army Reserve Center
USEPA	United State Environmental Protection Agency
USGS	United States Geologic Survey
UST	Underground storage tank
UTM	Universal Transverse Mercator
VOC	Volatile organic compounds
VPH	Volatile petroleum hydrocarbons
VR	Respiration rate

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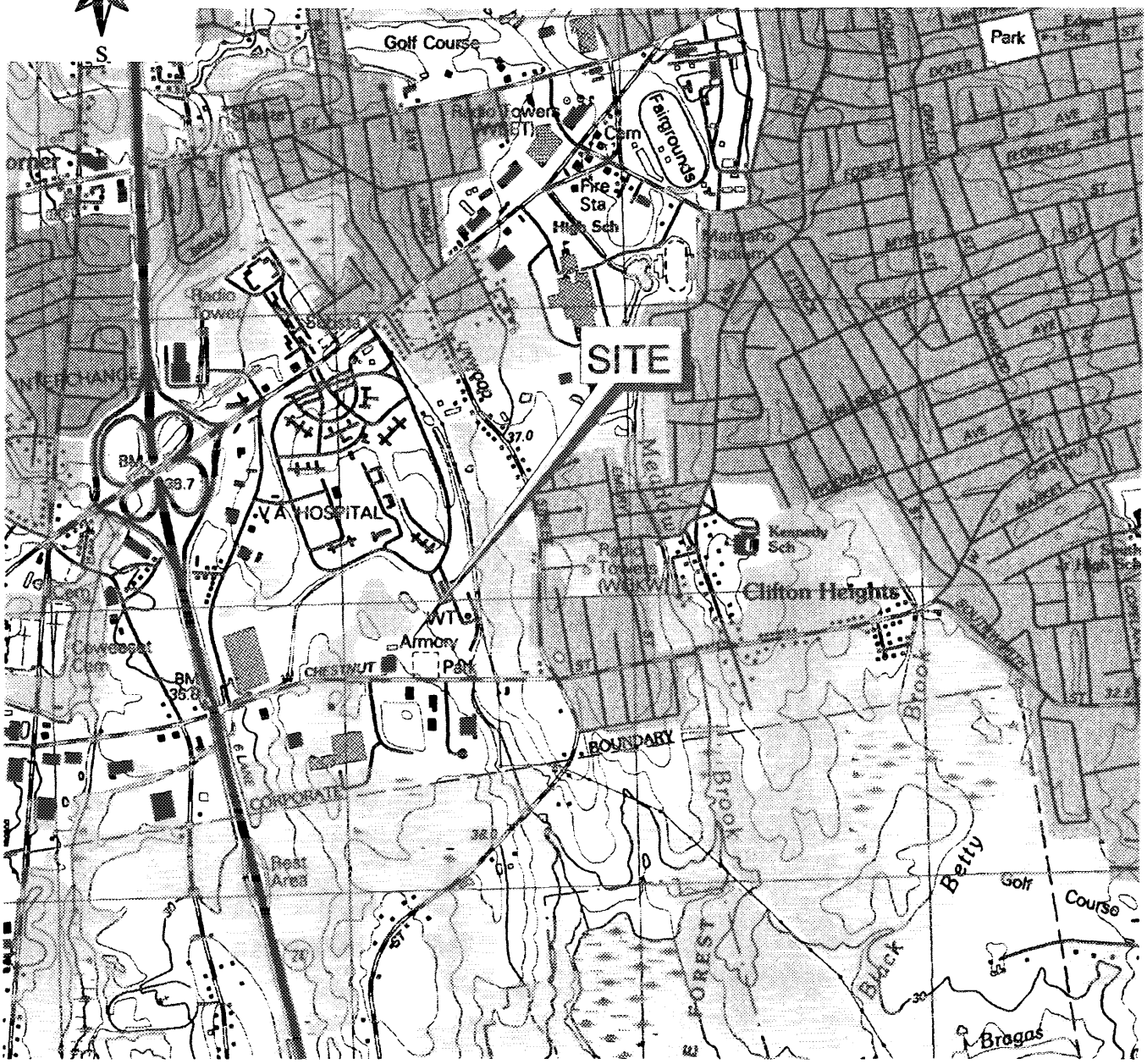
FIGURES



0 2000 4000 6000 8000

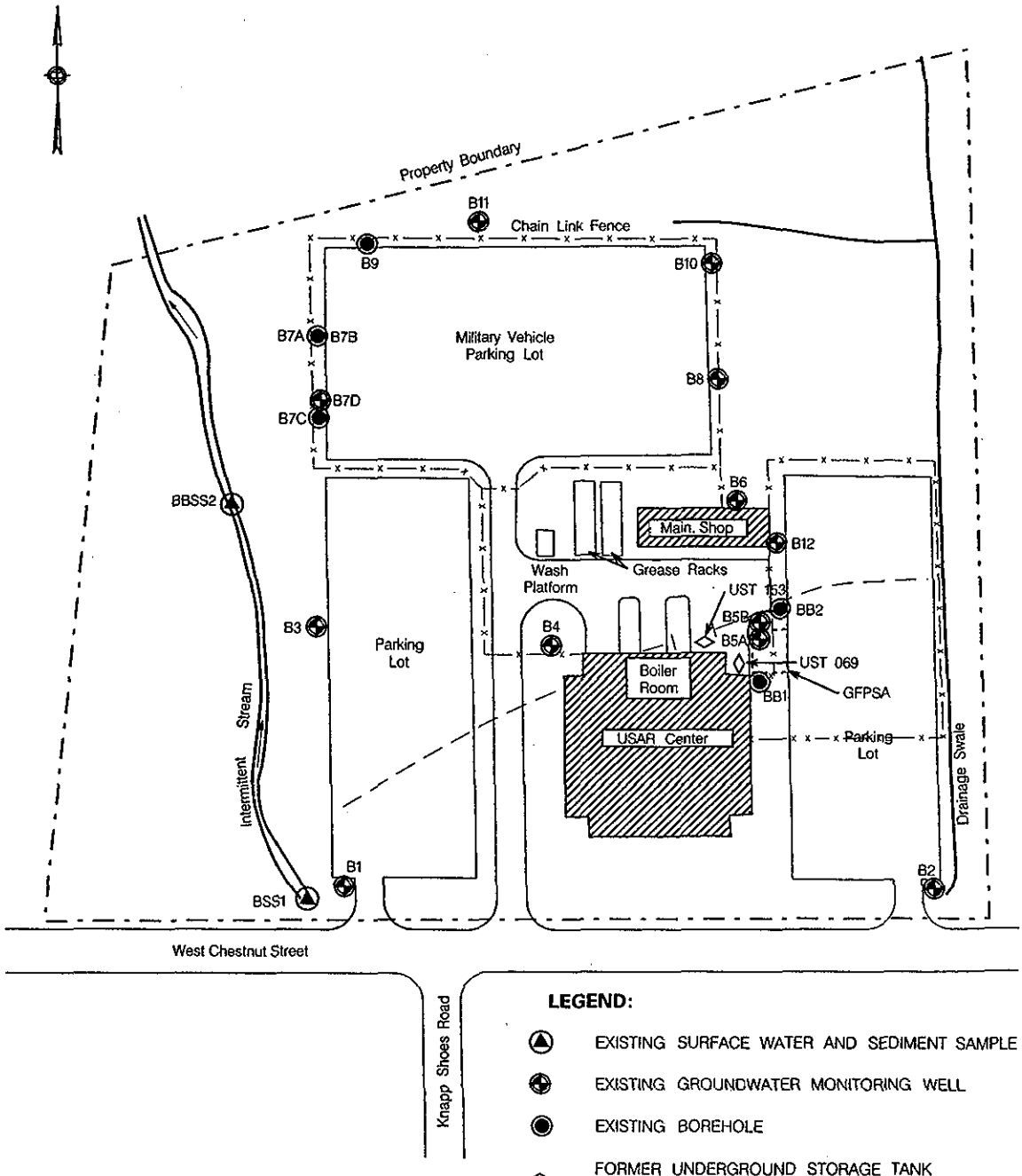
Scale 1:25000

PHASE II
COMPREHENSIVE
SITE ASSESSMENT
CPL. GORDON CRAIG
U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

Figure 1-1 Locus Map

Base Map : MASSGIS
Image No. 245866, 241866, 237866

Stone & Webster, Inc.
Stoughton, Massachusetts



LEGEND:

- EXISTING SURFACE WATER AND SEDIMENT SAMPLE
- EXISTING GROUNDWATER MONITORING WELL
- EXISTING BOREHOLE
- FORMER UNDERGROUND STORAGE TANK (APPROXIMATE LOCATION)
- ABANDONED SEWER LINE (BASED ON 1999 GPR SURVEY)

GFPSA - APPROXIMATE LOCATION OF FORMER GASOLINE FUEL POD STORAGE AREA

SOURCE: GEOHYDROLOGIC STUDY NO. 38-26-KN96-93, CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER, BROCKTON, MASSACHUSETTS, USAEHA, 1992

0 150 300 FEET

1" = 150'-0"

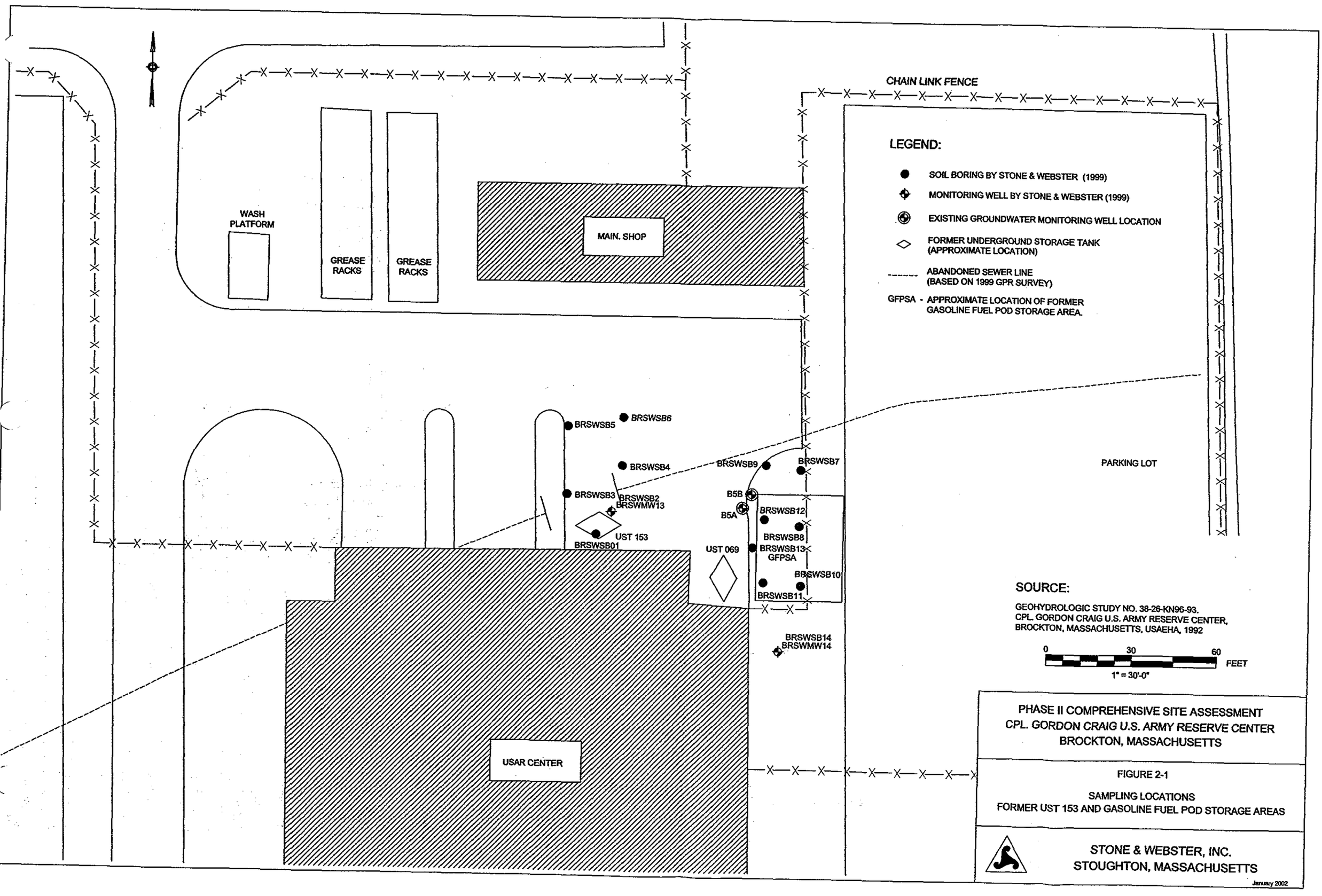
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

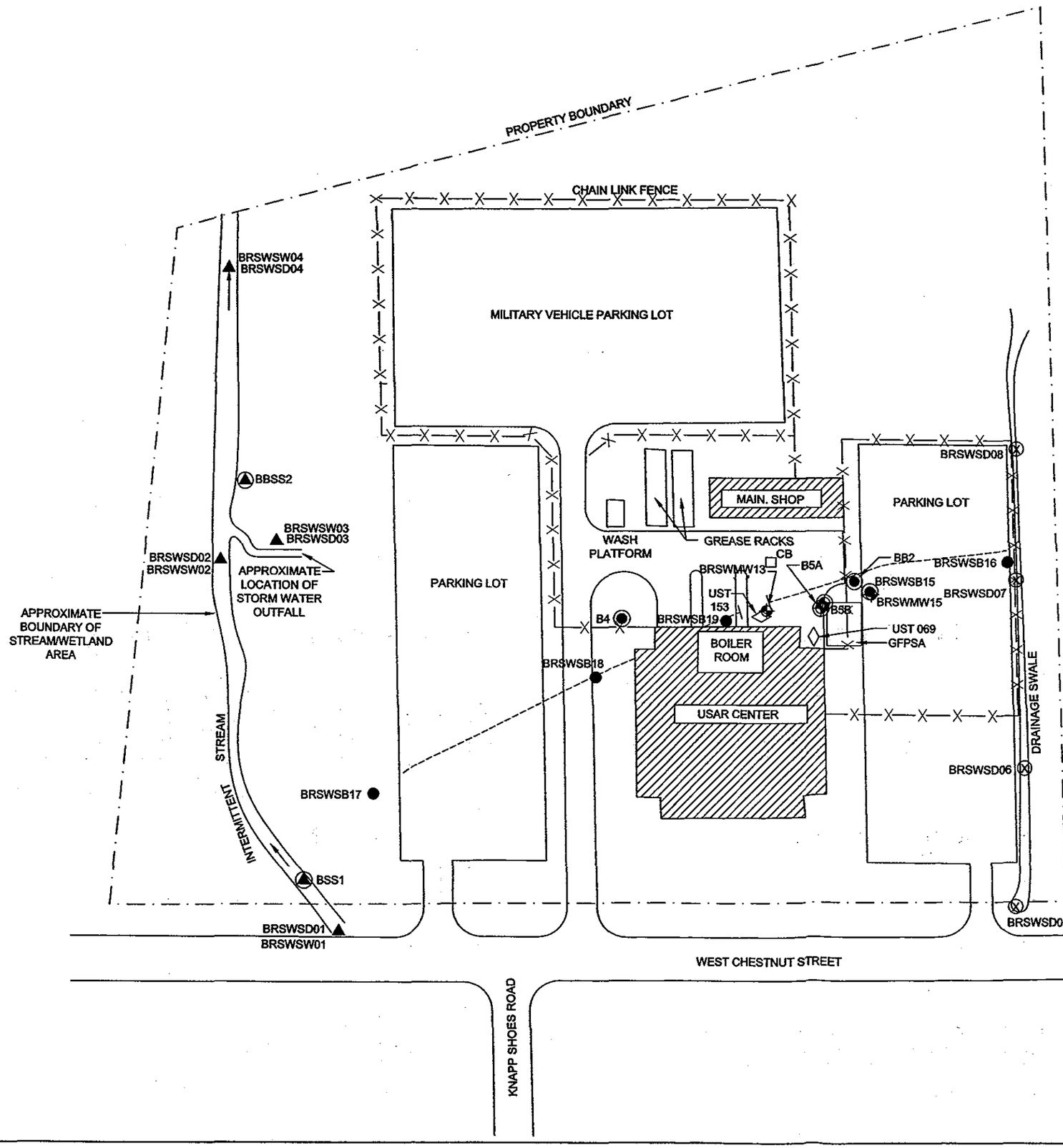
FIGURE 1-2
PREVIOUS SAMPLING LOCATIONS

STONE & WEBSTER, INC.
STOUGHTON, MASSACHUSETTS

January 2002

k:\33\esk\a\04\fig1-2.dgn 30-JAN-2002 12:12


CHAIN LINK FENCE
WASH PLATFORM
GREASE RACKS
GREASE RACKS
MAIN. SHOP
LEGEND:
SOIL BORING BY STONE & WEBSTER (1999)
MONITORING WELL BY STONE & WEBSTER (1999)
EXISTING GROUNDWATER MONITORING WELL LOCATION
FORMER UNDERGROUND STORAGE TANK (APPROXIMATE LOCATION)
ABANDONED SEWER LINE (BASED ON 1999 GPR SURVEY)
GFPSA - APPROXIMATE LOCATION OF FORMER GASOLINE FUEL POD STORAGE AREA.
BRSWSB6
BRSWSB5
BRSWSB4
BRSWSB3
BRSWSB2
BRSWMW13
UST 153
BRSWSB01
BRSWSB9
BRSWSB7
B5B
B5A
BRSWSB12
BRSWSB8
UST 069
BRSWSB13
GFPSA
BRSWSB10
BRSWSB11
BRSWSB14
BRSWMW14
PARKING LOT
USAR CENTER
SOURCE:
GEOHYDROLOGIC STUDY NO. 38-26-KN96-93.
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER,
BROCKTON, MASSACHUSETTS, USAEHA, 1992
0
30
60
FEET
1" = 30'-0"
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS
FIGURE 2-1
SAMPLING LOCATIONS
FORMER UST 153 AND GASOLINE FUEL POD STORAGE AREAS
STONE & WEBSTER, INC.
STOUGHTON, MASSACHUSETTS
January 2002



LEGEND:

- SEDIMENT/SURFACE WATER SAMPLE BY USAEHA (1992)
- SOIL BORING BY USAEHA (1992)
- EXISTING MONITORING WELL
- SEDIMENT AND SURFACE WATER SAMPLE BY STONE & WEBSTER
- SOIL BORING BY STONE & WEBSTER
- MONITORING WELL BY STONE & WEBSTER
- SURFACE SOIL SAMPLE BY STONE & WEBSTER
- FORMER UNDERGROUND STORAGE TANK (APPROXIMATE LOCATION)
- ABANDONED SEWER LINE (BASED ON 1999 GPR SURVEY)
- CB CATCH BASIN

GFPSA - APPROXIMATE LOCATION OF FORMER GASOLINE FUEL POD STORAGE AREA.

SOURCE:

GEOHYDROLOGIC STUDY NO. 38-26-KN96-93.
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER,
BROCKTON, MASSACHUSETTS, USAEHA, 1992

0 100 200 FEET
1" = 100'-0"

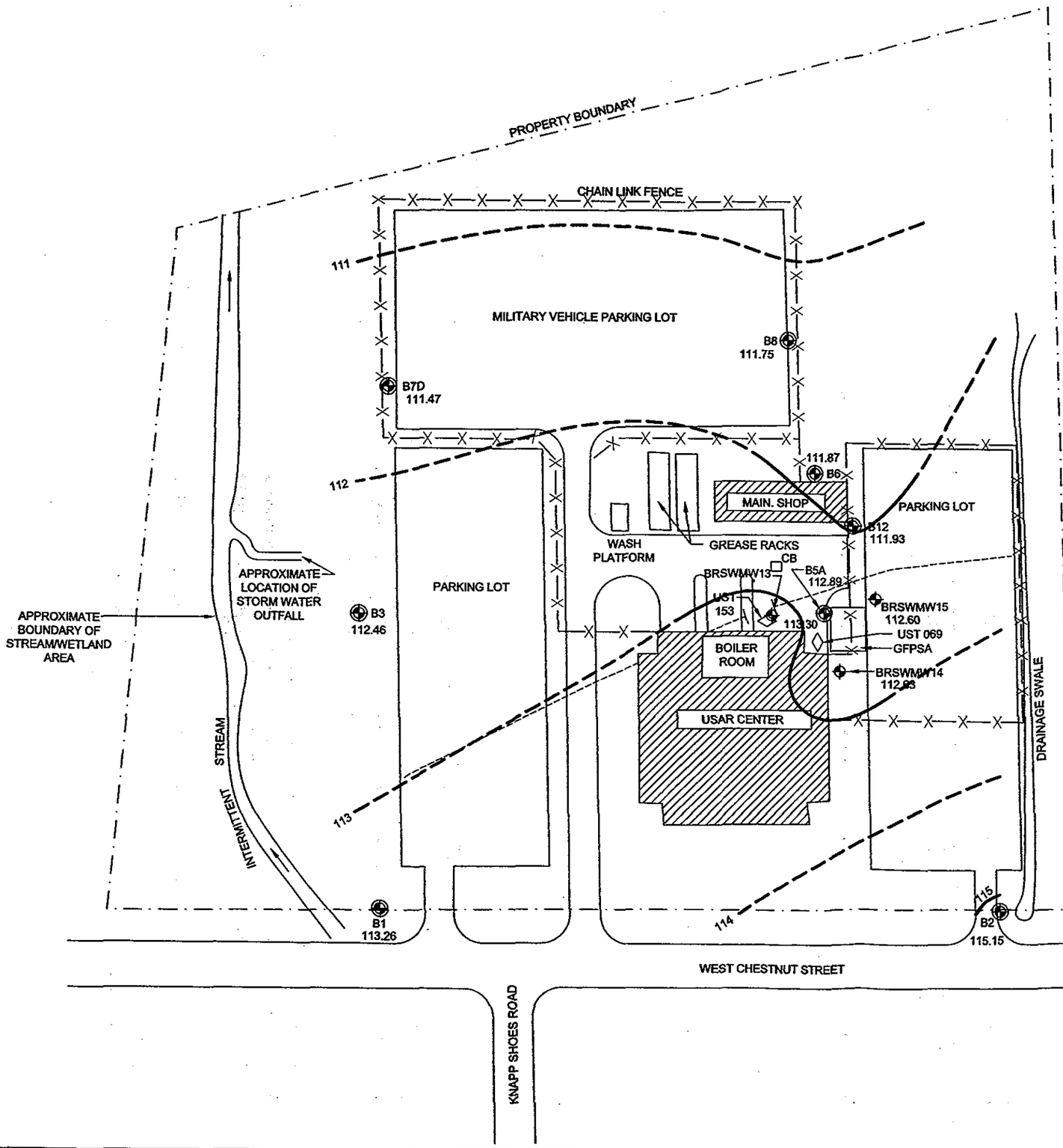
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

FIGURE 2-2

SAMPLING LOCATIONS
STREAM AND DRAINAGE SWALE SAMPLES
SOIL BORINGS ASSOCIATED WITH THE ABANDONED SEWER LINE

STONE & WEBSTER, INC.
STOUGHTON, MASSACHUSETTS

January 2002



LEGEND:

- EXISTING GROUNDWATER MONITORING WELL
- MONITORING WELL BY STONE & WEBSTER
- FORMER UNDERGROUND STORAGE TANK APPROXIMATE LOCATION)
- ABANDONED SEWER LINE (BASED ON 1999 GPR SURVEY)
- GROUNDWATER CONTOUR
- ESTIMATED GROUNDWATER CONTOUR

GFPSA - APPROXIMATE LOCATION OF FORMER GASOLINE FUEL POD STORAGE AREA.

SOURCE:

GEOHYDROLOGIC STUDY NO. 38-26-KN96-93.
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER,
BROCKTON, MASSACHUSETTS, USAEHA, 1992

0 100 200 FEET

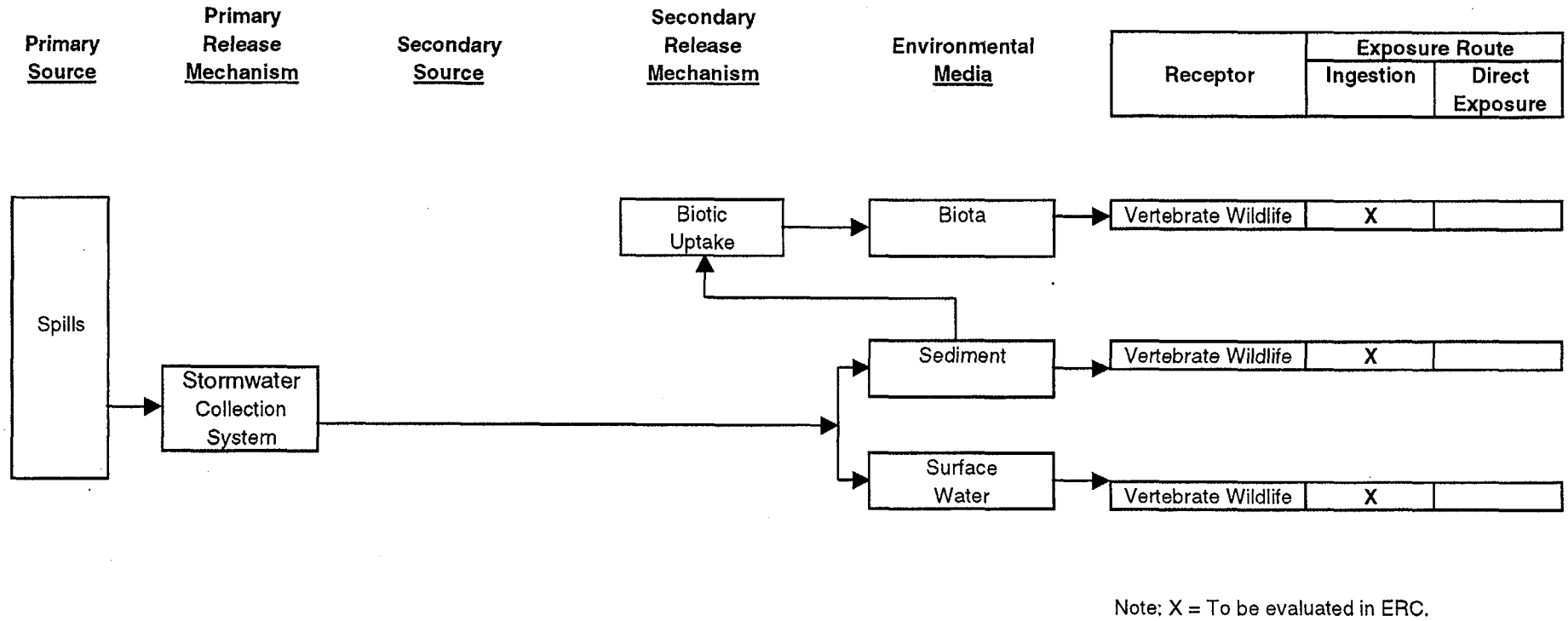
1" = 100'-0"

PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

FIGURE 2-3
GROUNDWATER SAMPLING LOCATIONS
GROUNDWATER CONTOUR MAP
NOVEMBER 29, 1999

STONE & WEBSTER, INC.
STOUGHTON, MASSACHUSETTS

January 2002



Note: X = To be evaluated in ERC.

FIGURE 6-1
CONCEPTUAL SITE MODEL
ENVIRONMENTAL RISK CHARACTERIZATION
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

FIGURE 6-2A
MODEL FOR ESTIMATION OF FOOD COMPOUND CONCENTRATIONS
ENVIRONMENTAL RISK CHARACTERIZATION
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Estimated Food Compound Concentration:

Aquatic Invertebrate Prey Compound Concentration (mg/kg)	=	BSAF	X	Sediment Concentration (mg/kg)

Where: BSAF = Biota/Sediment Accumulation Factor - See Table 6-6.

FIGURE 6-2B
MODEL FOR EXPOSURE ESTIMATES
ENVIRONMENTAL RISK CHARACTERIZATION
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Exposure Estimates:

$$\text{Sediment Compound Exposure (mg/kg/day)} = \frac{\text{Fraction of Diet as Sediment} \times \text{IRdiet (kg/day)} \times \text{Sediment Compound Concentration (mg/kg)} \times \text{AUF} \times \text{ED}}{\text{Body Weight (kg)}}$$

$$\text{Surface Water Compound Exposure (mg/kg/day)} = \frac{\text{Surface Water Ingestion Rate (L/day)} \times \text{Surface Water Concentration (mg/L)} \times \text{AUF} \times \text{ED}}{\text{Body Weight (kg)}}$$

$$\text{Aquatic Invertebrate Prey Exposure (mg/kg/day)} = \frac{\text{Fraction of Diet as Invertebrate Prey} \times \text{IRdiet (kg/day)} \times \text{Estimated Invertebrate Prey Compound Concentration (mg/kg)} \times \text{AUF} \times \text{ED}}{\text{Body Weight (kg)}}$$

Where:

IRdiet = Food ingestion rate of receptor (kg of food per day) - See Table 6-7.
AUF = Area Use Factor (site area [acres] divided by home range [acres])(not greater than 1) - See Table 6-7.
ED = Exposure Duration - See Table 6-7.

FIGURE 6-2C
MODEL FOR ESTIMATION OF POTENTIAL DIETARY EXPOSURES FOR REPRESENTATIVE WILDLIFE SPECIES
ENVIRONMENTAL RISK CHARACTERIZATION
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Star-Nose Mole Total Potential Dietary Exposure

Total Potential Dietary Exposure (mg/kg/day)	=	Invertebrate Prey Exposure (mg/kg/day)	+	Surface Water Exposure (mg/kg/day)	+	Sediment Exposure (mg/kg/day)

Marsh Wren Total Potential Dietary Exposure

Total Potential Dietary Exposure (mg/kg/day)	=	Invertebrate Prey Exposure (mg/kg/day)	+	Surface Water Exposure (mg/kg/day)	+	Sediment Exposure (mg/kg/day)

TABLES

Table 2-1
Description of Soil Borings
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Sample ID	Sample Depth (ft bgs)	Substrate	PID Reading (ppm)
BRSWSB01	(0-2)	Sandy fill, poorly sorted,angular to subround,5-7% gravel upto 0.5 in. max., mainly medium subround sand, 5-7% fines, very loose, wet, brown.	0.0
BRSWSB02	(6-8)	Silty sand, subangular to subround, poorly sorted, 5-10% gravel upto 0.5 in. max., mainly coarse to fine sand, 10-15% fines, dense, wet, grayish green, petroleum odor present.	11.8
BRSWSB03	(4-6)	Silty sand,subround to round, moderately sorted, 5-7% fine gravel upto 0.2 in. max., mainly medium to fine sand, 15-20% fines, wet, dense, tanish gray.	0.1
BRSWSB04	(6-8)	Silty sand, moderately sorted, subround to round, 5-10% upto1.0 in. max, mainly medium sand, 10-15% fines, damp, dense, tanish gray.	0.3
BRSWSB05	(4-6)	Silty sand, moderately sorted, subround to round, 5-10% upto 0.25in. max, mainly medium sand, 10-15%fines, wet, dense, tanish gray	0.2
BRSWSB06	(4-6)	Silty sand, moderately sorted, subround to round, 5-10% upto 0.25in. max, mainly medium sand, 10-15%fines, wet, dense, tanish gray	0.0
BRSWSB07	(0-3)	Sandy fill, poorly sorted, angular to subround, 5-10% gravel upto 1.0 in. max., mostly coarse to medium subangular to subrounded, 5-10% fines, moist, dense, brown.	0.2
BRSWSB08	(0-3)	Sandy fill, poorly sorted, angular to subround, 5-10% gravel upto 0.5 in. max., mostly coarse to medium subangular, subround, 5-10% fines, moist, dense, brown.	0.3
BRSWSB09	(0-3)	Sandy fill, poorly sorted, angular to subround, 5-7% gravel upto 0.5 in. max., mostly coarse to medium subangular to subrounded sand 5-10% fines, moist, dense, brown.	0.2
	(6-8)	Gravelly sand, poorly sorted, subangular, coarse gravel upto 1.5 in. max, subangular to subround, medium to fine sand, 5-10% fines, dense, damp, light brown to gray.	0.5
BRSWSB10	(0-3)	Sandy fill , poorly graded, angular to subround, 5-7% gravel upto 1.5 in. max., mostly coarse to medium subangular to subrounded sand, 5-10% fines, dense moist, brown.	0.2
	(3-5)	Gravelly sand, angular to subround, 10-15% gravel upto 1.5 in.max., mostly subround poorly sorted, coarse to fine, sand, 5-10% fines, very dense, moist brown to light brown.	0.1
BRSWSB11	(0-3)	Sandy fill , poorly sorted, angular to subround, 5-7% gravel upto 1.5 in. max., mostly coarse to medium subangular to subrounded sand, 5-10% fines, dense moist, brown	0.1
	(3-5)	Gravelly sand, angular to subround, 10-15% gravel upto 1.5 in.max., mostly subround poorly sorted, coarse to fine, sand, 5-10% fines, very dense, very wet and loose, brown to light brown.	0.0

Table 2-1
Description of Soil Borings
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Sample ID	Sample Depth (ft bgs)	Substrate	PID Reading (ppm)
BRSWSB12	(0-3)	Sandy fill , poorly sorted, angular to subround, 5-7% gravel upto 1.5 in. max., mostly coarse to medium subangular to subrounded sand, 5-10% fines, loose, moist, brown.	0.1
BRSWSB13	(0-3)	Sandy fill , poorly sorted, angular to subround, 5-7% gravel upto 1.5 in. max., mostly coarse to medium subangular to subrounded sand, 5-10% fines, medium dense, moist, brown.	0.1
BRSWSB14	(0-2)	Sandy fill , poorly sorted, subangular to subrounded, 5-7% gravel upto 0.5 in. max., mainly medium grained subrounded sand, 5-10% fines, loose,moist, dark brown to brown.	0.1
BRSWSB15	(6-8)	Gravelly, silty, sand, poorly sorted, subangular to subround medium to fine sand, 10-15% gravel, wet, dense tan to gray.	0.1
BRSWSB16	(6-8)	Gravelly, sand, angular to subround, moderately sorted 10-15% gravel upto 1.0 in. max subround, coarse to fine sand, 5-10% fines, very dense ,moist, brown to light brown.	0.0
BRSWSB17	(6-8)	Gravelly, sand,angular to subround, poorly sorted, 10-15% gravel upto 1.75in.max, changes to well sorted, subround to round, coarse to medium sand 0-5% fines, wet, medium dense, brown.	0.1
BRSWSB18	(4-6)	Gravel sand, poorly sorted, angular to subround, 20-25% gravel upto 0.25 in. max, mostly coarse to medium subangular sand 15% fines,moist, dense, grayish tan.	0.5
BRSWSB19	(6-8)	Silty sand, subround to round moderately sorted, gravel 5-10% upto 0.25 in.max, mostly fine sand, upto 25% fines, wet, loose, grayish tan.	1.1

Table 2-2
Groundwater Elevations
Phase II Comprehensive Site Investigation
Cpl. Gordon Craig U.S. Army Reserve Center
Brockton, MA

STATION/ WELL NO.	NORTHING	EASTING	REF. POINT-TPVC (ft msl)	REF. POINT - TOC (ft msl)	ELEVATION OF GROUND SURFACE (ft msl)	DEPTH TO GROUND WATER (TPVC)	Groundwater Elevation (ft msl)	
							Oct-92	Nov-99
MWB1	2845543.3	777518.6	117.82	118.37	115.18	4.56	112.90	113.26
MWB2	2845542.6	778052.3	119.26	119.66	117.33	4.11	113.20	115.15
MWB3	2845792.9	777499.6	117.69	118.31	115.16	5.23	111.50	112.46
MWB5A	2845794.3	777898.5	120.01	120.20	117	7.12	111.00	112.89
MWB6	2845914.2	777890.5	117.51	118.25	116.24	5.64	110.30	111.87
MWB7D	2846034.2	777496.8	120.23	120.71	117.12	8.76	111.00	111.47
MWB8	2846027.3	777866.1	114.13	114.75	112.81	2.38	110.30	111.75
MWB12	2845869.6	777923.8	117.52	117.57	115.44	5.59	110.30	111.93
MWB13	2845787.2	777846.9	117.15	117.67	117.67	3.85	--	113.30
MWB14	2845736.7	777904.9	117.66	117.85	117.71	5.03	--	112.63
MWB15	2845806.5	777943.7	114.89	115.29	115.29	2.29	--	112.60

Note:
1.) TOC - Top of Casing.
2.) TPVC - Top of PVC pipe.
3.) ft msl - feet above mean sea level
4.) -- - no data available (newly installed wells)

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	UST 153							GFPSA				
Sample ID:			BRSWSB01 (6-8)	BRSWSB02 (6-8)	BRSWSB03 (4-6)	BRSWSB04 (6-8)	BRSWSB05 (4-6)	BRSWSB05D (4-6)	BRSWSB06 (4-6)	BRSWSB07 (0-3)	BRSWSB07D(0-3)	BRSWSB08 (0-3)	BRSWSS09(0-3)	BRSWSB09(6-8)
VOCs (Method 8260B) µg/kg														
1,1,1,2-Tetrachloroethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,1-Dichloroethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,1-Dichloropropene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2,4,-Trimethylbenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2-Dibromoethane (EDB)	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2-Dichloroethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,2-Dichloropropane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,3-dichlorobenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,3-Dichloropropane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1,4-dichlorobenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
1.1-Dichloroethene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
2,2-Dichloropropane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
2-Butanone (MEK)	20		27 U	24 U	37 U	25 U	33 U	26 U	24 U	NA	NA	NA	NA	NA
2-Chlorotoluene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
2-Hexanone	20		27 U	24 U	37 U	25 U	33 U	26 U	24 U	NA	NA	NA	NA	NA
4-Chlorotoluene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
4-isopropyltoluene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	20		27 U	24 U	37 U	25 U	33 U	26 U	24 U	NA	NA	NA	NA	NA
Acetone	20		45	50	200 J	21 J	51 J	26 UJ	24 UJ	NA	NA	NA	NA	NA
Benzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Bromobenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Bromochloromethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Bromodichloromethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Bromoform	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Bromomethane	4		5.5 UJ	4.7 UJ	7.4 UJ	5.0 UJ	6.6 UJ	5.2 UJ	4.9 UJ	NA	NA	NA	NA	NA
Carbon disulfide	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Carbon tetrachloride	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Chlorobenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Chloroethane	4		5.5 UJ	4.7 UJ	7.4 UJ	5.0 UJ	6.6 UJ	5.2 UJ	4.9 UJ	NA	NA	NA	NA	NA
Chloroform	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Chloromethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	4		5.5 UJ	4.7 UJ	7.4 UJ	5.0 UJ	6.6 UJ	5.2 UJ	4.9 UJ	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Dibromochloromethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Dibromomethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Dichlorodifluoromethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Ethylbenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Hexachlorobutadiene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Isopropylbenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
m,p-Xylene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Methyl tert-butyl ether (MTBE)	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Methylene Chloride	20		27 U	15 J	25 J	17 J	33 U	26 U	14 J	NA	NA	NA	NA	NA
Naphthalene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
n-Butylbenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
n-Propylbenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
o-Xylene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
sec-Butylbenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Styrene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
tert-Butylbenzene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Tetrachloroethene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Toluene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Trichloroethene	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Trichlorofluoromethane	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA
Vinyl Chloride	4		5.5 U	4.7 U	7.4 U	5.0 U	6.6 U	5.2 U	4.9 U	NA	NA	NA	NA	NA

See notes page at the end of the table for references.

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	UST 153							GFPSA				
Sample ID:			BRSWSB01 (6-8)	BRSWSB02 (6-8)	BRSWSB03 (4-6)	BRSWSB04 (6-8)	BRSWSB05 (4-6)	BRSWSB05D (4-6)	BRSWSB06 (4-6)	BRSWSB07 (0-3)	BRSWSB07D(0-3)	BRSWSB08 (0-3)	BRSWSS09(0-3)	BRSWSB09(6-8)
SVOCs (Method 8270C) µg/kg														
1,2,4-Trichlorobenzene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
1,2-Diphenylhydrazine	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2,4-Dichlorophenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2,4-Dimethylphenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2,4-Dinitrophenol	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2-Chloronaphthalene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2-Chlorophenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2-Methylnaphthalene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2-Methylphenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
2-Nitroaniline	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
2-Nitrophenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
3-Nitroaniline	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
4-Bromophenyl phenylether	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
4-Chloroaniline	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
4-Methylphenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
4-Nitroaniline	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
4-Nitrophenol	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
Acenaphthene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Acenaphthylene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Anthracene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Benzidine	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Benzo(a)anthracene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Benzo(a)pyrene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Benzoic Acid	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
Benzyl Alcohol	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
bis(2-Chloroethoxy) methane	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
bis(2-Chloroethyl) ether	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Bis(2-chloroisopropyl)ether	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
bis(2-ethylhexyl)phthalate	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Butyl benzyl phthalate	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Carbazole	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Chrysene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Dibenzofuran	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Diethyl phthalate	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Dimethyl phthalate	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Di-n-butylphthalate	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Di-n-octylphthalate	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Fluoranthene	250		280 U	69 J	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Fluorene	250		280 U	61 J	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Hexachlorobenzene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Hexachlorobutadiene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Hexachloroethane	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Isophorone	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Naphthalene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Nitrobenzene	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
N-nitrosodimethylamine	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
n-Nitroso-di-n-propylamine	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
n-Nitrosodiphenylamine	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Pentachlorophenol	500		560 U	540 U	610 U	540 U	560 U	550 U	560 U	NA	NA	NA	NA	NA
Phenanthrene	250		280 U	70 J	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Phenol	250		280 U	270 U	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA
Pyrene	250		280 U	72 J	300 U	270 U	280 U	280 U	280 U	NA	NA	NA	NA	NA

See notes page at the end of the table for references.

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	UST 153							GFPSA				
Sample ID:			BRSWSB01 (6-8)	BRSWSB02 (6-8)	BRSWSB03 (4-6)	BRSWSB04 (6-8)	BRSWSB05 (4-6)	BRSWSB05D (4-6)	BRSWSB06 (4-6)	BRSWSB07 (0-3)	BRSWSB07D(0-3)	BRSWSB08 (0-3)	BRSWSS09(0-3)	BRSWSB09(6-8)
VPH (MADEP Method) mg/kg														
C5-C8 Aliphatic (3,4)	2.5		NA	2.6 U	NA	NA	2.5 U	2.3 U	NA	2.2 U	1.9 U	1.9 U	1.3 U	2.0 U
C9-C12 Aliphatic(3,5)	0.62		NA	0.66 U	NA	NA	0.62 U	0.58 U	NA	0.56 U	0.48 U	0.47 U	0.32U	0.50 U
C9-C10 Aromatics(3)	0.62		NA	0.66 U	NA	NA	0.62 U	0.58 U	NA	0.56 U	0.48 U	0.47 U	0.32 U	0.50 U
Benzene	0.05		NA	0.053 U	NA	NA	0.050 U	0.047 U	NA	0.045 U	0.038 U	0.038U	0.025 U	0.040U
Ethylbenzene	0.05		NA	0.053 U	NA	NA	0.050 U	0.047 U	NA	0.045 U	0.038 U	0.038U	0.025 U	0.040U
m,p-Xylene	0.05		NA	0.053 U	NA	NA	0.050 U	0.047 U	NA	0.045 U	0.038 U	0.038U	0.025 U	0.040U
Methyl tert-Butyl Ether	0.05		NA	0.053 U	NA	NA	0.050 U	0.047 U	NA	0.045 U	0.038 U	0.038U	0.025 U	0.040U
Napthalene	0.05		NA	0.053 U	NA	NA	0.050 U	0.047 U	NA	0.045 U	0.038 U	0.038U	0.025 U	0.040U
o-Xylene	0.05		NA	0.053 U	NA	NA	0.050 U	0.047 U	NA	0.045 U	0.038 U	0.038U	0.025 U	0.040U
Toluene	0.05		NA	0.053 U	NA	NA	0.050 U	0.047 U	NA	0.023 J	0.038 U	0.038U	0.025 U	0.040U
EPH (MADEP Method) mg/kg														
C9-C18 Aliphatic (1)	49		NA	56 U	NA	NA	54 U	54 U	NA	55 U	52 U	55 U	57 U	55 U
C19-C36 Aliphatic (1)	49		NA	56 U	NA	NA	54 U	54 U	NA	87 EB	52 U	55 U	58 EB	55 U
C11-C22 Aromatics(1,2)	49		NA	56 U	NA	NA	54 U	54 U	NA	65	52 U	55 U	57 U	55 U
2-Methylnaphthalene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Acenaphthene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Acenaphthylene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Anthracene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Benzo(a)anthracene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Benzo(a)pyrene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Benzo(b)fluoranthene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Benzo(g,h,i)perylene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Benzo(k)fluoranthene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Chrysene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Dibenzo(a,h)anthracene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Fluoranthene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Fluorene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Indeno(1,2,3-cd)pyrene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Naphthalene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Phenanthrene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
Pyrene	0.24		NA	0.28 U	NA	NA	0.27 U	0.27 U	NA	0.27 U	0.26 U	0.27 U	0.28 U	0.27 U
RCRA Metals & Antimony (Method 6010B/7000 series) mg/kg														
Antimony	4		5.7 U	5.4 U	6.1 U	5.3 U	5.5 U	5.3 U	5.4 U	NA	NA	NA	NA	NA
Arsenic	5		1.4 J	6.8 U	7.6 U	0.90 J	1.3 J	6.7 U	1.2 J	NA	NA	NA	NA	NA
Barium	20		7.1 J	14 J	18 J	12 J	18 J	13 J	16 J	NA	NA	NA	NA	NA
Cadmium	0.5		0.71 U	0.68 U	0.76 U	0.66 U	0.69 U	0.67 U	0.68 U	NA	NA	NA	NA	NA
Chromium	1		3.4 J	8.1 J	12 J	7.6 J	8.4 J	6.7 J	9.3 J	NA	NA	NA	NA	NA
Lead	5		2.8 J	3.2 J	4.3 J	3.2 J	4.2 J	3.2 J	4.4 J	NA	NA	NA	NA	NA
Selenium	8		11 U	11 U	12 U	11 U	11 U	11 U	11 U	NA	NA	NA	NA	NA
Silver	1.4		2.0 U	1.9 U	2.1 U	1.8 U	1.9 U	1.9 U	1.9 U	NA	NA	NA	NA	NA
Mercury	0.03		0.026 U	0.026 U	0.029 U	0.025 U	0.026 U	0.023 U	0.027 U	NA	NA	NA	NA	NA

See notes page at the end of the table for references.

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	GFPSA								Abandoned Sewer Line				
Sample ID:			BRSWSS10(0-3)	BRSWSB10(3-5)	BRSWSS11(0-3)	BRSWSB11(3-6)	BRSWSS12(0-3)	BRSWSB12(3-6)	BRSWSB13(0-3)	BRSWSB14(0-2)	BRSWSB15	BRSWSB16(6-8)	BRSWSB17	BRSWSB18(4-6)	BRSWSB19
VOCs (Method 8260B) µg/kg															
1,1,1,2-Tetrachloroethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,1,1-Trichloroethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,1,2,2-Tetrachloroethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,1,2-Trichloroethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,1-Dichloroethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,1-Dichloropropene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,2,3-Trichlorobenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 U	5.3 U	4.2 U
1,2,3-Trichloropropane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,2,4-Trimethylbenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	230
1,2,4-Trichlorobenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 U	5.3 U	4.2 U
1,2-Dibromo-3-chloropropane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 U	5.3 U	4.2 U
1,2-Dibromoethane (EDB)	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,2-Dichlorobenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 U	5.3 U	4.2 U
1,2-Dichloroethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,2-Dichloropropane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,3,5-Trimethylbenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	38
1,3-dichlorobenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,3-Dichloropropane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1,4-dichlorobenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
1.1-Dichloroethene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
2,2-Dichloropropane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
2-Butanone (MEK)	20		NA	NA	NA	NA	NA	NA	NA	NA	22 U	23 U	22 U	27 U	21 U
2-Chlorotoluene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
2-Hexanone	20		NA	NA	NA	NA	NA	NA	NA	NA	22 U	23 U	22 U	27 U	21 U
4-Chlorotoluene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 U	5.3 U	4.2 U
4-isopropyltoluene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	44
4-Methyl-2-pentanone (MIBK)	20		NA	NA	NA	NA	NA	NA	NA	NA	22 U	23 U	22 U	27 U	21 U
Acetone	20		NA	NA	NA	NA	NA	NA	NA	NA	22 U	23 U	18 J	28 J	21 U
Benzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Bromobenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Bromochloromethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Bromodichloromethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Bromoform	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 U	5.3 U	4.2 U
Bromomethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 UJ	4.3 UJ	5.3 UJ	4.2 UJ
Carbon disulfide	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Carbon tetrachloride	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Chlorobenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Chloroethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 UJ	4.3 UJ	5.3 UJ	4.2 UJ
Chloroform	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Chloromethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
cis-1,2-Dichloroethene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 UJ	4.3 U	5.3 UJ	4.2 U
cis-1,3-Dichloropropene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Dibromochloromethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 U	5.3 U	4.2 U
Dibromomethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Dichlorodifluoromethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 UJ	5.3 U	4.2 UJ
Ethylbenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	2.1 J
Hexachlorobutadiene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Isopropylbenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	36
m,p-Xylene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	19.0
Methyl tert-butyl ether (MTBE)	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Methylene Chloride	20		NA	NA	NA	NA	NA	NA	NA	NA	22 U	23 U	22 U	19 J	21 U
Naphthalene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 UJ	4.6 U	4.3 U	5.3 U	190
n-Butylbenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
n-Propylbenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	69
o-Xylene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.6
sec-Butylbenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	75
Styrene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
tert-Butylbenzene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Tetrachloroethene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Toluene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
trans-1,2-Dichloroethene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
trans-1,3-Dichloropropene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Trichloroethene	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Trichlorofluoromethane	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U
Vinyl Chloride	4		NA	NA	NA	NA	NA	NA	NA	NA	4.4 U	4.6 U	4.3 U	5.3 U	4.2 U

See notes page at the end of the table for references.

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	GFPSA								Abandoned Sewer Line				
Sample ID:			BRSWSS10(0-3)	BRSWSB10(3-5)	BRSWSS11(0-3)	BRSWSB11(3-6)	BRSWSS12(0-3)	BRSWSB12(3-6)	BRSWSB13(0-3)	BRSWSB14(0-2)	BRSWSB15	BRSWSB16(6-8)	BRSWSB17	BRSWSB18(4-6)	BRSWSB19
SVOCs (Method 8270C) µg/kg															
1,2,4-Trichlorobenzene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 UJ	280 U	270 U	290 U	270 U
1,2-Dichlorobenzene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 UJ	280 U	270 U	290 U	270 U
1,2-Diphenylhydrazine	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
1,3-Dichlorobenzene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 UJ	280 U	270 U	290 U	270 U
1,4-Dichlorobenzene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 UJ	280 U	270 U	290 U	270 U
2,4,5-Trichlorophenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2,4,6-Trichlorophenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2,4-Dichlorophenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2,4-Dimethylphenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2,4-Dinitrophenol	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
2,4-Dinitrotoluene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2,6-Dinitrotoluene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2-Chloronaphthalene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2-Chlorophenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2-Methylnaphthalene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2-Methylphenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
2-Nitroaniline	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
2-Nitrophenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
3,3'-Dichlorobenzidine	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
3-Nitroaniline	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
4,6-Dinitro-2-methylphenol	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
4-Bromophenyl phenylether	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
4-Chloro-3-methylphenol	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
4-Chloroaniline	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
4-Chlorophenyl phenyl ether	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
4-Methylphenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
4-Nitroaniline	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
4-Nitrophenol	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
Acenaphthene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Acenaphthylene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Anthracene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Benzidine	250		NA	NA	NA	NA	NA	NA	NA	NA	R	280 U	270 U	290 U	270 U
Benzo(a)anthracene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Benzo(a)pyrene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Benzo(b)fluoranthene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Benzo(g,h,i)perylene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Benzo(k)fluoranthene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Benzoic Acid	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
Benzyl Alcohol	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
bis(2-Chloroethoxy) methane	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
bis(2-Chloroethyl) ether	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Bis(2-chloroisopropyl)ether	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
bis(2-ethylhexyl)phthalate	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Butyl benzyl phthalate	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Carbazole	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Chrysene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Dibenz(a,h)anthracene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Dibenzofuran	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	64 J
Diethyl phthalate	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Dimethyl phthalate	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Di-n-butylphthalate	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Di-n-octylphthalate	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Fluoranthene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Fluorene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	110 J
Hexachlorobenzene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Hexachlorobutadiene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Hexachlorocyclopentadiene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Hexachloroethane	250		NA	NA	NA	NA	NA	NA	NA	NA	280 UJ	280 U	270 U	290 U	270 U
Indeno(1,2,3-cd)pyrene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Isophorone	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Naphthalene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	140 J
Nitrobenzene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
N-nitrosodimethylamine	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
n-Nitroso-di-n-propylamine	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
n-Nitrosodiphenylamine	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Pentachlorophenol	500		NA	NA	NA	NA	NA	NA	NA	NA	560 U	550 U	540 U	570 U	540 U
Phenanthrene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	300
Phenol	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U
Pyrene	250		NA	NA	NA	NA	NA	NA	NA	NA	280 U	280 U	270 U	290 U	270 U

See notes page at the end of the table for references.

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Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	GFPSA								Abandoned Sewer Line				
Sample ID:			BRSWSS10(0-3)	BRSWSB10(3-5)	BRSWSS11(0-3)	BRSWSB11(3-6)	BRSWSS12(0-3)	BRSWSB12(3-6)	BRSWSB13(0-3)	BRSWSB14(0-2)	BRSWSB15	BRSWSB16(6-8)	BRSWSB17	BRSWSB18(4-6)	BRSWSB19
VPH (MADEP Method) mg/kg															
C5-C8 Aliphatic (3,4)	2.5		1.6 U	2.3 U	2.1 U	2.4 U	1.7 U	2.0 U	1.9 U	1.9 U	2.2 U	2.0 U	2.0 U	2.3 U	2.1 U
C9-C12 Aliphatic(3,5)	0.62		0.39 U	0.58 U	0.52 U	0.60 U	0.42 U	0.50 U	0.47 U	0.48 U	0.56 U	0.50 U	0.51 U	0.57 U	1.4
C9-C10 Aromatics(3)	0.62		0.39 U	0.58 U	0.52 U	0.60 U	0.42 U	0.50 U	0.47 U	0.48 U	0.56 U	0.50 U	0.51 U	0.57 U	1.7
Benzene	0.05		0.032 U	0.047 U	0.041 U	0.048 U	0.034 U	0.040 U	0.037 U	0.039 U	0.045 U	0.040 U	0.041 U	0.045 U	0.041 U
Ethylbenzene	0.05		0.032 U	0.047 U	0.041 U	0.048 U	0.034 U	0.040 U	0.037 U	0.039 U	0.045 U	0.040 U	0.041 U	0.045 U	0.041 U
m,p-Xylene	0.05		0.032 U	0.047 U	0.041 U	0.048 U	0.034 U	0.040 U	0.037 U	0.039 U	0.045 U	0.040 U	0.041 U	0.045 U	0.041 U
Methyl tert-Butyl Ether	0.05		0.032 U	0.047 U	0.041 U	0.048 U	0.034 U	0.040 U	0.037 U	0.039 U	0.045 U	0.040 U	0.041 U	0.045 U	0.041 U
Napthalene	0.05		0.032 U	0.047 U	0.041 U	0.048 U	0.034 U	0.040 U	0.037 U	0.039 U	0.045 U	0.040 U	0.041 U	0.045 U	0.052
o-Xylene	0.05		0.032 U	0.047 U	0.041 U	0.048 U	0.034 U	0.040 U	0.037 U	0.039 U	0.045 U	0.040 U	0.041 U	0.045 U	0.041 U
Toluene	0.05		0.032 U	0.047 U	0.041 U	0.048 U	0.034 U	0.040 U	0.037 U	0.039 U	0.045 UJ	0.040 U	0.041 U	0.045 U	0.041 U
EPH (MADEP Method) mg/kg															
C9-C18 Aliphatic (1)	49		53 U	55 U	54 U	53 U	55 U	53 U	53 U	54 U	54 U	54 U	55 U	57 U	55 U
C19-C36 Aliphatic (1)	49		53 U	55 U	54 U	53 U	55 U	53 U	53 U	54 U	71 EB	54 U	55 U	57 U	55 U
C11-C22 Aromatics(1,2)	49		53 U	55 U	54 U	53 U	55 U	53 U	53 U	54 U	54 U	54 U	55 U	57 U	55 U
2-Methylnaphthalene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Acenaphthene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Acenaphthylene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Anthracene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Benzo(a)anthracene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Benzo(a)pyrene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Benzo(b)fluoranthene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Benzo(g,h,i)perylene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Benzo(k)fluoranthene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Chrysene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Dibenzo(a,h)anthracene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Fluoranthene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.16 J	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Fluorene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Indeno(1,2,3-cd)pyrene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Naphthalene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Phenanthrene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
Pyrene	0.24		0.27 U	0.28 U	0.27 U	0.27 U	0.14 J	0.27 U	0.27 U	0.27 UJ	0.27 U	NA	0.27 U	0.29 U	0.27 U
RCRA Metals & Antimony (Method 6010B/7000 series) mg/kg															
Antimony	4		NA	NA	NA	NA	NA	NA	NA	NA	20 J	2.7 J	2.0 J	5.7 U	5.2 U
Arsenic	5		NA	NA	NA	NA	NA	NA	NA	NA	6.7 U	4.8 J	1.5 J	7.2 U	6.6 U
Barium	20		NA	NA	NA	NA	NA	NA	NA	NA	13 J	20 J	12 J	11 J	14 J
Cadmium	0.5		NA	NA	NA	NA	NA	NA	NA	NA	0.67 U	0.64	0.65 U	0.72 U	0.66 U
Chromium	1		NA	NA	NA	NA	NA	NA	NA	NA	11 J	12 J	7.6 J	4.1 J	8.2 J
Lead	5		NA	NA	NA	NA	NA	NA	NA	NA	3.9 J	7.7	4.0 J	5.0 J	3.4 J
Selenium	8		NA	NA	NA	NA	NA	NA	NA	NA	11 U	10 U	10 U	11 U	10 U
Silver	1.4		NA	NA	NA	NA	NA	NA	NA	NA	1.9 U	1.8 U	1.8 U	2.0 U	1.8 U
Mercury	0.03		NA	NA	NA	NA	NA	NA	NA	NA	0.027 U	0.024 U	0.026U	0.026 U	0.025 U

See notes page at the end of the table for references.

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	Drainage Swale			
Sample ID:			**BRSWSD05**	**BRSWSD06**	**BRSWSD07**	**BRSWSD08**
VOCs (Method 8260B) ug/kg						
1,1,1,2-Tetrachloroethane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,1,1-Trichloroethane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,1,2,2-Tetrachloroethane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,1,2-Trichloroethane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,1-Dichloroethane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,1-Dichloropropene	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2,3-Trichlorobenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2,3-Trichloropropane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2,4,-Trimethylbenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2,4-Trichlorobenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dibromo-3-chloropropane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dibromoethane (EDB)	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dichlorobenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dichloroethane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dichloropropane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,3,5-Trimethylbenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
1,3-dichlorobenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
1,3-Dichloropropane	4		6.7 U	6.8 U	5.9 U	5.4 U
1,4-dichlorobenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
1,1-Dichloroethene	4		6.7 U	6.8 U	5.9 U	5.4 U
2,2-Dichloropropane	4		6.7 U	6.8 U	5.9 U	5.4 U
2-Butanone (MEK)	20		33 U	34 U	29 U	27 U
2-Chlorotoluene	4		6.7 U	6.8 U	5.9 U	5.4 U
2-Hexanone	20		37 U	34 U	29 U	27 U
4-Chlorotoluene	4		6.7 U	6.8 U	5.9 U	5.4 U
4-isopropyltoluene	4		6.7 U	6.8 U	5.9 U	5.4 U
4-Methyl-2-pentanone (MIBK)	20		33 U	34 U	29 U	27 U
Acetone	20	17	19 J	63	20 J	30
Benzene	4		6.7 U	6.8 U	5.9 U	5.4 U
Bromobenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
Bromochloromethane	4		6.7 U	6.8 U	5.9 U	5.4 U
Bromodichloromethane	4		6.7 U	6.8 U	5.9 U	5.4 U
Bromoform	4		6.7 U	6.8 U	5.9 U	5.4 U
Bromomethane	4		6.7 UJ	6.8 UJ	59 UJ	5.4 UJ
Carbon disulfide	4	1	6.7 U	6.8 U	5.9 U	5.4 U
Carbon tetrachloride	4		6.7 U	6.8 U	5.9 U	5.4 U
Chlorobenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
Chloroethane	4		6.7 UJ	6.8 UJ	5.9 UJ	5.4 UJ
Chloroform	4		6.7 U	6.8 U	5.9 U	5.4 U
Chloromethane	4		6.7 U	6.8 U	5.9 U	5.4 U
cis-1,2-Dichloroethene	4		6.7 U	6.8 U	5.9 U	5.4 U

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	Drainage Swale			
Sample ID:			**BRSWSD05**	**BRSWSD06**	**BRSWSD07**	**BRSWSD08**
cis-1,3-Dichloropropene	4		6.7 U	6.8 U	5.9 U	5.4 U
Dibromochloromethane	4		6.7 U	6.8 U	5.9 U	5.4 U
Dibromomethane	4		6.7 U	6.8 U	5.9 U	5.4 U
Dichlorodifluoromethane	4		6.7 UJ	6.8 UJ	5.9 UJ	5.4 UJ
Ethylbenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
Hexachlorobutadiene	4		6.7 U	6.8 U	5.9 U	5.4 U
Isopropylbenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
Xylene (mixed isomers)	4		6.7 U	6.8 U	5.9 U	5.4 U
Methyl tert-butyl ether (MTBE)	4		6.7 U	6.8 U	5.9 U	5.4 U
Methylene Chloride	20		33 U	34 U	29 U	27 U
Naphthalene	4		6.7 U	6.8 U	5.9 U	5.4 U
n-Butylbenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
n-Propylbenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
sec-Butylbenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
Styrene	4		6.7 U	6.8 U	5.9 U	5.4 U
tert-Butylbenzene	4		6.7 U	6.8 U	5.9 U	5.4 U
Tetrachloroethene	4		6.7 U	6.8 U	5.9 U	5.4 U
Toluene	4		6.7 U	6.8 U	5.9 U	5.4 U
trans-1,2-Dichloroethene	4		6.7 U	6.8 U	5.9 U	5.4 U
trans-1,3-Dichloropropene	4		6.7 U	6.8 U	5.9 U	5.4 U
Trichloroethene	4		6.7 U	6.8 U	5.9 U	5.4 U
Trichlorofluoromethane	4		6.7 U	6.8 U	5.9 U	5.4 U
Vinyl Chloride	4		6.7 U	6.8 U	5.9 U	5.4 U
SVOCs (Method 8270C) ug/kg						
1,2,4-Trichlorobenzene	250		350 U	350 U	330 U	310 U
1,2-Dichlorobenzene	250		350 UJ	350 UJ	330 UJ	310 UJ
1,2-Diphenylhydrazine	250		350 U	350 U	330 U	310 U
1,3-Dichlorobenzene	250		350 UJ	350 UJ	330 UJ	310 UJ
1,4-Dichlorobenzene	250		350 UJ	350 UJ	330 UJ	310 UJ
2,4,5-Trichlorophenol	250		350 U	350 U	330 U	310 U
2,4,6-Trichlorophenol	250		350 U	350 U	330 U	310 U
2,4-Dichlorophenol	250		350 U	350 U	330 U	310 U
2,4-Dimethylphenol	250		350 UJ	350 UJ	330 UJ	310 UJ
2,4-Dinitrophenol	500		700 U	690 U	660 U	630 U
2,4-Dinitrotoluene	250		350 U	350 U	330 U	310 U
2,6-Dinitrotoluene	250		350 U	350 U	330 U	310 U
2-Chloronaphthalene	250		350 U	350 U	330 U	310 U
2-Chlorophenol	250		350 U	350 U	330 U	310 U
2-Methylnaphthalene	250		350 U	350 U	330 U	310 U
2-Methylphenol	250	9	350 U	350 U	330 U	310 U
2-Nitroaniline	500		700 U	690 U	660 U	630 U
2-Nitrophenol	250		350 U	350 U	330 U	310 U

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	Drainage Swale			
Sample ID:			**BRSWSD05**	**BRSWSD06**	**BRSWSD07**	**BRSWSD08**
3,3'-Dichlorobenzidine	250		350 UJ	350 UJ	330 UJ	310 UJ
3-Nitroaniline	500		700 U	690 U	660 U	630 U
4,6-Dinitro-2-methylphenol	500		700 U	690 U	660 U	630 U
4-Bromophenyl phenylether	250		350 U	350 U	330 U	310 U
4-Chloro-3-methylphenol	500		700 U	690 U	660 U	630 U
4-Chloroaniline	250		350 U	350 U	330 U	310 U
4-Chlorophenyl phenyl ether	250		350 U	350 U	330 U	310 U
4-Methylphenol	250		350 U	350 U	330 U	310 U
4-Nitroaniline	500		700 U	690 U	660 U	630 U
4-Nitrophenol	500		700 U	690 U	660 U	630 U
Acenaphthene	250		350 U	350 U	330 U	310 U
Acenaphthylene	250		350 U	350 U	330 U	310 U
Anthracene	250	13	350 U	350 U	330 U	310 U
Benzidine	250		350 U	350 U	330 U	310 U
Benzo(a)anthracene	250	20	71 J	350 U	330 U	68 J
Benzo(a)pyrene	250	23	81 J	350 U	330 U	66 J
Benzo(b)fluoranthene	250	18	130 J	110 J	81 J	110 J
Benzo(g,h,i)perylene	250	18	73 J	350 U	330 U	69 J
Benzo(k)fluoranthene	250	12	350 U	350 U	330 U	310 U
Benzoic Acid	500		700 U	690 U	660 U	630 U
Benzyl Alcohol	500		700 U	690 U	660 U	630 U
bis(2-Chloroethoxy) methane	250		350 U	350 U	330 U	310 U
bis(2-Chloroethyl) ether	250		350 U	350 U	330 U	310 U
Bis(2-chloroisopropyl)ether	250		350 U	350 U	330 U	310 U
bis(2-ethylhexyl)phthalate	250		350 U	350 U	330 U	310 U
Butyl benzyl phthalate	250		350 U	350 U	330 U	310 U
Carbazole	250		350 U	350 U	330 U	310 U
Chrysene	250	18	110 J	80 J	330 U	92 J
Dibenz(a,h)anthracene	250	19	350 U	350 U	330 U	310 U
Dibenzofuran	250		350 U	350 U	330 U	310 U
Diethyl phthalate	250		350 U	350 U	330 U	310 U
Dimethyl phthalate	250		350 U	350 U	330 U	310 U
Di-n-butylphthalate	250		350 U	350 U	330 U	310 U
Di-n-octylphthalate	250		350 U	350 U	330 U	310 U
Fluoranthene	250	12	140 J	120 J	77 J	130 J
Fluorene	250	13	350 U	350 U	330 U	310 U
Hexachlorobenzene	250		350 U	350 U	330 U	310 U
Hexachlorobutadiene	250		350 U	350 U	330 U	310 U
Hexachlorocyclopentadiene	250		350 U	350 U	330 U	310 U
Hexachloroethane	250		350 U	350 U	330 U	310 U
Indeno(1,2,3-cd)pyrene	250	19	350 U	350 U	330 U	64 J
Isophorone	250		350 U	350 U	330 U	310 U

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	Drainage Swale			
Sample ID:			**BRSWSD05**	**BRSWSD06**	**BRSWSD07**	**BRSWSD08**
Naphthalene	250	13	350 U	350 U	330 U	310 U
Nitrobenzene	250		350 U	350 U	330 U	310 U
N-nitrosodimethylamine	500		700 U	690 U	660 U	630 U
n-Nitroso-di-n-propylamine	250		350 U	350 U	330 U	310 U
n-Nitrosodiphenylamine	250		350 U	350 U	330 U	310 U
Pentachlorophenol	500		700 U	690 U	660 U	630 U
Phenanthrene	250	17	77 J	350 U	330 U	65 J
Phenol	250		350 U	350 U	330 U	310 U
Pyrene	250	16	140 J	110 J	72 J	120 J
VPH (MADEP Method) ug/kg						
C5-C8 Aliphatic (3,4)	2.5		NA	NA	4.0 UJ	NA
C9-C12 Aliphatic(3,5)	0.62		NA	NA	1.0 U	NA
C9-C10 Aromatics(3)	0.62		NA	NA	1.0 UJ	NA
Benzene	0.05		NA	NA	0.081 UJ	NA
Ethylbenzene	0.05		NA	NA	0.081 UJ	NA
m,p-Xylene	0.05		NA	NA	0.081 UJ	NA
Methyl tert-Butyl Ether	0.05		NA	NA	0.081 UJ	NA
Napthalene	0.05	0.01	NA	NA	0.081 UJ	NA
o-Xylene	0.05		NA	NA	0.081 UJ	NA
Toluene	0.05		NA	NA	0.081 UJ	NA
EPH (MADEP Method) ug/kg						
C9-C18 Aliphatics	50		NA	NA	73 U	NA
C19-C36 Aliphatics	50		NA	NA	73 U	NA
C11-C22 Aromatics ***	50		NA	NA	73 U	NA
2-Methylnaphthalene	0.25		NA	NA	0.36 U	NA
Acenaphthene	0.25		NA	NA	0.36 U	NA
Acenaphthylene	0.25		NA	NA	0.36 U	NA
Anthracene	0.25	0.01	NA	NA	0.36 U	NA
Benzo(a)anthracene	0.25	0.02	NA	NA	0.36 U	NA
Benzo(a)pyrene	0.25	0.02	NA	NA	0.36 U	NA
Benzo(b)fluoranthene	0.25	0.02	NA	NA	0.36 U	NA
Benzo(g,h,i)perylene	0.25	0.02	NA	NA	0.36 U	NA
Benzo(k)fluoranthene	0.25	0.01	NA	NA	0.36 U	NA
Chrysene	0.25	0.02	NA	NA	0.36 U	NA
Dibenzo(a,h)anthracene	0.25	0.02	NA	NA	0.36 U	NA
Fluoranthene	0.25	0.01	NA	NA	0.36 U	NA
Fluorene	0.25	0.01	NA	NA	0.36 U	NA
Indeno(1,2,3-cd)pyrene	0.25		NA	NA	0.36 U	NA
Naphthalene	0.25	0.01	NA	NA	0.36 U	NA
Phenanthrene	0.25	0.02	NA	NA	0.36 U	NA
Pyrene	0.25	0.02	NA	NA	0.36 U	NA

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	Drainage Swale			
Sample ID:			**BRSWSD05**	**BRSWSD06**	**BRSWSD07**	**BRSWSD08**
RCRA Metals & Antimony (Method 6010B/7000 series) mg/kg						
Antimony	0.5		0.81 J	0.70 J	0.71 J	1.2
Arsenic	5		2.3 J	2.9 J	1.1 J	7.7 U
Barium	20		28 J	33 J	33 J	19 J
Cadmium	0.5		0.22 J	0.28 J	0.17 J	0.19 J
Chromium	1		12 J	13 J	9.2 J	9.1 J
Lead	5		48	53	15	10
Selenium	8		14 U	14 U	13 U	12 U
Silver	1.4		2.4 U	2.4 U	2.3 U	2.2 U
Mercury	0.03		0.047	0.071	0.030J	0.018 J
Total Organic Carbon mg/kg	100		36000 J	23400 J	17400 J	2760 J
% TOC	---		3.60	2.34	1.74	0.27

Table 4-1
Validated Soil Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Notes:

- For EPH, the laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
- (1) Hydrocarbon Range data exclude concentrations of any surrogates.
- (2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
- For VPH, the laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
- (3) Hydrocarbon Range data exclude concentrations of any surrogates.
- (4) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
- (5) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.
- * Based upon 100% total solids

NA - Not Analyzed
J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.

Table 4-2
Validated Groundwater Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs	Laboratory MDLs												
Monitoring Well ID:			B1	B2	B3	B5A		B6	B7D	B8	B12		SWMW13	SWMW14	SWMW15
Sample ID:			BRSWGW01	BRSWGW02	BRSWGW03	BRSWGW05A	BRSWGW05AD	BRSWGW06	BRSWGW07D	BRSWGW08	BRSWGW12	BRSWGW12D	BRSWGW13	BRSWGW14	BRSWGW15
VOCs (Method 8260B) µg/l															
1,1,1,2-Tetrachloroethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-Trichloroethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,2,2-Tetrachloroethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,2-Trichloroethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloropropene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichlorobenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 U
1,2,3-Trichloropropane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4,-Trimethylbenzene	2		2.0 U	2.0 U	2.0 U	0.63 J	0.64 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4-Trichlorobenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 U
1,2-Dibromo-3-chloropropane	5		5.0 U	5.0 U	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 UJ	5.0 U	5.0 UJ	5.0 UJ
1,2-Dibromoethane (EDB)	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichlorobenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloroethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloropropane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3,5-Trimethylbenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3-dichlorobenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3-Dichloropropane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,4-dichlorobenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethene	1		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Butanone (MEK)	10		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 UJ	10.0 UJ	10.0 U	10.0 U	10.0 U
2-Chlorotoluene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Hexanone	10		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
4-Chlorotoluene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-isopropyltoluene	2		2.0 U	2.0 U	2.0 U	0.92 J	0.92 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Methyl-2-pentanone (MIBK)	10		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Acetone	10		10.0U	10.0U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 UJ	10.0 UJ	10.0 U	10.0 U	10.0 U
Benzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromobenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromochloromethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromodichloromethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromoform	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromomethane	5		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon disulfide	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon tetrachloride	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chlorobenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroethane	5		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroform	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloromethane	5		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,3-Dichloropropene	1		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dibromomethane	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dichlorodifluoromethane	5		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Ethylbenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Hexachlorobutadiene	2	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isopropylbenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m,p-Xylene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Methyl tert-butyl ether (MTBE)	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	3.7	3.8	2.0 U	2.0 U	2.0 U
Methylene Chloride	5		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 U
n-Butylbenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
n-Propylbenzene	2		2.0 U	2.0 U	2.0 U	0.55 J	0.53 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
sec-Butylbenzene	2		2.0 U	2.0 U	2.0 U	0.80 J	0.87 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Styrene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
tert-Butylbenzene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Toluene	2		2.0 U	2.0 U	0.54 J	4.2	4.4	3.8	1.3 J	4.7	6.4	7.7	0.94 J	2.7	3.8
trans-1,2-Dichloroethene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
trans-1,3-Dichloropropene	1		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	2		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichlorofluoromethane	2		2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl Chloride	2		2.0 U	2.0U	2.0 U	2.0U	2.0 U	2.0 U	2.0U	2.0 U	2.0U	2.0 U	2.0 U	2.0 U	2.0 U

Table 4-2
Validated Groundwater Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs	Laboratory MDLs													
Monitoring Well ID:			B1	B2	B3	B5A		B6	B7D	B8	B12		SWMW13	SWMW14	SWMW15
Sample ID:			BRSWGW01	BRSWGW02	BRSWGW03	BRSWGW05A	BRSWGW05AD	BRSWGW06	BRSWGW07D	BRSWGW08	BRSWGW12	BRSWGW12D	BRSWGW13	BRSWGW14	BRSWGW15
SVOCs (Method 8270C) µg/l															
1,2,4-Trichlorobenzene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Diphenylhydrazine	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	20		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chloronaphthalene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10		10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10		10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Nitrophenol	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4,6-Dinitro-2-methylphenol	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4-Bromophenyl phenylether	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4-Chloroaniline	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10		10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
4-Nitrophenol	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Acenaphthene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzidine	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	R	20 U	20 U
Benzo(a)anthracene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzoic Acid	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Benzyl Alcohol	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
bis(2-Chloroethoxy) methane	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl) ether	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-chloroisopropyl)ether	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
bis(2-ethylhexyl) phthalate	10		10 U	10 U	10 U	4.0 J	5.2 J	10 U	1.8 J	10 U	10 U	10 U	10 U	10 U	10 U
Butyl benzyl phthalate	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbazole	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzofuran	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Diethyl phthalate	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dimethyl phthalate	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-butyl phthalate	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-octyl phthalate	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10	2	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isophorone	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
N-nitrosodimethylamine	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
n-Nitroso-di-n-propylamine	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
n-Nitrosodiphenylamine	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Table 4-2
Validated Groundwater Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs	Laboratory MDLs													
Monitoring Well ID:			B1	B2	B3	B5A		B6	B7D	B8	B12		SWMW13	SWMW14	SWMW15
Sample ID:			BRSWGW01	BRSWGW02	BRSWGW03	BRSWGW05A	BRSWGW05AD	BRSWGW06	BRSWGW07D	BRSWGW08	BRSWGW12	BRSWGW12D	BRSWGW13	BRSWGW14	BRSWGW15
Pentachlorophenol	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Phenanthrene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Phenol	10		2.1 J	1.8 J	4.5 J	34 J	43 J	6.8 J	10 UJ	10 UJ	17 J	16 J	9.6 J	10 U	10 U
Pyrene	10		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
VPH (MADEP Method) µg/l															
C5-C8 Aliphatic (3,4)	100		NA	NA	NA	100 U	100 U	NA	NA	NA	NA	NA	100 U	NA	NA
C9-C12 Aliphatic(3,5)	25		NA	NA	NA	72 J	210 J	NA	NA	NA	NA	NA	25 U	NA	NA
C9-C10 Aromatics(3)	25		NA	NA	NA	45 J	61 J	NA	NA	NA	NA	NA	25 U	NA	NA
Benzene	2.0		NA	NA	NA	2.0 U	2.0 U	NA	NA	NA	NA	NA	2.0 U	NA	NA
Ethylbenzene	2.0		NA	NA	NA	2.0 U	2.0 U	NA	NA	NA	NA	NA	2.0 U	NA	NA
m,p-Xylene	2.0		NA	NA	NA	2.0 U	2.0 U	NA	NA	NA	NA	NA	2.0 U	NA	NA
Methyl tert-Butyl Ether	2.0		NA	NA	NA	2.0 U	2.0 U	NA	NA	NA	NA	NA	2.0 U	NA	NA
Napthalene	2.0		NA	NA	NA	2.0 U	2.0 U	NA	NA	NA	NA	NA	2.0 U	NA	NA
o-Xylene	2.0		NA	NA	NA	2.0 U	2.0 U	NA	NA	NA	NA	NA	2.0 U	NA	NA
Toluene	2.0		NA	NA	NA	4.2	4.4	NA	NA	NA	NA	NA	2.0 U	NA	NA
EPH (MADEP Method) µg/l															
C9-C18 Aliphatic (1)	100		NA	NA	NA	870 J	200 J	NA	NA	NA	NA	NA	100 UJ	NA	NA
C19-C36 Aliphatic (1)	100		NA	NA	NA	240 J	100 UJ	NA	NA	NA	NA	NA	100 J	NA	NA
C11-C22 Aromatics(1,2)	100		NA	NA	NA	580 J	130 J	NA	NA	NA	NA	NA	100 UJ	NA	NA
2-Methylnaphthalene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RCRA Metals & Antimony (Method 6010B/7000 series) µg/l															
Field Filtered Sample (Y or N)			n	y	y	y	y	y	y	y	y	y	y	y	y
Antimony	20		20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Arsenic	25		25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Barium	200		200 U	340	290J	200 U	200 U	190 J	260 J	230 J	200 UJ	310 UJ	200 U	290 UJ	200 UJ
Cadmium	5		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chromium	10		2.5 J	2.5 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	3.6 J	10 U	2.8 J
Lead	25		25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	6.0 J	25 U	25 U
Selenium	80		80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U	80 U
Silver	7	0.2	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U
Mercury	0.2		0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Ca-Mg Hardness* (mg/l)	33		210	41	77	160 U	150 U	160	33 U	53	70 U	71 U	210 U	93 U	33 U

Table 4-2
Validated Groundwater Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Notes:

- Hardness determined by calculation using calcium and magnesium results obtained by ICP (method 6010B) analyses.
- For EPH, the laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
- (1) Hydrocarbon Range data exclude concentrations of any surrogates.
- (2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
- For VPH, the laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
- (3) Hydrocarbon Range data exclude concentrations of any surrogates.
- (4) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
- (5) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

NA - Not Analyzed
J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.

Table 4-3
Validated Surface Water Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs	Laboratory MDLs	West Stream				
Sample ID:			BRSWSW01	BRSWSW02	BRSWSW03	BRSWSW03D	BRSWSW04
VOCs (Method 8260B) µg/l							
1,1,1,2-Tetrachloroethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-Trichloroethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,2,2-Tetrachloroethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,2-Trichloroethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloropropene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichlorobenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichloropropane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4,-Trimethylbenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4-Trichlorobenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromo-3-chloropropane	4		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2-Dibromoethane (EDB)	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichlorobenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloroethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloropropane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3,5-Trimethylbenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3-dichlorobenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3-Dichloropropane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,4-dichlorobenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethene	4		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	4		2.0 U	2.0 U	2.0 UJ	2.0 UJ	2.0 U
2-Butanone (MEK)	20		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
2-Chlorotoluene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Hexanone	20		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
4-Chlorotoluene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-isopropyltoluene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Methyl-2-pentanone (MIBK)	20		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Acetone	20		10.0 U	10.0 U	10.0 UJ	10.0 UJ	10.0 U
Benzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromobenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromochloromethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromodichloromethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromoform	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromomethane	4		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon disulfide	4		2.0 U	0.81 J	2.0 U	2.0 U	2.0 U
Carbon tetrachloride	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chlorobenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroethane	4		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroform	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloromethane	4		5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ
cis-1,2-Dichloroethene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,3-Dichloropropene	4		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dibromomethane	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dichlorodifluoromethane	4		5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ
Ethylbenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Hexachlorobutadiene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isopropylbenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m,p-Xylene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Methyl tert-butyl ether (MTBE)	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Methylene Chloride	20		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	4		2.0 U	2.0 U	2.0 UJ	2.0 UJ	2.0 U
n-Butylbenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
n-Propylbenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
sec-Butylbenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Styrene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
tert-Butylbenzene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Toluene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
trans-1,2-Dichloroethene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
trans-1,3-Dichloropropene	4		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichlorofluoromethane	4		2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ
Vinyl Chloride	4		2.0 U	2.0U	2.0 U	2.0 U	2.0 U

Table 4-3
Validated Surface Water Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs	Laboratory MDLs	West Stream				
Sample ID:			BRSWSW01	BRSWSW02	BRSWSW03	BRSWSW03D	BRSWSW04
SVOCs (Method 8270C) µg/l							
1,2,4-Trichlorobenzene	10		10 U	12 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10		10 U	12 U	10 U	10 U	10 U
1,2-Diphenylhydrazine	10		10 U	12 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10		10 U	12 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10		10 U	12 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	10		10 U	R	10 U	10 U	10 U
2,4,6-Trichlorophenol	10		10 U	R	10 U	10 U	10 U
2,4-Dichlorophenol	10		10 U	R	10 U	10 U	10 U
2,4-Dimethylphenol	10		10 U	R	10 U	10 U	10 U
2,4-Dinitrophenol	20		21 U	R	20 U	20 U	20 U
2,4-Dinitrotoluene	10		10 U	12 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10		10 U	12 U	10 U	10 U	10 U
2-Chloronaphthalene	10		10 U	12 U	10 U	10 U	10 U
2-Chlorophenol	10		10 U	R	10 U	10 U	10 U
2-Methylnaphthalene	10		10 U	12 U	10 U	10 U	10 U
2-Methylphenol	10		10 U	R	10 U	10 U	10 U
2-Nitroaniline	20		21 U	24 U	20 U	20 U	20 U
2-Nitrophenol	10		10 U	R	10 U	10 U	10 U
3,3'-Dichlorobenzidine	10		10 U	12 U	10 U	10 U	10 U
3-Nitroaniline	20		21 U	24 U	20 U	20 U	20 U
4,6-Dinitro-2-methylphenol	20		21 U	R	20 U	20 U	20 U
4-Bromophenyl phenylether	10		10 U	12 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	20		21U	R	20 U	20 U	20 U
4-Chloroaniline	10		10 U	12 U	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10		10 U	12 U	10 U	10 U	10 U
4-Methylphenol	10		10 U	R	10 U	10 U	10 U
4-Nitroaniline	20		21 U	24 U	20 U	20 U	20 U
4-Nitrophenol	20		21 U	R	20 U	20 U	20 U
Acenaphthene	10		10 U	12 U	10 U	10 U	10 U
Acenaphthylene	10		10 U	12 U	10 U	10 U	10 U
Anthracene	10		10 U	12 U	10 U	10 U	10 U
Benzidine	20		R	R	R	R	R
Benzo(a)anthracene	10		10 U	12 U	10 U	10 U	10 U
Benzo(a)pyrene	10		10 U	12 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10		10 U	12 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10		10 U	12 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10		10 U	12 U	10 U	10 U	10 U
Benzoic Acid	20		21 U	R	20 U	20 U	20 U
Benzyl Alcohol	20		21 U	24 U	20 U	20 U	20 U
bis(2-Chloroethoxy) methane	10		10 U	12 U	10 U	10 U	10 U
bis(2-Chloroethyl) ether	10		10 U	12 U	10 U	10 U	10 U
Bis(2-chloroisopropyl)ether	10		10 U	12 U	10 U	10 U	10 U
bis(2-ethylhexyl)phthalate	10		10 U	12 U	1.3 J	1.3 J	10 U
Butyl benzyl phthalate	10		10 U	12 U	10 U	10 U	10 U
Carbazole	10		10 U	12 U	10 U	10 U	10 U
Chrysene	10		10 U	12 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10		10 U	12 U	10 U	10 U	10 U
Dibenzofuran	10		10 U	12 U	10 U	10 U	10 U
Diethyl phthalate	10		10 U	12 U	10 U	10 U	10 U
Dimethyl phthalate	10		10 U	12 U	10 U	10 U	10 U
Di-n-butylphthalate	10		10 U	12 U	10 U	10 U	10 U
Di-n-octylphthalate	10		10 U	12 U	10 U	10 U	10 U
Fluoranthene	10		10 U	12 U	10 U	10 U	10 U
Fluorene	10		10 U	12 U	10 U	10 U	10 U
Hexachlorobenzene	10		10 U	12 U	10 U	10 U	10 U
Hexachlorobutadiene	10	2	10 U	12 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10	5	10 U	12 U	10 U	10 U	10 U
Hexachloroethane	10		10 U	12 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10		10 U	12 U	10 U	10 U	10 U
Isophorone	10		10 U	12 U	10 U	10 U	10 U
Naphthalene	10		10 U	12 U	10 U	10 U	10 U
Nitrobenzene	10		10 U	12 U	10 U	10 U	10 U
N-nitrosodimethylamine	20		21 U	24 U	20 U	20 U	20 U
n-Nitroso-di-n-propylamine	10		10 U	12 U	10 U	10 U	10 U
n-Nitrosodiphenylamine	10		10 U	12 U	10 U	10 U	10 U

Table 4-3
Validated Surface Water Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs	Laboratory MDLs	West Stream				
Sample ID:			**BRSWSW01**	**BRSWSW02**	**BRSWSW03**	**BRSWSW03D**	**BRSWSW04**
Pentachlorophenol	20	0.5	21 U	R	20 U	20 U	20 U
Phenanthrene	10		10 U	12 U	10 U	10 U	10 U
Phenol	10		10 U	R	10 U	10 U	10 U
Pyrene	10		10 U	12 U	10 U	10 U	10 U
VPH (MADEP Method) µg/l							
C5-C8 Aliphatic (3,4)	100		NA	NA	100 U	100 U	NA
C9-C12 Aliphatic(3,5)	25		NA	NA	25 U	25 U	NA
C9-C10 Aromatics(3)	25		NA	NA	25 U	25 U	NA
Benzene	2.0		NA	NA	2.0 U	2.0 U	NA
Ethylbenzene	2.0		NA	NA	2.0 U	2.0 U	NA
m,p-Xylene	2.0		NA	NA	2.0 U	2.0 U	NA
Methyl tert-Butyl Ether	2.0		NA	NA	2.0 U	2.0 U	NA
Napthalene	2.0		NA	NA	2.0 U	2.0 U	NA
o-Xylene	2.0		NA	NA	2.0 U	2.0 U	NA
Toluene	2.0		NA	NA	2.0 U	2.0 U	NA
EPH (MADEP Method) µg/l							
C9-C18 Aliphatic (1)	100		NA	NA	100 U	100 U	NA
C19-C36 Aliphatic (1)	100		NA	NA	330 J	170 J	NA
C11-C22 Aromatics(1,2)	100		NA	NA	130 J	100 U J	NA
2-Methylnaphthalene	1		NA	NA	1.0 U	1.0 U	NA
Acenaphthene	1		NA	NA	1.0 U	1.0 U	NA
Acenaphthylene	1		NA	NA	1.0 U	1.0 U	NA
Anthracene	1		NA	NA	1.0 U	1.0 U	NA
Benzo(a)anthracene	1		NA	NA	1.0 U	1.0 U	NA
Benzo(a)pyrene	1		NA	NA	1.0 U	1.0 U	NA
Benzo(b)fluoranthene	1		NA	NA	1.0 U	1.0 U	NA
Benzo(g,h,i)perylene	1		NA	NA	1.0 U	1.0 U	NA
Benzo(k)fluoranthene	1		NA	NA	1.0 U	1.0 U	NA
Chrysene	1		NA	NA	1.0 U	1.0 U	NA
Dibenzo(a,h)anthracene	1		NA	NA	1.0 U	1.0 U	NA
Fluoranthene	1		NA	NA	1.0 U	1.0 U	NA
Fluorene	1		NA	NA	1.0 U	1.0 U	NA
Indeno(1,2,3-cd)pyrene	1		NA	NA	1.0 U	1.0 U	NA
Naphthalene	1		NA	NA	1.0 U	1.0 U	NA
Phenanthrene	1		NA	NA	1.0 U	1.0 U	NA
Pyrene	1		NA	NA	1.0 U	1.0 U	NA
RCRA Metals & Antimony (Method 6010B/7000 series) µg/l							
Antimony	5		5 U	2.5 J	5 U	2.5 J	2.8 J
Arsenic	25		25 U	25 U	25 U	25 U	25 U
Barium	200		200 U	60 J	200 U	200 U	45 J
Cadmium	0.5		0.5 UJ	2.5 UJ	1.9 J	2.6 J	0.5 UJ
Chromium	10		10 U	3.4 J	3.2 J	2.2 J	10 U
Lead	5	1	5 U	5 U	27	25	5
Selenium	40	5.8	9.1 J	40 U	40 U	40 U	40 U
Silver	0.5	0.12	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ
Mercury	0.2		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ca-Mg Hardness (mg/l)	33*		35	39	75	76	37
Dissolved Metals (Method 6010B/7000 series) ug/l [4]			**BRSWSW01R**	**BRSWSW02R**	**BRSWSW03R**	**BRSWSW03D**	**BRSWSW04R**
Cadmium	0.5	0.3	0.3 U	0.33 J	0.33 J	0.51 J	0.58 J
Lead	2.1	1.5	2.5 J	2.4 J	1.5 U	1.5 U	4.0
Selenium	4.2	2	2.3 U	2.3 U	3.0 J	2.3 U	2.3 U
Hardness (as CaCO3) (mg/l)	2.0		44	70	92	96	58

Table 4-3
Validated Surface Water Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Notes:

- Hardness determined by calculation using calcium and magnesium results obtained by ICP (method 6010B) analyses.*
- For EPH, the laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
- (1) Hydrocarbon Range data exclude concentrations of any surrogates.
- (2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
- For VPH, the laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
- (3) Hydrocarbon Range data exclude concentrations of any surrogates.
- (4) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
- (5) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.
- (6) Samples collected from original locations at a later date in order to analyze for dissolved metals.

NA - Not Analyzed
J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.

Table 4-4
Validated Sediment Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	West Stream				
Sample ID:			BRSWSD01	BRSWSD02	BRSWSD03	BRSWSD03D	BRSWSD04
VOCs (Method 8260B) µg/kg							
1,1,1,2-Tetrachloroethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,1,1-Trichloroethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,1,2,2-Tetrachloroethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,1,2-Trichloroethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,1-Dichloroethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,1-Dichloropropene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2,3-Trichlorobenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2,3-Trichloropropane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2,4,-Trimethylbenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2,4-Trichlorobenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2-Dibromo-3-chloropropane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2-Dibromoethane (EDB)	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2-Dichlorobenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2-Dichloroethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,2-Dichloropropane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,3,5-Trimethylbenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,3-dichlorobenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,3-Dichloropropane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,4-dichlorobenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
1,1-Dichloroethene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
2,2-Dichloropropane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
2-Butanone (MEK)	20		23 U	21 U	29 UJ	29 UJ	47 U
2-Chlorotoluene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
2-Hexanone	20		23 U	28 U	29 UJ	29 UJ	47 U
4-Chlorotoluene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
4-isopropyltoluene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
4-Methyl-2-pentanone (MIBK)	20		23 U	28 U	29 UJ	29 UJ	47 U
Acetone	20	17	18 J	28 U	160 J	54 J	89 J
Benzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Bromobenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Bromochloromethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Bromodichloromethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Bromoform	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Bromomethane	4		4.7 UJ	5.6 UJ	5.8 UJ	5.8 UJ	9.4 UJ
Carbon disulfide	4	1	4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Carbon tetrachloride	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Chlorobenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Chloroethane	4		4.7 UJ	5.6 UJ	5.8 UJ	5.8 UJ	9.4 UJ
Chloroform	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Chloromethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
cis-1,2-Dichloroethene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
cis-1,3-Dichloropropene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Dibromochloromethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Dibromomethane	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Dichlorodifluoromethane	4		4.7 UJ	5.6 UJ	5.8 UJ	5.8 UJ	9.4 U
Ethylbenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Hexachlorobutadiene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Isopropylbenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
m,p-Xylene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Methyl tert-butyl ether (MTBE)	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Methylene Chloride	20		23 U	21 U	29 UJ	29 UJ	47 U
Naphthalene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
n-Butylbenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
n-Propylbenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
o-Xylene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
sec-Butylbenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Styrene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
tert-Butylbenzene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Tetrachloroethene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Toluene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
trans-1,2-Dichloroethene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U

Table 4-4
Validated Sediment Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	West Stream				
Sample ID:			BRSWSD01	BRSWSD02	BRSWSD03	BRSWSD03D	BRSWSD04
trans-1,3-Dichloropropene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Trichloroethene	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Trichlorofluoromethane	4		4.3 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
Vinyl Chloride	4		4.7 U	5.6 U	5.8 UJ	5.8 UJ	9.4 U
SVOCs (Method 8270C) µg/kg							
1,2,4-Trichlorobenzene	250		270 U	300 U	320 UJ	320 UJ	450 U
1,2-Dichlorobenzene	250		270 UJ	300 UJ	320 UJ	320 UJ	450 UJ
1,2-Diphenylhydrazine	250		270 U	300 U	320 U	320 U	450 U
1,3-Dichlorobenzene	250		270 UJ	300 UJ	320 UJ	320 UJ	450 UJ
1,4-Dichlorobenzene	250		270 UJ	300 UJ	320 UJ	320 UJ	450 UJ
2,4,5-Trichlorophenol	250		270 U	300 U	320 U	320 U	450 U
2,4,6-Trichlorophenol	250		270 U	300 U	320 U	320 U	450 U
2,4-Dichlorophenol	250		270 U	300 U	320 U	320 U	450 U
2,4-Dimethylphenol	250		270 UJ	300 UJ	320 UJ	320 UJ	450 UJ
2,4-Dinitrophenol	500		540 U	600 U	640 U	640 U	900 U
2,4-Dinitrotoluene	250		270 U	300 U	320 U	320 U	450 U
2,6-Dinitrotoluene	250		270 U	300 U	320 U	320 U	450 U
2-Chloronaphthalene	250		270 U	300 U	320 U	320 U	450 U
2-Chlorophenol	250		270 U	300 U	320 U	320 U	450 U
2-Methylnaphthalene	250		270 U	300 U	320 U	320 U	450 U
2-Methylphenol	250	9	270 U	300 U	320 U	320 U	450 U
2-Nitroaniline	500		540 U	600 U	640 U	640 U	900 U
2-Nitrophenol	250		270 U	300 U	320 U	320 U	450 U
3,3'-Dichlorobenzidine	250		270 UJ	300 UJ	320 UJ	320 UJ	450 UJ
3-Nitroaniline	500		540 U	600 U	640 U	640 U	900 U
4,6-Dinitro-2-methylphenol	500		540 U	600 U	640 U	640 U	900 U
4-Bromophenyl phenylether	250		270 U	300 U	320 U	320 U	450 U
4-Chloro-3-methylphenol	500		540 U	600 U	640 U	640 U	900 U
4-Chloroaniline	250		270 U	300 U	320 U	320 U	450 U
4-Chlorophenyl phenyl ether	250		270 U	300 U	320 U	320 U	450 U
4-Methylphenol	250		270 U	300 U	320 U	320 U	450 U
4-Nitroaniline	500		540 U	600 U	640 U	640 U	900 U
4-Nitrophenol	500		540 U	600 U	640 U	640 U	900 U
Acenaphthene	250		270 U	300 U	320 U	320 U	450 U
Acenaphthylene	250		270 U	300 U	320 U	320 U	450 U
Anthracene	250	13	270 U	300 U	320 U	320 U	450 U
Benzidine	250		270 U	300 U	320 U	320 U	450 U
Benzo(a)anthracene	250	20	190 J	300 U	88 J	88 J	450 U
Benzo(a)pyrene	250	23	270 J	300 U	120 J	84 J	99 J
Benzo(b)fluoranthene	250	18	430	89 J	130 J	98 J	210 J
Benzo(g,h,i)perylene	250	18	260 J	300 U	100 J	72 J	110 J
Benzo(k)fluoranthene	250	12	120 J	300 U	70 J	320 UJ	450 U
Benzoic Acid	500		540 U	600 U	640 U	640 U	900 U
Benzyl Alcohol	500		540 U	600 U	640 U	640 U	900 U
bis(2-Chloroethoxy) methane	250		270 U	300 U	320 U	320 U	450 U
bis(2-Chloroethyl) ether	250		270 U	300 U	320 U	320 U	450 U
Bis(2-chloroisopropyl)ether	250		270 U	300 U	320 U	320 U	450 U
bis(2-ethylhexyl)phthalate	250		250 J	300 U	380	580	450 U
Butyl benzyl phthalate	250		270 U	300 U	320 U	320 U	450 U
Carbazole	250		270 U	300 U	320 U	320 U	450 U
Chrysene	250	18	310	60 J	120 J	94 J	160 J
Dibenz(a,h)anthracene	250	19	270 U	300 U	320 U	320 U	450 U
Dibenzofuran	250		270 U	300 U	320 U	320 U	450 U
Diethyl phthalate	250		270 U	300 U	320 U	320 U	450 U
Dimethyl phthalate	250		270 U	300 U	320 U	320 U	450 U
Di-n-butylphthalate	250		270 U	300 U	320 U	320 U	450 U
Di-n-octylphthalate	250		270 U	300 U	320 U	320 U	450 U
Fluoranthene	250	12	570	60 J	320 UJ	140 J	190 J
Fluorene	250	13	270 U	300 U	320 U	320 U	450 U
Hexachlorobenzene	250		270 U	300 U	320 U	320 U	450 U
Hexachlorobutadiene	250		270 U	300 U	320 U	320 U	450 U
Hexachlorocyclopentadiene	250		270 U	300 U	320 U	320 U	450 U
Hexachloroethane	250		270 U	300 U	320 U	320 U	450 U

Table 4-4
Validated Sediment Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Parmeter/Method	Laboratory PQLs*	Laboratroy MDLs	West Stream				
Sample ID:			BRSWSD01	BRSWSD02	BRSWSD03	BRSWSD03D	BRSWSD04
Indeno(1,2,3-cd)pyrene	250	19	280	300 U	88 J	64 J	110 J
Isophorone	250		270 U	300 U	320 U	320 U	450 U
Naphthalene	250	13	270 U	300 U	320 U	320 U	450 U
Nitrobenzene	250		270 U	300 U	320 U	320 U	450 U
N-nitrosodimethylamine	500		530 U	600 U	640 U	640 U	900 U
n-Nitroso-di-n-propylamine	250		270 U	300 U	320 U	320 U	450 U
n-Nitrosodiphenylamine	250		270 U	300 U	320 U	320 U	450 U
Pentachlorophenol	500		540 U	600 U	640 U	640 U	900 U
Phenanthrene	250	17	260 J	300 U	320 UJ	100 J	450 U
Phenol	250		270 U	300 U	320 U	320 U	450 U
Pyrene	250	16	480	300 U	150 J	160 J	180 J
VPH (MADEP Method) mg/kg							
C5-C8 Aliphatic (3,4)	2.5		NA	NA	3.2 U	3.4 U	NA
C9-C12 Aliphatic(3,5)	0.62		NA	NA	0.81 U	0.84 U	NA
C9-C10 Aromatics(3)	0.62		NA	NA	0.81 U	0.84 U	NA
Benzene	0.05		NA	NA	0.065U	0.067 U	NA
Ethylbenzene	0.05		NA	NA	0.065U	0.067 U	NA
m,p-Xylene	0.05		NA	NA	0.065U	0.067 U	NA
Methyl tert-Butyl Ether	0.05		NA	NA	0.065U	0.067 U	NA
Napthalene	0.05	0.01	NA	NA	0.065U	0.067 U	NA
o-Xylene	0.05		NA	NA	0.065U	0.067 U	NA
Toluene	0.05		NA	NA	0.065U	0.067 U	NA
EPH (MADEP Method) mg/kg							
C9-C18 Aliphatics	50		NA	NA	63 U	64 U	NA
C19-C36 Aliphatics	50		NA	NA	630 J	110 J	NA
C11-C22 Aromatics ***	50		NA	NA	130 UJ	64 UJ	NA
2-Methylnaphthalene	0.25		NA	NA	0.32 U	0.32 U	NA
Acenaphthene	0.25		NA	NA	0.32 U	0.32 U	NA
Acenaphthylene	0.25		NA	NA	0.32 U	0.32 U	NA
Anthracene	0.25	0.01	NA	NA	0.32 U	0.32 U	NA
Benzo(a)anthracene	0.25	0.02	NA	NA	0.32 U	0.32 U	NA
Benzo(a)pyrene	0.25	0.02	NA	NA	0.32 U	0.32 U	NA
Benzo(b)fluoranthene	0.25	0.02	NA	NA	0.32 U	0.32 U	NA
Benzo(g,h,i)perylene	0.25	0.02	NA	NA	0.32 U	0.32 U	NA
Benzo(k)fluoranthene	0.25	0.01	NA	NA	0.32 U	0.32 U	NA
Chrysene	0.25	0.02	NA	NA	0.23 J	0.32 UJ	NA
Dibenzo(a,h)anthracene	0.25	0.02	NA	NA	0.32 U	0.32 U	NA
Fluoranthene	0.25	0.01	NA	NA	0.32 U	0.32 U	NA
Fluorene	0.25	0.01	NA	NA	0.32 U	0.32 U	NA
Indeno(1,2,3-cd)pyrene	0.25		NA	NA	0.32 U	0.32 U	NA
Naphthalene	0.25	0.01	NA	NA	0.32 U	0.32 U	NA
Phenanthrene	0.25	0.02	NA	NA	0.32 U	0.32 U	NA
Pyrene	0.25	0.02	NA	NA	0.24 J	0.32 UJ	NA
RCRA Metals & Antimony (Method 6010B/7000 series) mg/kg							
Antimony	0.5		0.55 J	0.57 J	4.9	5.7	1.1 J
Arsenic	5		2.3 J	7.4 U	7.8	6.6 J	7.5 J
Barium	20		13 J	15 J	30 J	28 J	84
Cadmium	0.5		0.22 J	0.74 U	3.3	3.0	1.4
Chromium	1		11	7.8	25	32	18
Lead	5		24	7.2 J	63	50	170
Selenium	8		10 U	12 U	12 U	12 U	18 U
Silver	1.4		1.8 U	2.1 U	2.1 U	2.2 U	3.1 J
Mercury	0.03		0.025 U	0.016 J	0.020 J	0.018 J	0.13
Total Organic Carbon mg/kg	100		8460 J	4380 J	5130 J	7940 J	36400 J
% TOC	---		0.85	0.44	0.51	0.79	3.64

Table 4-4
Validated Sediment Analytical Results
Phase II Comprehensive Site Assessment
CPL. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Note:

- For EPH, the laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
- (1) Hydrocarbon Range data exclude concentrations of any surrogates.
- (2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
- For VPH, the laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
- (3) Hydrocarbon Range data exclude concentrations of any surrogates.
- (4) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
- (5) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.
- * Based upon 100% total solids

NA - Not Analyzed
J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.

Table 5-1
Identification of Human Health OHM of Potential Concern in Soils (0-15 Feet)

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Site Data/Concentration				Background Concentration [2]	OHM of Concern? [3]	Reason [4]
	Frequency of Detection [1]	Range of SQLs	Range of Detected Concentrations	Arithmetic Mean			
VOCs (mg/kg)							
1,2,4,-Trimethylbenzene	1/ 15	0.0043 : 0.0074	0.23 - 0.23	0.018	NA	Yes	
1,3,5-Trimethylbenzene	1/ 15	0.0043 : 0.0074	0.038 - 0.038	0.0051	NA	Yes	
4-isopropyltoluene	1/ 15	0.0043 : 0.0074	0.044 - 0.044	0.0055	NA	Yes	
Acetone	11/ 15	0.021 : 0.024	0.018 - 0.2	0.038	NA	Yes	
Ethylbenzene	1/ 27	0.0043 : 0.048	0.0021 - 0.0021	0.010	NA	Yes	[a]
Isopropylbenzene	1/ 15	0.0043 : 0.0074	0.036 - 0.036	0.0050	NA	Yes	
m,p-Xylene	1/ 27	0.0043 : 0.048	0.019 - 0.019	0.011	NA	Yes	
Methylene Chloride	5/ 15	0.021 : 0.034	0.014 - 0.025	0.015	NA	Yes	
n-Propylbenzene	1/ 15	0.0043 : 0.0074	0.069 - 0.069	0.0072	NA	Yes	
o-Xylene	1/ 27	0.0043 : 0.048	0.0046 - 0.0046	0.010	NA	Yes	[a]
sec-Butylbenzene	1/ 15	0.0043 : 0.0074	0.075 - 0.075	0.0076	NA	Yes	
Toluene	1/ 27	0.0042 : 0.048	0.021 - 0.021	0.010	NA	Yes	
SVOCs (mg/kg)							
Benzo(a)anthracene	2/ 27	0.265 : 0.35	0.068 - 0.071	0.13	NA	No	FC
Benzo(a)pyrene	2/ 27	0.265 : 0.35	0.066 - 0.081	0.13	NA	No	FC
Benzo(b)fluoranthene	4/ 27	0.265 : 0.3	0.081 - 0.13	0.13	NA	Yes	
Benzo(g,h,i)perylene	2/ 27	0.265 : 0.35	0.069 - 0.073	0.13	NA	No	FC
Chrysene	3/ 27	0.265 : 0.33	0.08 - 0.11	0.13	NA	Yes	
Dibenzofuran	1/ 15	0.27 : 0.35	0.064 - 0.064	0.14	NA	No	FC
Fluoranthene	6/ 27	0.265 : 0.3	0.069 - 0.16	0.13	NA	Yes	
Fluorene	2/ 27	0.265 : 0.35	0.061 - 0.11	0.14	NA	No	FC
Indeno(1,2,3-cd)pyrene	1/ 27	0.265 : 0.35	0.064 - 0.064	0.14	NA	No	FC
Naphthalene	1/ 27	0.0043 : 0.048	0.19 - 0.19	0.017	NA	Yes	
Phenanthrene	4/ 27	0.265 : 0.35	0.065 - 0.3	0.14	NA	Yes	
Pyrene	6/ 27	0.265 : 0.3	0.072 - 0.14	0.13	NA	Yes	
Inorganics (mg/kg)							
Antimony	7/ 15	5.2 : 6.1	0.7 - 20	3.3	1.4	Yes	
Arsenic	24/ 30	6.6 : 7.7	0.9 - 4.8	2.6	17	No	B
Barium	30/ 30	:	7.1 - 37	18	45	No	B
Cadmium	9/ 30	0.25 : 0.76	0.17 - 1	0.30	2	No	B
Chromium	30/ 30	:	3.4 - 30	10	29	Yes	

Table 5-1
Identification of Human Health OHM of Potential Concern in Soils (0-15 Feet)

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Site Data/Concentration				Background Concentration [2]	OHM of Concern? [3]	Reason [4]
	Frequency of Detection [1]	Range of SQLs	Range of Detected Concentrations	Arithmetic Mean			
Lead	30 / 30		2.8 - 53	16	99	No	B
Mercury	4 / 30	0.024 : 0.1	0.018 - 0.071	0.035	0.3	No	B
Other (mg/kg)							
TPH	10 / 16	10 : 10	13 - 1800	128	NA	Yes	
C11-C22 Aromatic	1 / 20	53 : 73	45.5 - 45.5	29	NA	Yes	[a]
C19-C36 Aliphatic	3 / 20	53 : 73	56.5 - 71	33	NA	Yes	[a]
C9-C10 Aromatic	1 / 20	0.32 : 1	1.7 - 1.7	0.34	NA	Yes	
C9-C12 Aliphatic	1 / 20	0.32 : 1	1.4 - 1.4	0.32	NA	Yes	

Notes:

[1] Samples included in data set are listed in Appendix I.
Duplicate samples were averaged with their original samples prior to calculation of summary statistics.
The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[2] The MADEP Background Soil Concentration is reported as the background concentration (MADEP, 1995a).

[3] OHM of concern are OHM that are inconsistent with background conditions and not detected at a low frequency and low concentration.

[4] Reason for exclusion as OHM of Concern:
B = Background; the maximum detected site concentration is less than or equal to the MADEP background soil concentration.
FC = Low Frequency and Concentration; the OHM was not detected in more than two samples (where total number of samples is greater than or equal to 10) and the maximum detected concentration was not more than 2 times the minimum SQL.

[a] Although the OHM meets the criteria for low frequency and concentration, the presence of the OHM is considered to be attributable to historical petroleum release at the Site. Therefore, the OHM is retained as a OHM of potential concern.

OHM = Oil or Hazardous Material
SQL = Sample Quanitation Limit
NA = Not Available/Not Applicable
MADEP (1995a): Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contigency Plan (WSC/ORS-95-141, July).

Table 5-2
Identification of Human Health OHM of Potential Concern in Groundwater

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

	Site Data/Concentration								
OHM of Concern	Frequency of Detection [1]	Range of SQLs	Range of Detected Concentrations	Arithmetic Mean	Background Concentration [2]	OHM of Concern? [3]	Reason [4]
VOCs (mg/L)							
1,2,4-Trimethylbenzene	2 / 15	0.002 : 0.002	0.000635 - 0.001	0.00098	NA	Yes	[a]
1,3,5-Trimethylbenzene	1 / 15	0.002 : 0.002	0.0006 - 0.0006	0.00097	NA	Yes	[a]
4-isopropyltoluene	1 / 11	0.002 : 0.002	0.00092 - 0.00092	0.00099	NA	Yes	[a]
Isopropylbenzene	1 / 15	0.002 : 0.002	0.0003 - 0.0003	0.00095	NA	Yes	[a]
m,p-Xylene	1 / 15	0.002 : 0.002	0.0007 - 0.0007	0.00098	NA	Yes	[a]
Methyl tert-butyl ether (MTBE)	1 / 11	0.002 : 0.002	0.00375 - 0.00375	0.0013	NA	Yes	[a]
n-Propylbenzene	1 / 11	0.002 : 0.002	0.00054 - 0.00054	0.00096	NA	Yes	[a]
sec-Butylbenzene	2 / 15	0.002 : 0.002	0.0006 - 0.00835	0.0015	NA	Yes	[a]
Toluene	10 / 15	0.002 : 0.002	0.00054 - 0.00705	0.0023	NA	Yes	[a]
SVOCs (mg/L)							
bis(2-ethylhexyl) phthalate	2 / 15	0.01 : 0.01	0.0018 - 0.0046	0.0048	NA	No	FC
Naphthalene	1 / 15	0.002 : 0.002	0.003 - 0.003	0.0011	NA	Yes	[a]
Phenol	7 / 15	0.01 : 0.01	0.0018 - 0.0385	0.0080	NA	Yes	
Inorganics (mg/L)							
Barium, dissolved	8 / 14	0.01 : 0.29	0.01 - 0.34	0.14	NA	Yes	
Chromium, dissolved	3 / 14	0.001 : 0.01	0.0025 - 0.0036	0.0033	NA	Yes	
Lead, dissolved	*3 / 14*	*0.001 : 0.025*	*0.003 - 0.006*	*0.0091*	*0.0088*	No	B
Mercury, dissolved	1 / 14	0.0002 : 0.0005	0.0002 - 0.0002	0.00012	0.00095	No	B
Thallium, dissolved	1 / 4	0.001 : 0.001	0.002 - 0.002	0.00088	NA	Yes	
Zinc, dissolved	*3 / 4*	*0.01 : 0.01*	*0.01 - 0.018*	*0.011*	NA	Yes	
Other (mg/L)							
Ammonia	2 / 4	0.05 : 0.05	0.06 - 0.11	0.055	NA	Yes	
Nitrate-Nitrite-N	*3 / 4*	*0.05 : 0.05*	*0.08 - 0.52*	*0.24*	NA	Yes	
C11-C22 Aromatic	1 / 2	0.1 : 0.1	0.355 - 0.355	0.20	NA	Yes	
C19-C36 Aliphatic	2 / 2	:	0.1 - 0.145	0.12	NA	Yes	
C9-C18 Aliphatic	*1 / 2*	*0.1 : 0.1*	*0.535 - 0.535*	*0.29*	NA	Yes	
C9-C10 Aromatic	1 / 2	0.025 : 0.025	0.053 - 0.053	0.033	NA	Yes	
C9-C12 Aliphatic	1 / 2	0.025 : 0.025	0.141 - 0.141	0.077	NA	Yes	

Table 5-2
Identification of Human Health OHM of Potential Concern in Groundwater

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[2] The MADEP Background Groundwater Concentration is reported as the background concentration (MADEP, 1994).

[3] OHM of concern are OHM that are inconsistent with background conditions and not detected at a low frequency and low concentration.

[4] Reason for exclusion as OHM of Concern:

B = Background; the maximum detected site concentration is less than or equal to the MADEP background groundwater concentration.

FC = Low Frequency and Concentration; the OHM was not detected in more than two samples (where total number of samples is greater than or equal to 10) and the maximum detected concentration was not more than 2 times the minimum SQL.

[a] Although the OHM meets the criteria for low frequency and concentration, the presence of the OHM is considered to be attributable to historical petroleum release at the Site. Therefore, the OHM is retained as a OHM of potential concern.

OHM = Oil or Hazardous Material

SQL = Sample Quanitation Limit

NA = Not Available/Not Applicable

MADEP (1994): Background Documentation for the Development of the MCP Numerical Standards (April).

MADEP (1995a): Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contigency Plan (WSC/ORS-95-141, July).

Table 5-3
Identification of Human Health OHM of Potential Concern in Surface Water

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Site Data/Concentration				Background Concentration [2]	OHM of Concern? [3]	Reason [4]
	Frequency of Detection [1]	Range of SQLs	Range of Detected Concentrations	Arithmetic Mean			
VOCs (mg/L)							
Carbon disulfide	1 / 4	0.002 : 0.002	0.00081 - 0.00081	0.00095	NA	Yes	
SVOCs (mg/L)							
bis(2-ethylhexyl) phthalate	2 / 6	0.01 : 10	0.0013 - 0.004	0.01	NA	Yes	
Inorganics (mg/L)							
Antimony	4 / 6	0.005 : 0.005	0.0025 - 0.013	0.0043	NA	Yes	
Arsenic	1 / 6	0.005 : 0.025	0.01 - 0.01	0.010	NA	Yes	
Barium	4 / 6	0.2 : 0.2	0.04 - 0.15	0.083	NA	Yes	
Cadmium	2 / 6	0.0005 : 0.0025	0.00225 - 0.028	0.0054	NA	Yes	
Chromium	3 / 6	0.001 : 0.01	0.0027 - 0.061	0.013	NA	Yes	
Copper	2 / 2	:	0.02 - 0.33	0.18	NA	Yes	
Lead	4 / 6	0.005 : 0.005	0.005 - 0.43	0.079	NA	Yes	
Mercury	2 / 6	0.0002 : 0.0002	0.0002 - 0.0003	0.00015	NA	Yes	
Nickel	1 / 2	*0.05* : *0.05*	0.05 - *0.05*	*0.038*	NA	Yes	
Selenium	1 / 6	0.001 : 0.04	0.0091 - 0.0091	0.012	NA	Yes	
Zinc	2 / 2	:	0.16 - 0.56	0.36	NA	Yes	
Other (mg/L)							
Ammonia	2 / 2	:	0.14 - 1.2	0.67	NA	Yes	
Chloride	2 / 2	:	4 - 22	13	NA	Yes	
Nitrate-Nitrite-N	2 / 2	:	0.37 - 1.9	1.1	NA	Yes	
Sulfate	2 / 2	:	7.4 - 8.5	8.0	NA	Yes	
C11-C22 Aromatic	1 / 1	:	0.115 - 0.115	0.12	NA	Yes	
C19-C36 Aliphatic	1 / 1	:	0.25 - 0.25	0.25	NA	Yes	

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[3] OHM of concern are OHM that are inconsistent with background conditions and not detected at a low frequency and low concentration.

[4] Reason for exclusion as OHM of Concern:

FC = Low Frequency and Concentration; the OHM was not detected in more than two samples (where total number of samples is greater than or equal to 10) and the maximum detected concentration was not more than 2 times the minimum SQL.

OHM = Oil or Hazardous Material

SQL = Sample Quantitation Limit

NA = Not Available/Not Applicable

Table 5-4
Identification of Human Health OHM of Potential Concern in Sediment

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Site Data/Concentration				Background Concentration [2]	OHM of Concern? [3]	Reason [4]
	Frequency of Detection [1]	Range of SQLs	Range of Detected Concentrations	Arithmetic Mean			
VOCs (mg/kg)							
Acetone	2 / 4	0.028 : 0.028	0.018 - 0.089	0.030	NA	Yes	
SVOCs (mg/kg)							
Benzo(a)anthracene	2 / 4	0.3 : 0.45	0.088 - 0.19	0.16	NA	Yes	
Benzo(a)pyrene	3 / 4	0.3 : 0.3	0.099 - 0.27	0.16	NA	Yes	
Benzo(b)fluoranthene	4 / 4	:	0.089 - 0.43	0.21	NA	Yes	
Benzo(g,h,i)perylene	3 / 4	0.3 : 0.3	0.086 - 0.26	0.15	NA	Yes	
Benzo(k)fluoranthene	2 / 4	0.3 : 0.45	0.115 - 0.12	0.15	NA	Yes	
bis(2-ethylhexyl) phthalate	2 / 4	0.3 : 0.45	0.25 - 0.48	0.28	NA	Yes	
Chrysene	4 / 4	:	0.06 - 0.31	0.17	NA	Yes	
Fluoranthene	4 / 4	:	0.06 - 0.57	0.24	NA	Yes	
Indeno(1,2,3-cd)pyrene	3 / 4	0.3 : 0.3	0.076 - 0.28	0.15	NA	Yes	
Phenanthrene	2 / 4	0.3 : 0.45	0.13 - 0.26	0.19	NA	Yes	
Pyrene	3 / 4	0.3 : 0.3	0.18 - 0.48	0.25	NA	Yes	
Inorganics (mg/kg)							
Antimony	4 / 4	:	0.55 - 5.3	1.9	NA	Yes	
Arsenic	5 / 6	7.4 : 7.4	1.5 - 11	5.5	NA	Yes	
Barium	6 / 6	:	13 - 120	46	NA	Yes	
Cadmium	4 / 6	0.25 : 0.74	0.22 - 20	4.2	NA	Yes	
Chromium	6 / 6	:	7.8 - 65	23	NA	Yes	
Lead	6 / 6	:	7.2 - 390	112	NA	Yes	
Mercury	3 / 6	0.025 : 0.1	0.016 - 0.13	0.046	NA	Yes	
Silver	1 / 6	0.5 : 2.15	3.1 - 3.1	1.1	NA	Yes	
Other (mg/kg)							
TPH	2 / 2	:	82 - 200	141	NA	Yes	
C19-C36 Aliphatic	1 / 1	:	370 - 370	370	NA	Yes	

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[3] OHM of concern are OHM that are inconsistent with background conditions and not detected at a low frequency and low concentration.

[4] Reason for exclusion as OHM of Concern:

FC = Low Frequency and Concentration; the OHM was not detected in more than two samples (where total number of samples is greater than or equal to 10) and the maximum detected concentration was not more than 2 times the minimum SQL.

OHM = Oil or Hazardous Material

SQL = Sample Quanitation Limit

NA = Not Available/Not Applicable

TABLE 5-5
SUMMARY OF EXPOSURE PATHWAYS EVALUATED FOR CURRENT LAND USE CONDITIONS
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

Exposure Medium	Exposure Point	Receptor	Exposure Pathway				Selected for Evaluation in Risk Assessment?
			Ingestion	Dermal Contact	Dust inhalation	Indoor vapor inhalation	
Soil	Unpaved soils 0-3 ft bgs	USARC personnel					No; workers are indoor (office) employees; any work performed outdoors would be at areas that are paved. VOCs were detected at very low concentrations in soil, and are therefore not expected to pose a volatile migration concern. [a]
		Older child trespasser	X	X	X		Yes; portions of the site are not fenced, and unpaved soil could be contacted when trespassing.
		Utility worker	X	X	X		Yes; Utility workers could be exposed to soils during emergency utility repair. [b]
	Paved soils 0-15 ft bgs And Unpaved soils 3-15 ft bgs	USARC personnel					No; Pavement prevents exposures to soils; deeper soils are not accessible. [a]
		Older child trespasser					No; Pavement prevents exposures to soils; deeper soils are not accessible. [a]
		Utility worker	X	X	X		Yes; Utility workers could be exposed to soils during emergency utility repair. [b]
Surface water and Sediment	On-site Stream	USARC personnel					
		Older child trespasser	X	X			Yes; Children may play in stream; site workers and utility workers would not be expected to contact stream.
		Utility worker					

TABLE 5-5, cont.
SUMMARY OF EXPOSURE PATHWAYS EVALUATED FOR CURRENT LAND USE CONDITIONS
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

Exposure Medium	Exposure Point	Receptor	Exposure Pathway				Selected for Evaluation in Risk Assessment?
			Ingestion	Dermal Contact	Dust inhalation	Indoor vapor inhalation	
Groundwater	On-site; beneath buildings	USARC personnel				X	Yes; vapors may migrate from groundwater beneath buildings to indoor air. Groundwater is not a source of potable water; potable water is supplied by public water supply from a remote source.
		Older child trespasser					No; Trespassers would not be expected inside the building; visitors would have much lower exposures than workers
		Utility worker					No; Utility repair would not breach the groundwater table (9-10 ft bgs)
	On-site; outside building footprints	USARC personnel					No; Groundwater vapors would not migrate into ambient air at concentrations that would pose an exposure concern.
		Older child trespasser					
		Utility worker					No; Utility repair would not breach the groundwater table (9-10 ft bgs)
	Off-site	Resident					No; Groundwater is not a source of potable water; potable water is supplied by public water supply from a remote source. Constituents in groundwater are not migrating from the site and, therefore, do not pose a volatile migration concern.

[a] Exposures to these soils will be evaluated under possible future residential land use conditions (Table 5-6) that assume no AULs will be placed on the property; residential use provides an assessment that is protective for other receptors.
[b] The construction worker scenario evaluated for possible future land use conditions (Table 5-6) provides a conservative assessment of possible risks to a utility worker. Therefore, to streamline the risk assessment, possible soil exposures are evaluated for a construction worker only.

TABLE 5-6
SUMMARY OF EXPOSURE PATHWAYS EVALUATED FOR FUTURE LAND USE CONDITIONS
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

Exposure Medium	Exposure Point	Receptor	Exposure Pathway				Selected for Evaluation in Risk Assessment?
			Ingestion	Dermal Contact	Dust inhalation	Indoor vapor inhalation	
Soil	All soils 0-15 ft bgs	Site worker	[a]	[a]	[a]		Yes; pathways could be complete if presently inaccessible soil was made accessible under future land use. VOCs were detected at very low concentrations in soil, and are therefore not expected to pose a volatile migration concern. [a]
		Older child trespasser	[a]	[a]	[a]		Yes; pathways could be complete if presently inaccessible soil was made accessible under future land use. [a]
		Construction worker	X	X	X		Yes; pathways could be complete if construction activities occurred.
		On-site resident	X	X	X		Yes; Future use is assumed to be unrestricted (i.e., no AULs).
Surface water and Sediment	On-site Stream	Site worker					
		Older child trespasser	[a]	[a]			Yes; Children may play in stream; site workers and construction workers would not be expected to contact stream. Future land use is assumed to be unrestricted (i.e., no AULs).
		On-site resident	X	X			
		Construction worker					
Shallow Groundwater	On-site	Site worker				X	Yes; vapors may migrate from soils beneath buildings to indoor air. Shallow groundwater is not a source of potable water; potable water is supplied by public water supply from a remote source. [a]
		Older child trespasser					No; Trespassers would not be expected inside the building; visitors would have much lower exposures than workers
		On-site resident				X	Yes; Future land use is assumed to be unrestricted (i.e., no AULs).
		Construction worker					No; Normal work gear used by construction workers (e.g., gloves and boots) in anticipation of contacting groundwater during subsurface excavations would prevent significant exposures.

[a] Exposures are evaluated for possible future residential land use conditions that assume no AULs will be placed on the property; residential use provides an assessment that is protective for other receptors.

TABLE 5-7
EXPOSURE PARAMETERS - CURRENT USARC PERSONNEL

CPL GORDON CRAIG US ARMY RESERVE
BROCKTON, MASSACHUSETTS

PARAMETER	OFFICE WORKER	UNITS	SOURCE
Soil Ingestion Rate	NE	mg/day	
Inhalation Rate	1.2	m^3/hr	Assumption [1]
Body Weight	70	Kg	MADEP, 1995a [2]
Exposure Time - indoors	8	hours	Assumption [3]
Exposure Frequency - indoors	236	days/year	MADEP, 1996a [3]
Exposure Period	27	years	MADEP, 1996a [4]
Exposure Duration	1	day/event	Assumption [5]
Surface Area of Exposed Skin	NE	cm^2	
Soil Adherence Factor	NE	mg/cm^2	
Averaging Time			
Cancer	75	years	MADEP, 1995a
Noncancer	27	years	MADEP, 1995a [6]

Notes:
[1] - Value for adults - light exertion (MADEP, 1995a)
[2] - Value for adult males
[3] - Value for indoor air. Assumes 8-hour work-day for indoor workers.
[4] - Value for indoor workers
[5] - Assumes exposure at one exposure point during each exposure event.
[6] - Equal to ED

mg = milligrams
m3 = cubic meters
Kg = kilograms
NE - Not evaluated
MADEP, 1995a. Guidance for Disposal Site Risk Characterization in Support of the MCP. WSC/ORS-95-141
MADEP, 1996a. Commercial/Industrial ShortForm Exposure Scenarios. Draft.

TABLE 5-8
EXPOSURE PARAMETERS - OLDER CHILD TRESPASSER

CPL GORDON CRAIG US ARMY RESERVE
BROCKTON, MASSACHUSETTS

PARAMETER	*OLDER CHILD* AGES 6-17	UNITS	SOURCE
Soil Ingestion Rate	50	mg/day	MADEP, 1995a [1]
Sediment Ingestion Rate	25	mg/day	Assumption [13]
Surface Water Ingestion Rate	25	ml/hr	Assumption [14]
Inhalation Rate (soil)	2.2	m^3/hr	MADEP, 1995a [2]
Body Weight	42	Kg	MADEP, 1995a [3]
Exposure Time	2	hours	Assumption [4]
Exposure Frequency - Soi	106	days/yeai	Assumption [5]
Exposure Frequency - Surface water/sedimer	39	days/yeai	Assumption [5]
Exposure Perioc	12	years	Assumption [6]
Exposure Duratior	1	day/even	Assumption [12]
Surface Area of Exposed Skin - Soil	5409	cm^2	MADEP, 1995a [7]
Surface Area of Exposed Skin - Surface water/sediment	3290	cm^2	MADEP, 1995a [7]
Soil Adherence Factor	0.51	mg/cm^2	MADEP, 1995a [8]
Sediment Adherence Factor	0.51	mg/cm^2	Assumption [13]
Fraction Adhered Material from So	1	unitless	MADEP, 1995a
Particulate Air Concentration	32	ug/m^3	MADEP, 1995a [9]
Proportion of Particulates from Site	100%		Assumption [10]
Averaging Time			
Cancer	75	years	MADEP, 1995a
Noncancer	12	years	MADEP, 1995a [11]

Notes:

[1] - Value for persons older than age 5

[2] - Value for heavy exertion; value is average of males ages 6 through 17

[3] - Value for males; value is average for ages 6 through 17

[4] - Two-hours per event .

[5] - Assumes exposure to site (soils) three times per week April through November. Assumes exposures to surface water and sediment three times per week June through August (i.e., when water is warmer).

[6] - Ages 6 through 17

[7] - For soil, value is average of values for males ages 6 through 17 - head, hands, arms, lower legs
For surface water and sediment, value is average of values for males ages 6 through 17 - hands, lower legs, and feet

[8] - Value is used for calculation of quantitative cancer and non-cancer health risks for dermal contact with soil.

[9] - Value for open field.

[10] - Assumes all particulates are generated from soil at site.

[11] - Equal to ED

[12] - Assumes exposure at one exposure point during each exposure event.

[13] - 1/2 value for soil used because sediment is submerged and is not as easily contacted as soil.

[14] - One-half the value for swimming (MADEP, 1995a) is used to evaluate potential exposures during wading activities.

mg = milligrams
m^3 = cubic meters
Kg = kilograms

MADEP, 1994. Documentation for the Risk Assessment ShortForm Residential Scenario. WSC\ORS-142-92
MADEP, 1995a. Guidance for Disposal Site Risk Characterization in Support of the MCP. WSC/ORS-95-141

TABLE 5-9
EXPOSURE PARAMETERS - FUTURE CONSTRUCTION WORKER

CPL GORDON CRAIG US ARMY RESERVE
BROCKTON, MASSACHUSETTS

PARAMETER	CONSTRUCTION WORKER	UNITS	SOURCE
Soil Ingestion Rate	500	mg/day	MADEP, 1995a [1]
Inhalation Rate	3.6	m^3/hr	MADEP, 1996a [2]
Body Weight	70	Kg	MADEP, 1995a [3]
Exposure Time	8	hours	Assumption [4]
Exposure Frequency	250	days/year	MADEP, 1996a [5]
Exposure Period	0.5	years	MADEP, 1996a [6]
Exposure Duration	1	day/event	Assumption [11]
Surface Area of Exposed Skin	5834	cm^2	MADEP, 1996a [7]
Soil Adherence Factor	0.51	mg/cm^2	MADEP, 1995a [8]
Particulate Air Concentration	60	ug/m^3	MADEP, 1996a [9]
Proportion of Particulates from Site	100%		Assumption
Averaging Time			
Cancer	75	years	MADEP, 1995a
Noncancer	0.5	years	MADEP, 1995a [10]

Notes:
[1] - Value for high-intensity exposures.
[2] - Value for construction workers - heavy exertion
[3] - Value for adult males
[4] - Assumes 8-hour outdoor work-day
[5] - Value for construction workers; exposures five work-days per seven-day week over a 6 month (0.5 year) period.
[6] - Value for construction workers
[7] - Value for construction workers; assumes soil contact with face, neck, hands, forearms, lower legs, feet
[8] - Value is used for calculation of quantitative cancer and non-cancer health risks for dermal contact with soil.
[9] - Value for construction workers
[10] - Equal to ED
[11] - Assumes exposure at one exposure point during each exposure event.

mg = milligrams
m^3 = cubic meters
Kg = kilograms

MADEP, 1995a. Guidance for Disposal Site Risk Characterization in Support of the MCP. WSC/ORS-95-141
MADEP, 1996a. Commercial/Industrial ShortForm Exposure Scenarios. Draft.

TABLE 5-10
EXPOSURE PARAMETERS - FUTURE RESIDENT

CPL GORDON CRAIG US ARMY RESERVE
BROCKTON, MASSACHUSETTS

PARAMETER	ADULT RESIDENT	CHILD RESIDENT	UNITS	SOURCE
Soil Ingestion Rate	50	100	mg/day	MADEP, 1994 [1]
Sediment Ingestion Rate	NA	50	mg/day	Assumption [12]
Surface Water Ingestion Rate	NA	25	ml/hr	Assumption [13]
Inhalation Rate	0.98	0.32	m^3/hr	MADEP, 1995a [2]
Body Weight	59	15	Kg	MADEP, 1995a [3]
Exposure Time (dust - outdoors)	24	24	hours	Assumption [4]
Exposure Time (vapor - indoors)	24	24	hours	Assumption [4]
Exposure Time (surface water/sediment)	NA	2	hours	Assumption [14]
Exposure Frequency - Soil and dust	153	153	days/year	MADEP, 1995a [5]
Exposure Frequency - Indoor air	350	350	days/year	MADEP, 1995a [5]
Exposure Frequency - Surface water/sediment	NA	39	days/year	MADEP, 1995a [5]
Exposure Period	25	5	years	MADEP, 1994 [6]
Exposure Duration	1	1	day/event	Assumption
Surface Area of Exposed Skin - Soil	6372	3472	cm^2	MADEP, 1994 [7]
Surface Area of Exposed Skin - Surface water/sedimer	NA	1542	cm^2	MADEP, 1994 [7]
Soil Adherence Factor	0.51	0.51	mg/cm^2	MADEP, 1994 [8]
Sediment Adherence Factor	NA	0.51	mg/cm^2	Assumption [12]
Fraction Adhered Material from Soil or Sediment	1	1	unitless	MADEP, 1994
Particulate Air Concentration	32	32	ug/m^3	MADEP, 1995a [9]
Proportion of Particulates from Site	100%	100%		Assumption [10]
Averaging Time				
Cancer	75	75	years	MADEP, 1995a
Noncancer	25	5	years	MADEP, 1994 [11]

Notes:

[1] - Value for adults and children ages 1 through 5. Value for children accounts for exposures to soils outdoors and exposures throughout the year to soils that are brought into the home. Calculated as follows: [(days indoors x soil ing rate indoor) + (days outdoors x soil ing rate outdoor)] / 153 days per yr. Days indoors = 212; days outdoors = 153 Indoor soil ing. Rate = 23.64 mg/day (age-normalized); outdoor soil ing. Rate = 100 mg/day

[2] - Value for light exertion; child value is average of values for children ages 1 through 5; adult value is average of values for ages 6 through 30.

[3] - Value for males; child value is average of values for children ages 1 through 5; adult value is average of values for ages 6 through 30.

[4] - Assumes dusts are deposited and re-suspended indoors; Assumes that a person spends the majority of time indoors

[5] - Value for residential exposures; outdoor exposures five days per week, April through October. Indoor exposures to children are accounted for through the soil ingestion factor (see [1]). Value for surface water/sediment is based on assumption that exposures will occur three-times per week June through August (when water is warmest).

[6] - Value for residential exposures.

[7] - Child values for males - soil: hands, arms, legs, feet; surface water/sediment: hands, lower legs, feet. Child values are average of values for children ages 1 through 5. Adult values for males - hands, arms, lower legs, feet; adult value is average of values for ages 6 through 30.

[8] - Value is used for calculation of quantitative cancer and non-cancer health risks for dermal contact with soil. Although dermal exposure to soils deposited indoors may occur throughout the year, the assumption of exposure 153 days/yr with an AF of 0.51 mg/cm2 is more conservative than the approach used in MADEP (1994).

[9] - Value for open field.

[10] - Assumes all particulates are generated from soil at residence.

[11] - Equal to ED

[12] - 1/2 value for soil used because sediment is submerged and is not as easily contacted as soil. Adults are unlikely to wade in stream.

[13] - One-half the value for swimming (MADEP, 1995a) is used to evaluate potential exposures during wading activities.

[14] - Assumes that children will play in stream; adults are unlikely to play in stream and, therefore, are not evaluated for potential exposures to surface water and sediment.

mg = milligrams
m^3 = cubic meters
Kg = kilograms

MADEP, 1994. Documentation for the Risk Assessment ShortForm Residential Scenario. WSC\ORS-142-92
MADEP, 1995a. Guidance for Disposal Site Risk Characterization in Support of the MCP. WSC/ORS-95-141

Table 5-11
Summary Statistics for Unpaved Soil (0-3 ft bgs) in Unfenced Areas and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Frequency of Detection [1]			Range of SQLS			Range of Detected Concentrations			Arithmetic Mean	Exposure Point Concentration	
VOCs (mg/kg)												
Acetone	4	/	4		:		0.019	-	0.063	0.033	0.033	A
SVOCs (mg/kg)												
Benzo(b)fluoranthene	4	/	4		:		0.081	-	0.13	0.11	0.11	A
Chrysene	3	/	4	0.33	:	0.33	0.08	-	0.11	0.11	0.11	A
Fluoranthene	4	/	4		:		0.077	-	0.14	0.12	0.12	A
Phenanthrene	2	/	4	0.33	:	0.35	0.065	-	0.077	0.12	0.077	M [a]
Pyrene	4	/	4		:		0.072	-	0.14	0.11	0.11	A
Inorganics (mg/kg)												
Antimony	4	/	4		:		0.7	-	1.2	0.86	0.86	A
Chromium	8	/	8		:		5.5	-	13	9.3	9.3	A
Other (mg/kg)												
TPH	2	/	4	10	:	10	14	-	54	20	20	A

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

M - Maximum detected concentration used as EPC. Per 310 CMR 40.0926(3), the data exhibit a high degree of variability as evidenced by more than a 10-fold difference in the range of detected concentrations (or in the difference between the detected concentration and; the minimum SQL, for OHM detected only once) therefore, the maximum detected concentration is selected to conservatively represent the true mean.

A - Arithmetic mean concentration used as EPC. Per 310 CMR 40.0926(3), the data do not exhibit a high degree of variability as evidenced by a less-than a 10-fold difference in the range of detected concentrations; therefore, the arithmetic mean concentration is selected to conservatively represent the true mean.

[a] - Due to elevated SQLs, the calculated arithmetic mean is greater than the maximum detected concentration. Therefore, the maximum detected concentration is used as the EPC.

Table 5-12
Summary Statistics for Soil (0 - 15 ft) Throughout Site and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Frequency of Detection [1]	Range of SQLS	Range of Detected Concentrations	Arithmetic Mean	Exposure Point Concentration	
VOCs (mg/kg)						
1,2,4,-Trimethylbenzene	1 / 15	0.0043 : 0.0074	0.23 - 0.23	0.018	0.23	M [a]
1,3,5-Trimethylbenzene	1 / 15	0.0043 : 0.0074	0.038 - 0.038	0.0051	0.038	M
4-isopropyltoluene	1 / 15	0.0043 : 0.0074	0.044 - 0.044	0.0055	0.044	M [a]
Acetone	11 / 15	0.021 : 0.024	0.018 - 0.2	0.038	0.2	M
Ethylbenzene	1 / 27	0.0043 : 0.048	0.0021 - 0.0021	0.010	0.0021	M
Isopropylbenzene	1 / 15	0.0043 : 0.0074	0.036 - 0.036	0.0050	0.036	M
m,p-Xylene	1 / 27	0.0043 : 0.048	0.019 - 0.019	0.011	0.019	M
Methylene Chloride	5 / 15	0.021 : 0.034	0.014 - 0.025	0.015	0.015	A
n-Propylbenzene	1 / 15	0.0043 : 0.0074	0.069 - 0.069	0.0072	0.069	M [a]
o-Xylene	1 / 27	0.0043 : 0.048	0.0046 - 0.0046	0.010	0.0046	M
sec-Butylbenzene	1 / 15	0.0043 : 0.0074	0.075 - 0.075	0.0076	0.075	M [a]
Toluene	1 / 27	0.0042 : 0.048	0.021 - 0.021	0.010	0.021	M
SVOCs (mg/kg)						
Benzo(b)fluoranthene	4 / 27	0.265 : 0.3	0.081 - 0.13	0.13	0.13	A
Chrysene	3 / 27	0.265 : 0.33	0.08 - 0.11	0.13	0.11	M [b]
Fluoranthene	6 / 27	0.265 : 0.3	0.069 - 0.16	0.13	0.13	A
Naphthalene	1 / 27	0.0043 : 0.048	0.19 - 0.19	0.017	0.19	M
Phenanthrene	4 / 27	0.265 : 0.35	0.065 - 0.3	0.14	0.14	A
Pyrene	6 / 27	0.265 : 0.3	0.072 - 0.14	0.13	0.13	A
Inorganics (mg/kg)						
Antimony	7 / 15	5.2 : 6.1	0.7 - 20	3.3	20	M [a]
Chromium	30 / 30	:	3.4 - 30	10	10	A
Other (mg/kg)						
TPH	10 / 16	10 : 10	13 - 1800	128	1800	M [a]
C11-C22 Aromatic	1 / 20	53 : 73	45.5 - 45.5	29	45.5	M
C19-C36 Aliphatic	3 / 20	53 : 73	56.5 - 71	33	71	M (b)
C9-C10 Aromatic	1 / 20	0.32 : 1	1.7 - 1.7	0.34	1.7	M
C9-C12 Aliphatic	1 / 20	0.32 : 1	1.4 - 1.4	0.32	1.4	M

Table 5-12
Summary Statistics for Soil (0 - 15 ft) Throughout Site and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

M - Maximum detected concentration used as EPC. Per 310 CMR 40.0926(3), the data exhibit a high degree of variability as evidenced by more than a 10-fold difference in the range of detected concentrations (or in the difference between the detected concentration and; the minimum SQL, for OHM detected only once) therefore, the maximum detected concentration is selected to conservatively represent the true mean.

A - Arithmetic mean concentration used as EPC. Per 310 CMR 40.0926(3), the data do not exhibit a high degree of variability as evidenced by a less-than a 10-fold difference in the range of detected concentrations; therefore, the arithmetic mean concentration is selected to conservatively represent the true mean.

[a] - The maximum concentration is used as the EPC in order to represent the concentrations associated with the soil hot spot.

[b] - Due to elevated SQLs, the calculated arithmetic mean is greater than the maximum detected concentration. Therefore, the maximum detected concentration is used as the EPC.

[c] - The maximum detected concentration is used as the EPC because the arithmetic mean is lower than the minimum detected concentration.

Table 5-13
Summary Statistics for Groundwater and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Frequency of Detection [1]	Range of SQLS	Range of Detected Concentrations	Arithmetic Mean	Exposure Point Concentration	
VOCs (mg/L)						
1,2,4-Trimethylbenzene	2 / 15	0.002 : 0.002	0.00064 - 0.001	0.00098	0.00098	A
1,3,5-Trimethylbenzene	1 / 15	0.002 : 0.002	0.0006 - 0.0006	0.00097	0.0006	M
4-isopropyltoluene	1 / 11	0.002 : 0.002	0.00092 - 0.00092	0.00099	0.00092	M
Isopropylbenzene	1 / 15	0.002 : 0.002	0.0003 - 0.0003	0.00095	0.0003	M
m,p-Xylene	1 / 15	0.002 : 0.002	0.0007 - 0.0007	0.00098	0.0007	M
Methyl tert-butyl ether (MTBE)	1 / 11	0.002 : 0.002	0.00375 - 0.00375	0.0013	0.00375	M
n-Propylbenzene	1 / 11	0.002 : 0.002	0.00054 - 0.00054	0.00096	0.00054	M
sec-Butylbenzene	2 / 15	0.002 : 0.002	0.0006 - 0.00835	0.0015	0.00835	M
Toluene	10 / 15	0.002 : 0.002	0.00054 - 0.00705	0.0023	0.00705	M
SVOCs (mg/L)						
Naphthalene	1 / 15	0.002 : 0.002	0.003 - 0.003	0.0011	0.003	M
Phenol	7 / 15	0.01 : 0.01	0.0018 - 0.0385	0.0080	0.0385	M
Inorganics (mg/L)						
Barium, dissolved	8 / 14	0.01 : 0.29	0.01 - 0.34	0.14	0.34	M
Chromium, dissolved	3 / 14	0.001 : 0.01	0.0025 - 0.0036	0.0033	0.0033	A
Thallium, dissolved	1 / 4	0.001 : 0.001	0.002 - 0.002	0.00088	0.002	M
Zinc, dissolved	3 / 4	0.01 : 0.01	0.01 - 0.018	0.011	0.011	A
Other (mg/L)						
Ammonia	2 / 4	0.05 : 0.05	0.06 - 0.11	0.055	0.055	A
Nitrate-Nitrite-N	3 / 4	0.05 : 0.05	0.08 - 0.52	0.24	0.24	A
C11-C22 Aromatic	1 / 2	0.1 : 0.1	0.355 - 0.355	0.20	0.355	M
C19-C36 Aliphatic	2 / 2	:	0.1 - 0.145	0.12	0.12	A
C9-C18 Aliphatic	1 / 2	0.1 : 0.1	0.535 - 0.535	0.29	0.535	M
C9-C10 Aromatic	1 / 2	0.025 : 0.025	0.053 - 0.053	0.033	0.053	M
C9-C12 Aliphatic	1 / 2	0.025 : 0.025	0.141 - 0.141	0.077	0.141	M

Table 5-13
Summary Statistics for Groundwater and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

M - Maximum detected concentration used as EPC. Per 310 CMR 40.0926(3), the data exhibit a high degree of variability as evidenced by more than a 10-fold difference in the range of detected concentrations (or in the difference between the detected concentration and; the minimum SQL, for OHM detected only once) therefore, the maximum detected concentration is selected to conservatively represent the true mean.

A - Arithmetic mean concentration used as EPC. Per 310 CMR 40.0926(3), the data do not exhibit a high degree of variability as evidenced by a less-than a 10-fold difference in the range of detected concentrations; therefore, the arithmetic mean concentration is selected to conservatively represent the true mean.

Table 5-14
Summary Statistics for Surface Water and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Frequency of Detection [1]	Range of SQLS		Range of Detected Concentrations		Arithmetic Mean	Exposure Point Concentration	
VOCs (mg/L)								
Carbon disulfide	1 / 4	0.002	: 0.002	0.00081	- 0.00081	0.00095	0.00081	M
SVOCs (mg/L)								
bis(2-ethylhexyl) phthalate	2 / 6	0.01	: 10	0.0013	- 0.004	0.01	0.004	M [a]
Inorganics (mg/L)								
Antimony	4 / 6	0.005	: 0.005	0.0025	- 0.013	0.0043	0.0043	A
Arsenic	1 / 6	0.005	: 0.025	0.01	- 0.01	0.010	0.01	M
Barium	4 / 6	0.2	: 0.2	0.04	- 0.15	0.083	0.083	A
Cadmium	2 / 6	0.0005	: 0.0025	0.00225	- 0.028	0.0054	0.0054	A
Chromium	3 / 6	0.001	: 0.01	0.0027	- 0.061	0.013	0.061	M
Copper	2 / 2		:	0.02	- 0.33	0.18	0.33	M
Lead	4 / 6	0.005	: 0.005	0.005	- 0.43	0.079	0.43	M
Mercury	2 / 6	0.0002	: 0.0002	0.0002	- 0.0003	0.00015	0.00015	A
Nickel	1 / 2	0.05	: 0.05	0.05	- 0.05	0.038	0.05	M
Selenium	1 / 6	0.001	: 0.04	0.0091	- 0.0091	0.012	0.0091	M
Zinc	2 / 2		:	0.16	- 0.56	0.36	0.36	A
Other (mg/L)								
Ammonia	2 / 2		:	0.14	- 1.2	0.67	0.67	A
Nitrate-Nitrite-N	2 / 2		:	0.37	- 1.9	1.1	1.1	A
C11-C22 Aromatic	1 / 1		:	0.115	- 0.115	0.12	0.115	M
C19-C36 Aliphatic	1 / 1		:	0.25	- 0.25	0.25	0.25	M

Table 5-14
Summary Statistics for Surface Water and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

M - Maximum detected concentration used as EPC. Per 310 CMR 40.0926(3), the data exhibit a high degree of variability as evidenced by more than a 10-fold difference in the range of detected concentrations (or in the difference between the detected concentration and; the minimum SQL, for OHM detected only once) therefore, the maximum detected concentration is selected to conservatively represent the true mean.

A - Arithmetic mean concentration used as EPC. Per 310 CMR 40.0926(3), the data do not exhibit a high degree of variability as evidenced by a less-than a 10-fold difference in the range of detected concentrations; therefore, the arithmetic mean concentration is selected to conservatively represent the true mean.

[a] - Due to elevated SQLs, the calculated arithmetic mean is greater than the maximum detected concentration. Therefore, the maximum detected concentration is used as the EPC.

Table 5-15
Summary Statistics for Sediment and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Frequency of Detection [1]	Range of SQLS			Range of Detected Concentrations			Arithmetic Mean	Exposure Point Concentration	
VOCs (mg/kg)										
Acetone	2 / 4	0.028	:	0.028	0.018	-	0.089	0.030	0.030	A
SVOCs (mg/kg)										
Benzo(a)anthracene	2 / 4	0.3	:	0.45	0.088	-	0.19	0.16	0.16	A
Benzo(a)pyrene	3 / 4	0.3	:	0.3	0.099	-	0.27	0.16	0.16	A
Benzo(b)fluoranthene	4 / 4		:		0.089	-	0.43	0.21	0.21	A
Benzo(g,h,i)perylene	3 / 4	0.3	:	0.3	0.086	-	0.26	0.15	0.15	A
Benzo(k)fluoranthene	2 / 4	0.3	:	0.45	0.115	-	0.12	0.15	0.12	M [a]
bis(2-ethylhexyl) phthalate	2 / 4	0.3	:	0.45	0.25	-	0.48	0.28	0.28	A
Chrysene	4 / 4		:		0.06	-	0.31	0.17	0.17	A
Fluoranthene	4 / 4		:		0.06	-	0.57	0.24	0.24	A
Indeno(1,2,3-cd)pyrene	3 / 4	0.3	:	0.3	0.076	-	0.28	0.15	0.15	A
Phenanthrene	2 / 4	0.3	:	0.45	0.13	-	0.26	0.19	0.19	A
Pyrene	3 / 4	0.3	:	0.3	0.18	-	0.48	0.25	0.25	A
Inorganics (mg/kg)										
Antimony	4 / 4		:		0.55	-	5.3	1.9	1.9	A
Arsenic	5 / 6	7.4	:	7.4	1.5	-	11	5.5	5.5	A
Barium	6 / 6		:		13	-	120	46	46	A
Cadmium	4 / 6	0.25	:	0.74	0.22	-	20	4.2	4.2	A
Chromium	6 / 6		:		7.8	-	65	23	23	A
Lead	6 / 6		:		7.2	-	390	112	390	M
Mercury	3 / 6	0.025	:	0.1	0.016	-	0.13	0.046	0.046	A
Silver	1 / 6	0.5	:	2.15	3.1	-	3.1	1.1	3.1	M
Other (mg/kg)										
TPH	2 / 2		:		82	-	200	141	141	A
C19-C36 Aliphatic	1 / 1		:		370	-	370	370	370	M

Table 5-15
Summary Statistics for Sediment and Identification of Exposure Point Concentrations

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

M - Maximum detected concentration used as EPC. Per 310 CMR 40.0926(3), the data exhibit a high degree of variability as evidenced by more than a 10-fold difference in the range of detected concentrations (or in the difference between the detected concentration and; the minimum SQL, for OHM detected only once) therefore, the maximum detected concentration is selected to conservatively represent the true mean.

A - Arithmetic mean concentration used as EPC. Per 310 CMR 40.0926(3), the data do not exhibit a high degree of variability as evidenced by a less-than a 10-fold difference in the range of detected concentrations; therefore, the arithmetic mean concentration is selected to conservatively represent the true mean.

[a] - *Due to elevated SQLs, the calculated arithmetic mean is greater than the maximum detected concentration. Therefore,* the maximum detected concentration is used as the EPC.

TABLE 5-16
HUMAN HEALTH RISK SUMMARY
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MA

Land Use	Receptor	Exposure Route	Hazard Index	Excess Lifetime Cancer Risk
Current Land Use				
	Commercial / Industrial Worker	Indoor inhalation of vapors from groundwater beneath existing building	0.003	NC
		Total groundwater	**0.003**	**NC**
		Total Commercial / Industrial Worker	**0.003**	**NC**
	Older Child Trespasser	Incidental ingestion of unfenced unpaved soils 0-3 ft	0.002	$4x10^{-9}$
		Dermal exposure to unfenced unpaved soils 0-3 ft	0.01	$1x10^{-8}$
		Inhalation of particulates from unfenced unpaved soils 0-3 ft	0.00007	$1x10^{-8}$
		Total soils	**0.01**	**$2x10^{-8}$**
		Incidental ingestion of sediment	0.02	$1x10^{-7}$
		Dermal exposure to sediment	0.03	$2x10^{-7}$
		Total sediment	**0.05**	**$3x10^{-7}$**
		Incidental ingestion of surface water	0.05	$3x10^{-7}$
		Dermal exposure to surface water	0.04	$8x10^{-8}$
		Total surface water	**0.09**	**$4x10^{-7}$**
		Total Trespasser	**0.2**	**$7x10^{-7}$**

TABLE 6-16
HUMAN HEALTH RISK SUMMARY
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MA

Land Use	Receptor	Exposure Route	Hazard Index	Excess Lifetime Cancer Risk
Future Land Use				
	Child Resident	Incidental ingestion of soils 0-15 ft	0.3	$2x10^{-8}$
		Dermal exposure to soils 0-15 ft	0.8	$1x10^{-9}$
		Inhalation of particulates from soils 0-15 ft	0.02	$1x10^{-7}$
		Total soils	**1**	**$1x10^{-7}$**
		Indoor inhalation of vapors from groundwater beneath existing building	0.01	NC
		Total groundwater	**0.01**	**NC**
		Incidental ingestion of sediment	0.1	$2x10^{-7}$
		Dermal exposure to sediment	0.04	$1x10^{-7}$
		Total sediment	**0.1**	**$3x10^{-7}$**
		Incidental ingestion of surface water	0.1	$4x10^{-7}$
		Dermal exposure to surface water	0.05	$4x10^{-8}$
		Total surface water	**0.2**	**$4x10^{-7}$**
		Total Child Resident	**1**	**$8x10^{-7}$**
	Adult Resident	Incidental ingestion of soils 0-15 ft	0.04	$1x10^{-8}$
		Dermal exposure to soils 0-15 ft	0.4	$3x10^{-8}$
		Inhalation of particulates from soils 0-15 ft	0.002	$5x10^{-7}$
		Total soils	**0.4**	**$5x10^{-7}$**
		Indoor inhalation of vapors from groundwater beneath existing building	0.01	NC
		Total groundwater	**0.01**	**NC**
		Total Adult Resident	**0.4**	**$5x10^{-7}$**
		Total Resident	**NA**	**$1x10^{-6}$**
	Construction Worker	Incidental ingestion of soils 0-15 ft	0.3	$3x10^{-9}$
		Dermal exposure to soils 0-15 ft	0.2	$8x10^{-10}$
		Inhalation of particulates from soils 0-15 ft	0.002	$1x10^{-8}$
		Total soils	***0.5***	***$1x10^{-8}$***
		Total Construction Worker	**0.5**	**$1x10^{-8}$**

NC - Not calculated because there are no potentially carcinogenic OHM.
NA - Not additive.

Table 5-17
Comparison of EPCs for Soils (0 - 15 ft) Throughout Site to Upper Concentration Limits

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Frequency of Detection [1]	Range of SQLS	Range of Detected Concentrations	Arithmetic Mean	Exposure Point Concentration		UCL [2]	Does EPC Exceed UCL?
VOCs (mg/kg)								
1,2,4,-Trimethylbenzene	1 / 15	0.0043 : 0.0074	0.23 - 0.23	0.018	0.23	M [a]	1000 [d]	No
1,3,5-Trimethylbenzene	1 / 15	0.0043 : 0.0074	0.038 - 0.038	0.0051	0.038	M	1000 [d]	No
4-isopropyltoluene	1 / 15	0.0043 : 0.0074	0.044 - 0.044	0.0055	0.044	M [a]	1000 [d]	No
Acetone	11 / 15	0.021 : 0.024	0.018 - 0.2	0.038	0.2	M	10000	No
Ethylbenzene	1 / 27	0.0043 : 0.048	0.0021 - 0.0021	0.010	0.0021	M	10000	No
Isopropylbenzene	1 / 15	0.0043 : 0.0074	0.036 - 0.036	0.0050	0.036	M	1000 [d]	No
m,p-Xylene	1 / 27	0.0043 : 0.048	0.019 - 0.019	0.011	0.019	M	10000	No
Methylene Chloride	5 / 15	0.021 : 0.034	0.014 - 0.025	0.015	0.015	A	7000	No
n-Propylbenzene	1 / 15	0.0043 : 0.0074	0.069 - 0.069	0.0072	0.069	M [a]	1000 [d]	No
o-Xylene	1 / 27	0.0043 : 0.048	0.0046 - 0.0046	0.010	0.0046	M	10000	No
sec-Butylbenzene	1 / 15	0.0043 : 0.0074	0.075 - 0.075	0.0076	0.075	M [a]	1000 [d]	No
Toluene	1 / 27	0.0042 : 0.048	0.021 - 0.021	0.010	0.021	M	10000	No
SVOCs (mg/kg)								
Benzo(b)fluoranthene	4 / 27	0.265 : 0.3	0.081 - 0.13	0.13	0.13	A	100	No
Chrysene	3 / 27	0.265 : 0.33	0.08 - 0.11	0.13	0.11	M [b]	400	No
Fluoranthene	6 / 27	0.265 : 0.3	0.069 - 0.16	0.13	0.13	A	10000	No
Naphthalene	1 / 27	0.0043 : 0.048	0.19 - 0.19	0.017	0.19	M	10000	No
Phenanthrene	4 / 27	0.265 : 0.35	0.065 - 0.3	0.14	0.14	A	10000	No
Pyrene	6 / 27	0.265 : 0.3	0.072 - 0.14	0.13	0.13	A	10000	No
Inorganics (mg/kg)								
Antimony	7 / 15	5.2 : 6.1	0.7 - 20	3.3	20	M [a]	400	No
Chromium	30 / 30	:	3.4 - 30	10	10	A	10000	No
Other (mg/kg)								
TPH	10 / 16	10 : 10	13 - 1800	128	1800	M [a]	10000	No
C11-C22 Aromatic	1 / 20	53 : 73	45.5 - 45.5	29	45.5	M	10000	No
C19-C36 Aliphatic	3 / 20	53 : 73	56.5 - 71	33	71	M (b)	20000	No
C9-C10 Aromatic	1 / 20	0.32 : 1	1.7 - 1.7	0.34	1.7	M	5000	No
C9-C12 Aliphatic	1 / 20	0.32 : 1	1.4 - 1.4	0.32	1.4	M	20000	No

Notes:

Table 5-17
Comparison of EPCs for Soils (0 - 15 ft) Throughout Site to Upper Concentration Limits

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

[1] Samples included in data set are listed in Appendix I.
Duplicate samples were averaged with their original samples prior to calculation of summary statistics.
The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[2] Upper Concentration Limits (UCLs) are published in 310 CMR 40.0996(7)

M - Maximum detected concentration used as EPC. Per 310 CMR 40.0926(3), the data exhibit a high degree of variability as evidenced by more than a 10-fold difference in the range of detected concentrations (or in the difference between the detected concentration and; the minimum SQL, for OHM detected only once) therefore, the maximum detected concentration is selected to conservatively represent the true mean.

A - Arithmetic mean concentration used as EPC. Per 310 CMR 40.0926(3), the data do not exhibit a high degree of variability as evidenced by a less-than a 10-fold difference in the range of detected concentrations; *therefore, the arithmetic mean concentration is selected to conservatively represent the true mean.*

[a] - The maximum concentration is used as the EPC in order to represent the concentrations associated with the soil hot spot.

[b] - Due to elevated SQLs, the calculated arithmetic mean is greater than the maximum detected concentration. Therefore, the maximum detected concentration is used as the EPC.

[c] - The maximum detected concentration is used as the EPC because the arithmetic mean is lower than the minimum detected concentration.

[d] - Per 310 CMR 40.0996(8), for any OHM not listed in 40.0996(7), a default UCL of 1,000 mg/kg shall be used.

UCL - Upper Concentration Limit

Table 5-18
Comparison of EPCs for Groundwater to Upper Concentration Limits

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

OHM of Concern	Frequency of Detection [1]	Range of SQLS	Range of Detected Concentrations	Arithmetic Mean	Exposure Point Concentration		UCL [2]	Does EPC Exceed UCL?
VOCs (mg/L)								
1,2,4-Trimethylbenzene	2 / 15	0.002 : 0.002	0.00064 - 0.001	0.00098	0.00098	A	10 [a]	No
1,3,5-Trimethylbenzene	1 / 15	0.002 : 0.002	0.0006 - 0.0006	0.00097	0.0006	M	10 [a]	No
4-isopropyltoluene	1 / 11	0.002 : 0.002	0.00092 - 0.00092	0.00099	0.00092	M	10 [a]	No
Isopropylbenzene	1 / 15	0.002 : 0.002	0.0003 - 0.0003	0.00095	0.0003	M	10 [a]	No
m,p-Xylene	1 / 15	0.002 : 0.002	0.0007 - 0.0007	0.00098	0.0007	M	100	No
Methyl tert-butyl ether (MTBE)	1 / 11	0.002 : 0.002	0.00375 - 0.00375	0.0013	0.00375	M	100	No
n-Propylbenzene	1 / 11	0.002 : 0.002	0.00054 - 0.00054	0.00096	0.00054	M	10 [a]	No
sec-Butylbenzene	2 / 15	0.002 : 0.002	0.0006 - 0.00835	0.0015	0.00835	M	10 [a]	No
Toluene	10 / 15	0.002 : 0.002	0.00054 - 0.00705	0.0023	0.00705	M	100	No
SVOCs (mg/L)								
Naphthalene	1 / 15	0.002 : 0.002	0.003 - 0.003	0.0011	0.003	M	60	No
Phenol	7 / 15	0.01 : 0.01	0.0018 - 0.0385	0.0080	0.0385	M	100	No
Inorganics (mg/L)								
Barium, dissolved	8 / 14	0.01 : 0.29	0.01 - 0.34	0.14	0.34	M	100	No
Chromium, dissolved	3 / 14	0.001 : 0.01	0.0025 - 0.0036	0.0033	0.0033	A	20	No
Thallium, dissolved	1 / 4	0.001 : 0.001	0.002 - 0.002	0.00088	0.002	M	4	No
Zinc, dissolved	3 / 4	0.01 : 0.01	0.01 - 0.018	0.011	0.011	A	20	No
Other (mg/L)								
Ammonia	2 / 4	0.05 : 0.05	0.06 - 0.11	0.055	0.055	A	10 [a]	No
Nitrate-Nitrite-N	3 / 4	0.05 : 0.05	0.08 - 0.52	0.24	0.24	A	10 [a]	No
C11-C22 Aromatic	1 / 2	0.1 : 0.1	0.355 - 0.355	0.20	0.355	M	100	No
C19-C36 Aliphatic	2 / 2	:	0.1 - 0.145	0.12	0.12	A	100	No
C9-C18 Aliphatic	1 / 2	0.1 : 0.1	0.535 - 0.535	0.29	0.535	M	100	No
C9-C10 Aromatic	1 / 2	0.025 : 0.025	0.053 - 0.053	0.033	0.053	M	100	No
C9-C12 Aliphatic	1 / 2	0.025 : 0.025	0.141 - 0.141	0.077	0.141	M	100	No

Table 5-18
Comparison of EPCs for Groundwater to Upper Concentration Limits

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix I.

Duplicate samples were averaged with their original samples prior to calculation of summary statistics.

The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[2] Upper Concentration Limits (UCLs) are published in 310 CMR 40.0996(7)

M - Maximum detected concentration used as EPC. Per 310 CMR 40.0926(3), the data exhibit a high degree of variability as evidenced by more than a 10-fold difference in the range of detected concentrations (or in the difference between the detected concentration and; the minimum SQL, for OHM detected only once) therefore, the maximum detected concentration is selected to conservatively represent the true mean.

A - Arithmetic mean concentration used as EPC. Per 310 CMR 40.0926(3), the data do not exhibit a high degree of variability as evidenced by a less-than a 10-fold difference in the range of detected concentrations; *therefore, the arithmetic mean concentration is selected to conservatively represent the true mean.*

[a] - Per 310 CMR 40.0996(8), for any OHM not listed in 40.0996(7), a default UCL of 10,000 ug/L shall be used.

UCL - Upper Concentration Limit

Table 5-19
Potential Sources of Uncertainty

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

UNCERTAINTY	EFFECT	JUSTIFICATION
Likelihood of exposure pathways	Overestimate	Future exposures would only occur if land use changed, which is not planned at this time.
Degradation of chemicals not considered	Overestimate	Risk estimates are based on recent chemical concentrations. Concentrations will tend to decrease over time as a result of degradation, so future exposures may be to lower concentrations.
Extrapolation of animal toxicity data to humans	Unknown, probably overestimate	Animals and humans differ with respect to absorption, metabolism, distribution, and excretion of chemicals. The magnitude and direction of the difference will vary with each chemical. Animal studies typically involve high-dose exposures, whereas humans are exposed to low doses in the environment.
Use of linearized, multistage model to derive cancer slope factors	Overestimate	Model assumes a non-threshold, linear-at-low-dose relationship for carcinogens. Many compounds induce cancer by non-genotoxic mechanisms. Model results in a 95% upper confidence limit of the cancer risk. The true risk is unlikely to be higher and may be as low as zero.
Summation of effects (cancer risks and hazard indices) from multiple substances	Unknown	The assumption that effects are additive ignores potential synergistic and/or antagnonistic effects. Assumes similarity in mechanism of action, which is not the case for many substances. Compounds may induce tumors or other toxic effects in different organs or systems.
Use of uncertainty factors in the derivation of reference doses.	Unknown	Ten-fold uncertainty factors are incorporated to account for various sources of uncertainty. Although some data seem to support the ten-fold factor, its selection is somewhat arbitrary.

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TABLE 6-1
DETECTED SOIL ANALYTES - DRAINAGE SWALE - COMPARED TO BACKGROUND
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Parameter	Maximum Site-Specific Background Concentration*	Published MADEP Background Concentration**	Frequency of Detection	Minimum Detected	Maximum Detected	Arithmetic Mean	Does the Maximum Detected Value Exceed the Site-Specific Background Value?	Does the Maximum Detected Value Exceed the Published Background Value?
VOCs (Method 8260B) mg/kg								
Acetone	0.063	none available	2/2	0.02	0.03	0.025	No	NA
SVOCs (Method 8270C) mg/kg								
Benzo(a)anthracene	0.071	2	1/2	0.068	0.068	0.068	No	No
Benzo(a)pyrene	0.081	2	1/2	0.066	0.066	0.066	No	No
Benzo(b)fluoranthene	0.13	2	2/2	0.081	0.11	0.096	No	No
Benzo(g,h,i)perylene	0.073	1	1/2	0.069	0.069	0.069	No	No
Chrysene	0.11	2	1/2	0.092	0.092	0.092	No	No
Fluoranthene	0.14	4	2/2	0.077	0.13	0.104	No	No
Indeno(1,2,3-cd)pyrene	0.350 U	1	1/2	0.064	0.064	0.064	No	No
Phenanthrene	0.077	3	1/2	0.065	0.065	0.065	No	No
Pyrene	0.14	4	2/2	0.072	0.12	0.096	No	No
Total RCRA Metals & Antimony (Method 6010B/7000 series) mg/kg								
Antimony	0.81	1.4	2/2	0.7	1.2	0.96	Yes	No
Arsenic	2.9	17	1/2	1.1	1.1	1.1	No	No
Barium	33	45	2/2	19	33	26	No	No
Cadmium	0.28	2	2/2	0.17	0.19	0.18	No	No
Chromium	13	29	2/2	9.1	9.2	9.2	No	No
Lead	53	99	2/2	10	15	12.5	No	No
Mercury	0.071	0.3	2/2	0.018	0.03	0.024	No	No

Notes:

U = Not detected at the stated method detection limit.

* Maximum of concentrations detected at background soil locations BRSWSD05 and BRSWSD06.

** Sources of Published Background Concentrations:

SVOCs - MADEP, 2001.

Metals - MADEP, 1995a

TABLE 6-2
DETECTED SURFACE WATER ANALYTES COMPARED TO BACKGROUND
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Parmeter/Method	Site Background Concentration*	Frequency of Detection	Minimum Detected Concentration	Arithmetic Mean Concentration (Mean EPC)	Maximum Detected Concentration (Max EPC)	Maximum Concentration Sample	Does the Maximum Detected Value Exceed the Background Value?
VOCs (Method 8260B) µg/l							
Carbon disulfide	ND	1/3	0.81	0.81	0.81	BRSWSW02	Yes
SVOCs (Method 8270C) µg/l							
bis(2-ethylhexyl)phthalate	ND	1/3	1.3	1.3	1.3	BRSWSW03	Yes
EPH (MADEP Method) µg/l							
C19-C36 Aliphatic	NA	1/1	250	250	250	BRSWSW03	--
C11-C22 Aromatics	NA	1/1	90	90	90	BRSWSW03	--
Total RCRA Metals & Antimony (Method 6010B/7000 series) µg/l							
Antimony	ND	3/3	2.5	2.6	2.8	BRSWSW04	Yes
Barium	ND	2/3	45	52.5	60	BRSWSW02	Yes
Cadmium	ND	1/3	2.3	1.3	2.3	BRSWSW03	Yes
Chromium	ND	2/3	2.7	3.1	3.4	BRSWSW02	Yes
Lead	ND	2/3	5	11.2	26	BRSWSW03	Yes
Dissolved Metals (Method 6010B) µg/l (sampled 2001)							
Cadmium	ND	3/3	0.33	0.44	0.58	BRSWSW04R	Yes
Lead	2.5	2/3	2.4	2.4	4.0	BRSWSW04R	Yes
Selenium	ND	1/3	2.1	1.5	2.1	BRSWSW03R	Yes

Notes:

*Concentration detected at background surface water location BRSWSW01.

ND = Not detected.

NA = Not analyzed.

-- = Not calculated due to absence of background value.

TABLE 6-3
DETECTED SEDIMENT ANALYTES COMPARED TO BACKGROUND
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Parmeter/Method	Site Background Concentration*	Frequency of Detection	Minimum Concentration	Arithmetic Mean (Mean EPC)	Maximum Concentration (Max EPC)	Maximum Concentration Sample	Does the Maximum Detected Value Exceed the Site Background Value?
VOCs (Method 8260B) µg/kg							
Acetone	18	2/3	89	70	107	BRSWSD03	Yes
SVOCs (Method 8270C) µg/kg							
Benzo(a)anthracene	190	1/3	88	88	88	BRSWSD03	No
Benzo(a)pyrene	270	3/4	99	101	102	BRSWSD03	No
Benzo(b)fluoranthene	430	3/3	89	138	210	BRSWSD04	No
Benzo(g,h,i)perylene	260	2/3	86	98	110	BRSWSD04	No
Benzo(k)fluoranthene	120	1/3	70	70	70	BRSWSD03	No
bis(2-ethylhexyl)phthalate	250	1/3	480	285	480	BRSWSD03	Yes
Chrysene	310	3/3	60	109	160	BRSWSD04	No
Fluoranthene	570	3/3	60	130	190	BRSWSD04	No
Indeno(1,2,3-cd)pyrene	280	2/3	76	93	110	BRSWSD04	No
Phenanthrene	260	1/3	100	100	100	BRSWSD03	No
Pyrene	480	2/3	155	162	180	BRSWSD04	No
Total PAHs	3,170	3/3	209	769	1,059	BRSWSD04	No
EPH (MADEP Method) mg/kg							
C19-C36 Aliphatics	NA	1/1	370	370	370	BRSWSD03	--
Chrysene	NA	1/1	0.195	0.195	0.195	BRSWSD03	--
Pyrene	NA	1/1	0.2	0.2	0.2	BRSWSD03	--
RCRA Metals & Antimony (Method 6010B/7000 series) mg/kg							
Antimony	0.55	3/3	0.57	2.3	5.3	BRSWSD03	Yes
Arsenic	2.3	2/3	7.2	6.1	7.5	BRSWSD03	Yes
Barium	13	3/3	15	42.7	84	BRSWSD04	Yes
Cadmium	0.22	2/3	1.4	1.6	3.2	BRSWSD03	Yes
Chromium	11	3/3	7.8	18.1	28.5	BRSWSD03	Yes
Lead	24	3/3	7.2	77.9	170	BRSWSD04	Yes
Silver	ND	1/3	3.1	1.8	3.1	BRSWSD04	Yes
Mercury	ND	3/3	0.016	0.055	0.13	BRSWSD04	Yes

Notes:

*Concentration detected at background sediment location BRSWSD01.

NA = Not analyzed.

(Not calculated due to absence of background value.

TABLE 6-4
SURFACE WATER EFFECTS-BASED SCREENING
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Parmeter/Method	Maximum Detected Concentration	Maximum Concentration Sample	Chronic Water Quality Screening Value		Does the Maximum Detected Value Exceed the Screening Value?
VOCs (Method 8260B) µg/l					
Carbon disulfide	0.81	BRSWSW02	0.92		No
SVOCs (Method 8270C) µg/l					
bis(2-ethylhexyl)phthalate	1.3	BRSWSW03	360	P	No
EPH (MADEP Method) µg/l					
C19-C36 Aliphatic	250	BRSWSW03	None available		--
C11-C22 Aromatics	90	BRSWSW03	None available		--
Total RCRA Metals & Antimony (Method 6010B/7000 series) µg/l					
Antimony	2.8	BRSWSW04	30	P	No
Barium	60	BRSWSW02	4		Yes
Cadmium	2.3	BRSWSW03	0.15	DH	Yes
Chromium	3.4	BRSWSW02	11	D	No
Lead	26	BRSWSW03	1.1	DH	Yes
Dissolved Metals (Method 6010B) µg/l (sampled 2001)					
Cadmium	0.58	BRSWSW04R	0.19	DH	Yes
Lead	4.0	BRSWSW04R	1.6	DH	Yes
Selenium	2.1	BRSWSW03R	5	T	No

Notes:

Sources of Water Quality Screening Values:

Carbon disulfide and barium: Secondary Chronic Value from Suter and Tsao, 1996.

Bis(2-ethylhexyl)phthalate and antimony: no AWQC available, these are proposed AWQC from Buchman, 1999.

Chromium, lead, selenium: AWQC from EPA 1999a. Value for Chromium IV used because it was more conservative than Chromium III.

Cadmium: AWQC from EPA 2001.

[P] = Proposed value.

[D] = Expressed in terms of dissolved metal in the water column.

[H] = Screening value adjusted to reflect the site-specific water hardness (47 mg/L as CaCO3 - 1999 data; 67 mg/L - 2001 data)).

[T] = Expressed in terms of total metal.

TABLE 6-5
SEDIMENT EFFECTS-BASED SCREENING
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Parmeter/Method	Current MADEP ORS Recommended Freshwater Sediment Screening Values		Maximum Concentration	Maximum Concentration Sample	Does the Maximum Detected Value Exceed the Current Screening Value?
VOCs (Method 8260B) µg/kg					
Acetone	none available		107	BRSWSD03	--
SVOCs (Method 8270C) µg/kg					
bis(2-ethylhexyl)phthalate	none available		480	BRSWSD03	--
EPH (MADEP Method) mg/kg					
C19-C36 Aliphatics	none available		370	BRSWSD03	--
Chrysene	0.34	O	0.195	BRSWSD03	No
Pyrene	0.49	O	0.2	BRSWSD03	No
RCRA Metals & Antimony (Method 6010B/7000 series) mg/kg					
Antimony	none available		5.3	BRSWSD03	--
Arsenic	6.0	O	7.5	BRSWSD03	Yes
Barium	none available		84	BRSWSD04	--
Cadmium	0.6	O	3.2	BRSWSD03	Yes
Chromium	26	O	28.5	BRSWSD03	Yes
Lead	31	O	170	BRSWSD04	Yes
Silver	none available		3.1	BRSWSD04	--
Mercury	0.20	O	0.13	BRSWSD04	No

Notes:

O = Lowest Effect Level from the Ontario Ministry of the Environment (Persaud et al., 1993).

-- = Not calculated due to absence of screening value.

TABLE 6-6
BIOTA-SEDIMENT ACCUMULATION FACTORS
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Chemical	Aquatic Organism BSAFs
Inorganics	
Antimony	0.9 [a]
Arsenic	0.9 [a]
Barium	0.9 [a]
Cadmium	3.4 [a]
Chromium	0.39 [a]
Lead	0.63 [a]
Silver	0.9 [a]

Reference:
[a] USEPA, 1999b.

TABLE 6-7
ESTIMATED EXPOSURE PARAMETERS FOR WILDLIFE RECEPTORS
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Receptor Species	Body Weight (kg)	Assumed Diet (% of diet)		Food Ingestion Rate (kg/day)	Water Intake Rate (kg/day)	Exposure Duration (unitless)	Home Range Size (acres)	Area Use Factor (unitless)
		Invertebrates	Sediment					
Star-nosed Mole *(Condylura cristata)*	0.05 [a]	90% [b]	10% [c]	0.0059 [d]	0.0067 [e]	1 [f]	1 [g]	0.06
Marsh Wren *(Cistothorus palustris)*	0.0106 [h]	97.5% [b]	2.5% [c]	0.0030 [i]	0.0028 [j]	0.75 [f]	0.34 [k]	0.16

[a] Mid-point of body weight range (34-78 g) of *C. cristata* cited in Burt and Grossenheider, 1976.
[b] Approximate diet based on qualitative assumptions. DeGraaf and Rudis, 1987.
[c] Conservative assumption.
[d] Estimated from model by Nagy (1987; Equation 3-7 in USEPA, 1993g). IR (g/day) = $0.235Wt^{0.822}$ (g).
[e] Estimated from model by Calder & Braun (1983; Eq 3-17 in USEPA, 1993g). IR (L/day) = $0.099Wt^{0.9}$ (kg).
[f] All receptors are assumed to be present year-round, with the exception of the wren (assumed present 9 months).
[g] Approximate home range size from DeGraaf and Rudis, 1987.
[h] Breeding female body weight in New York study (USEPA, 1993g).
[i] Estimated from model by Nagy (1987; Equation 3-3 in USEPA, 1993g). IR (g/day) = $0.648Wt^{0.651}$ (g).
[j] Estimated from model by Calder & Braun (1983; Eq 3-15 in USEPA, 1993g). IR (L/day) = $0.059Wt^{0.67}$ (kg).
[k] Territory size in cattail-sedge association (DeGraaf and Rudis, 1987).

TABLE 6-8
TOXICITY REFERENCE VALUES (TRVs)
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Constituent	Test Species	Body Weight (kg)	Test Dose (mg/kg-day)	Scaling Factors		TRVs (mg/kg-day)	
				Star-Nosed Mole	Marsh Wren	Star-Nosed Mole	Marsh Wren
Inorganics							
Antimony	Mouse	0.03	0.125				
	NA	--	--	0.88	--	1.10E-01	--
Arsenic	Mouse	0.03	0.92				
	Cowbird	0.049	2.46	0.88	1.00	8.10E-01	2.46E+00
Barium	Rat	0.435	5.06				
	Chick	0.121	20.8	1.72	1.00	8.69E+00	2.08E+01
Cadmium	Rat	0.35	12.5				
	Ducks	1.153	1.45	1.63	1.00	2.03E+01	1.45E+00
Chromium	Rat	0.35	2737				
	Black duck	1.25	1	1.63	1.00	4.45E+03	1.00E+00
Lead	Rat	0.35	8				
	Kestrals	0.13	3.85	1.63	1.00	1.30E+01	3.85E+00
Silver	Rat	0.35	18.1				
	Chick	0.07	2.29	1.63	1.00	2.94E+01	2.29E+00

Notes:
All TRVs were derived using the methodology in Sample et al. (1996), where a test dose is multiplied by a body weight scaling factor.
In accordance with Sample et al. (1996), a scaling factor of 1 was applied for avian wildlife species.
Scaling factors for mammalian wildlife species were derived from the following equation from Sample et al. (1996):

$$\left[\frac{bw_t}{bw_w}\right]^{1/4}$$

where bw_t = body weight of the mammalian test species, and
bw_w = body weight of the mammalian wildlife species.

Body weights of the mammalian test species are from the studies referenced in Table 6-9;
body weights of the mammalian wildlife species are as listed in Table 6-7.
Test doses were taken from the references listed in Table 6-9.

TABLE 6-9
ORIGIN OF TEST SPECIES BODY WEIGHTS AND TEST DOSES USED TO DERIVE TRVs
ENVIRONMENTAL RISK CHARACTERIZATION
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Constituent	Test Species	Body Weight (kg)	Body Weight Reference	Test Dose (NOAEL) (mg/kg-day)	Test Dose Derived by	Test Dose Reference
Inorganics						
Antimony	Mouse	0.03	USEPA, 1988a*	0.125	Sample et al., 1996	Chronic mouse toxicity study (Schroeder et al., 1968*)
	NA	--	--	--	--	--
Arsenic	Mouse	0.03	USEPA, 1988a*	0.92	using Sample et al., 1996 methodology	Chronic mouse toxicity study (Eisler, 1988)
	Cowbird	0.049	Dunning, 1984*	2.46	Sample et al., 1996	Chronic toxicity study with male brown-headed cowbirds (USFWS, 1969*)
Barium	Rat	0.435	Perry et al., 1983*	5.06	Sample et al., 1996	Chronic rat toxicity study (Perry et al., 1983*)
	Chick	0.121	USEPA, 1988a*	20.8	Sample et al., 1996	Sub-chronic toxicity study with 1-day old chicks (Johnson et al., 1960*)
Cadmium	Rat	0.35	USEPA, 1988a*	12.5	using Sample et al., 1996 methodology	Chronic rat toxicity study (Machemer and Lorke, 1981 as cited in ATSDR, 1993)
	Ducks	1.153	White and Finley, 1978*	1.45	Sample et al., 1996	Chronic toxicity study with mallard ducks (White and Finley, 1978*)
Chromium	Rat	0.35	USEPA, 1988a*	2737	Sample et al., 1996	Chronic rat toxicity study (Ivankovic and Preussmann, 1975*)
	Black duck	1.25	Dunning, 1984*	1	Sample et al., 1996	Chronic toxicity study with black duck (Haseltine et al., unpubl. data*)
Lead	Rat	0.35	USEPA, 1988a*	8	Sample et al., 1996	Chronic rat toxicity study (Azar et al., 1973*)
	Kestrals	0.13	Pattee, 1984*	3.85	Sample et al., 1996	Chronic study of American kestrels (Pattee, 1984*)
Silver	Rat	0.35	USEPA, 1988a*	18.1	using Sample et al., 1996 methodology	Sub-chronic rat toxicity study (Walker, 1971)
	Chick	0.07	Scott et al., 1976	2.29	using Sample et al., 1996 methodology	Chronic toxicity study with immature chicks (NRC, 1984)

* As cited by Sample et al., 1996.

TABLE 6-10
RISK CHARACTERIZATION
HAZARD QUOTIENT - VERTEBRATE WILDLIFE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Analyte	Hazard Quotient[1]			
	Star-Nosed Mole		Carolina Wren	
	Mean	Max	Mean	Max
INORGANICS				
Antimony	0.10	0.29	NC	NC
Arsenic	0.04	0.06	0.07	0.09
Barium	0.02	0.06	0.05	0.12
Cadmium	0.001	0.003	0.10	0.25
Chromium	0.00001	0.00002	0.23	0.40
Lead	0.02	0.06	0.37	0.97
Silver	0.000	0.001	0.02	0.04

Notes:
1. Spreadsheets and assumptions are included in Appendix R.
NC = Not Calculated because there is no TRV available for this compound.

TABLE 6-11
SEM:AVS DATA
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

Sampling Location	Concentration (umoles/g)							Ratio	Difference
	AVS	Copper	Lead	Cadmium	Zinc	Nickel	[SEM]	[SEM]:[AVS]	[SEM]-[AVS]
BRSWSD01R	0.9794136	0.0975610	0.0472973	0.0014235	0.8779443	0.0306644	1.0549054	1.07700	0.07549
BRSWSD02R	0.3181535	0.0173092	0.0202703	0.0005338	0.1713062	0.0131175	0.2225200	0.70000	-0.09563
BRSWSD03R	0.3212726	0.3052714	0.1288610	0.0160142	1.0905476	0.0374787	1.5782228	4.91200	1.25695
BRSWSD04R	0.6955708	0.3210071	0.5791506	0.0115658	2.2942796	0.1413969	3.3479982	4.81300	2.65243

[SEM] = Sum of concentrations of all metals (umoles/g)
[AVS] = Concentration of AVS (umoles/g)
SEM = Simultaneously extracted metals
AVS = Acid volatile sulfides
umoles/g = micromoles per gram
Metals are presented in order of binding preference; from least to most soluble.

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Table 7-1
Contaminants of Potential Concern Evaluated for Fate and Transport
Phase II Comprehensive Site Assessment
Cpl. Gordon Craig U.S. Army Reserve Center
Brockton, MA

Extractable Petroleum Hydrocarbons
C9-C18 Aliphatics
C19-C36 Aliphatics
C11-C22 Aromatics
Target EPH Parameters/Semi-Volatiles
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,I)perylene
Benzo(k)fluoranthene
Chrysene
Dibenzofuran
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Naphthalene
Phenanthrene
Phenol
Pyrene
Volatile Petroleum Hydrocarbons
C5-C8 Aliphatics
C9-C12 Aliphatics
C9-C10 Aromatics*
Target VPH Constituents & Other VOCs
Acetone
Carbon Disulfide
Ethylbenzene
Methylene Chloride
MTBE
Toluene
Xylene (as ortho)
Metals
Antimony
Arsenic
Barium
Cadmium
Chromium
Lead
Mercury
Selenium
Silver

Note:
* The site COPCs 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, n-propylbenzene, sec-Butylbenzene do not have specific fate data. However, since they are C9-C10 aromatics, they are believed to behave similarly.

Table 7-2
Solubility of Site COPCs
Phase II Comprehensive Site Assessment
Cpl. Gordon Craig U.S. Army Reserve Center
Brockton, MA

COPC	Maximum Solubility (mg/L)
Extractable Petroleum Hydrocarbons	
C11-C22 Aromatics	5.8
C9-C18 Aliphatics	0.01
C19-C36 Aliphatics	Considered Immobile
Target EPH Parameters/Semi-Volatiles	
Phenol	84000.0000
Naphthalene	31.7000
Dibenzofuran	10.0000
Fluorene	1.9800
Phenanthrene	1.2900
Fluoranthene	0.2750
Pyrene	0.1350
Benzo(a)anthracene	0.0140
Benzo(b)fluoranthene	0.0140
Chrysene	0.0060
Benzo(k)fluoranthene	0.0043
Benzo(a)pyrene	0.0038
Indeno(1,2,3-cd)pyrene	0.0005
Benzo(g,h,I)perylene	0.0003
Volatile Petroleum Hydrocarbons	
C9-C10 Aromatics*	51
C5-C8 Aliphatics	11
C9-C12 Aliphatics	0.07
Target VPH Constituents & Other VOCs	
Acetone	1000000
MTBE	50,000
Methylene Chloride	13200
Carbon Disulfide	2100
Toluene	515
Xylene (as ortho)	170
Ethylbenzene	152
Metals	
Mercury	600
Selenium	2.2
Cadmium	2
Lead	0.5
Barium	<1
Chromium	<1
Silver	<1
Antimony	NS
Arsenic	NS

Notes:

* The site COPCs 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, n-propylbenzene, sec-Butylbenzene do not have specific fate data. However, since they are C9-C10 aromatics, they are believed to behave similarly.

NS - Not Soluble

Table 7-3
Partitioning Coefficients for Site COPCs
Phase II Comprehensive Site Assessment
Cpl. Gordon Craig U.S. Army Reserve Center
Brockton, MA

COPC	Koc (mL/g)	foc (dec. %)	Calculated Kd (mL/g) (Kd=Koc*foc)
Extractable Petroleum Hydrocarbons			
C9-C18 Aliphatics	680000	0.0044	2992.00
C11-C22 Aromatics	5000	0.0044	22.00
C19-C36 Aliphatics	Immobile	0.0044	Immobile
Target EPH Parameters/Semi-Volatiles			
Benzo(a)pyrene	5500000	0.0044	24200.00
Dibenzo(a,h)anthracene	3300000	0.0044	14520.00
Indeno(1,2,3-cd)pyrene	1580000	0.0044	6952.00
Benzo(g,h,I)perylene	1500000	0.0044	6600.00
Benzo(a)anthracene	1380000	0.0044	6072.00
Benzo(b)fluoranthene	550000	0.0044	2420.00
Chrysene	200000	0.0044	880.00
Pyrene	63400	0.0044	278.96
Phenanthrene	*23000*	*0.0044*	*101.20*
Fluoranthene	19800	0.0044	87.12
Fluorene	5835	0.0044	25.67
Dibenzofuran	2140	0.0044	9.42
Naphthalene	1300	0.0044	5.72
Phenol	14	0.0044	0.06
Volatile Petroleum Hydrocarbons			
C9-C12 Aliphatics	150000	0.0044	660.00
C5-C8 Aliphatics	2265	0.0044	9.97
C9-C10 Aromatics*	1778	0.0044	7.82
Target VPH Constituents & Other VOCs			
Xylene (as ortho)	692	0.0044	3.04
Ethylbenzene	676	0.0044	2.97
Toluene	257	0.0044	1.13
Carbon Disulfide	63	0.0044	0.28
Methylene Chloride	8.79	0.0044	0.04
MTBE	5	0.0044	0.02
Acetone	2.2	0.0044	0.01
Metals			
Chromium	NA	NA	2200.00
Lead	NA	NA	323.00
Mercury	NA	NA	145.00
Cadmium	NA	NA	120.00
Arsenic	NA	NA	29.00
Selenium	NA	NA	5.00
Barium	NA	NA	1.40
Antimony	NA	NA	NA
Silver	NA	NA	NA

Notes:

* The site COPCs 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, n-propylbenzene, sec-Butylbenzene do not have specific fate data. However, since they are C9-C10 aromatics, they are believed to behave similarly.

NA - Not Applicable

Table 7-4
Retardation and Solute Velocities for Site COPCs
Phase II Comprehensive Site Assessment
Cpl. Gordon Craig U.S. Army Reserve Center
Brockton, MA

COPC	Calculated Retardation Value (Rf = 1+(rb/q)*Kd)	Solute Velocity (ft/day)
Extractable Petroleum Hydrocarbons		
C9-C18 Aliphatics	12286.59	8.14E-05
C11-C22 Aromatics	91.34	1.09E-02
C19-C36 Aliphatics	Immobile	Immobile
Target EPH Parameters/Semi-Volatiles		
Benzo(a)pyrene	99369.72	1.01E-05
Dibenzo(a,h)anthracene	59622.23	1.68E-05
Indeno(1,2,3-cd)pyrene	28546.92	3.50E-05
Benzo(g,h,I)perylene	27101.56	3.69E-05
Benzo(a)anthracene	24933.51	4.01E-05
Benzo(b)fluoranthene	9937.87	1.01E-04
Chrysene	3614.41	2.77E-04
Pyrene	1146.45	8.72E-04
Phenanthrene	416.54	2.40E-03
Fluoranthene	358.73	2.79E-03
Fluorene	106.42	9.40E-03
Dibenzofuran	39.66	2.52E-02
Naphthalene	24.49	4.08E-02
Phenol	1.25	8.02E-01
Volatile Petroleum Hydrocarbons		
C9-C12 Aliphatics	2711.06	3.69E-04
C5-C8 Aliphatics	41.92	2.39E-02
C9-C10 Aromatics*	33.12	3.02E-02
Target VPH Constituents & Other VOCs		
Xylene (as ortho)	13.50	7.41E-02
Ethylbenzene	13.21	7.57E-02
Toluene	5.64	1.77E-01
Carbon Disulfide	2.15	4.65E-01
Methylene Chloride	1.16	8.59E-01
MTBE	1.09	9.17E-01
Acetone	1.04	9.61E-01
Metals		
Chromium	9034.52	1.11E-04
Lead	1327.28	7.53E-04
Mercury	596.39	1.68E-03
Cadmium	493.74	2.03E-03
Arsenic	120.08	8.33E-03
Selenium	21.53	4.64E-02
Barium	5.11	1.96E-01
Antimony	NA	NA
Silver	NA	NA

Notes:

* The site COPCs 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, n-propylbenzene, sec-Butylbenzene do not have specific fate data. However, since they are C9-C10 aromatics, they are believed to behave similarly.

NA - Not Applicable

Table 7-5
Vapor Pressure and Henry's Law Constants for Site COPCs
Phase II Comprehensive Site Assessment
Cpl. Gordon Craig U.S. Army Reserve Center
Brockton, MA

COPC	Vapor Pressure (Torrs @ 20-30 deg. Centrigrade)	Henry's Law Constant, H (Dimensionless)
Extractable Petroleum Hydrocarbons		
C9-C18 Aliphatics	0.1064	6.90E+01
C11-C22 Aromatics	0.02432	3.00E-02
C19-C36 Aliphatics	Considered Immobile	Considered Immobile
Target EPH Constituents/Semi-Volatiles		
Naphthalene	0.082	5.16E-02
Fluorene	NA	3.11E-03
Phenanthrene	9.60E-04	1.62E-03
Benzo(b)fluoranthene	NA	4.94E-04
Pyrene	2.50E-06	4.88E-04
Fluoranthene	5.00E-06	2.64E-04
Phenol	3.50E-01	5.27E-05
Chrysene	6.30E-09	4.25E-05
Benzo(a)anthracene	5.00E-09	4.05E-05
Benzo(a)pyrene	5.00E-09	1.98E-05
Benzo(g,h,I)perylene	1.00E-10	5.83E-06
Dibenzo(a,h)anthracene	1.00E-10	2.96E-06
Indeno(1,2,3-cd)pyrene	1.00E-09	2.81E-06
Dibenzofuran	NA	NA
Volatile Petroleum Hydrocarbons		
C9-C12 Aliphatics	0.6612	6.50E+01
C5-C8 Aliphatics	76	5.40E+01
C9-C10 Aromatics*	2.204	3.30E-01
Target VPH Constituents & Other VOCs		
Ethylbenzene	10	3.21E-01
Toluene	28	2.69E-01
O-Xylene	6	2.01E-01
Methylene Chloride	429	1.04E-01
Carbon Disulfide	297	5.73E-02
MTBE	245	1.29E-02
Acetone	270	1.73E-03
Metals		
Antimony	NA	NA
Arsenic	NA	NA
Barium	NA	NA
Cadmium	NA	NA
Chromium	NA	NA
Lead	NA	NA
Mercury	NA	NA
Selenium	NA	NA
Silver	NA	NA

Notes:

* The site COPCs 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene, n-propylbenzene, sec-Butylbenzene do not have specific fate data. However, since they are C9-C10 aromatics, they are believed to behave similarly.

NA - Not Applicable

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APPENDIX A

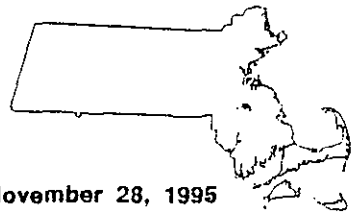
MASSACHUSETTS GEOGRAPHICAL INFORMATION SYSTEM SITE SCORING MAP

MA DEP - Bureau of Waste Site Cleanup

Site Scoring Map: 500 feet & 0.5 Mile Radii

SITE NAME:

Craig US Army Reserve Center
West Chestnut St
Brockton, Ma
4657825n 330150ew



November 28, 1995

0 2000 feet
0 500 meters

SCALE 1:15000

- Potentially Productive Medium Yield Aquifer
- Potentially Productive High Yield Aquifer
- NOT Potentially Productive Medium Yield Aquifer
- NOT Potentially Productive High Yield Aquifer
- EPA Designated Sole Source Aquifers
- DEP Approved Wellhead Protection Area - ZONE 2
- Interim Wellhead Protection Area
- Public Surface Water Supply
- Lakes, Ponds, Other Fresh Water Features
- Bays, Estuaries, Other Salt Water Features
- Fresh Water Non-Forested Wetlands
- Salt Water Wetlands
- State, Federal, Municipal, Nonprofit and Private Open Space and Recreational Facilities
- Areas of Critical Environmental Concern
- DEP Permitted Solid Waste Facilities
- NHESP Estimated Habitats of Rare Wetlands Wildlife 1995 - for use with Wetlands Protection Act ONLY

- State, U.S., Interstate Routemarkers
- Interstate Highway
- U.S. Highway
- State Highway
- Other Roads
- Municipal Boundary
- County Boundary
- Train
- Powerline
- Pipeline
- Aqueduct
- Major Drainage Basin
- Sub Drainage Basin
- Zone of Contribution
- Public Water Supply - Groundwater
- Public Water Supply - Surface Water
- Non Community Public Water Supply
- Certified Vernal Pools

MASSGIS

N W E S

MARSHALL CORNER

BROCKTON

WEST BRIDGEWATER

NRS SCORING MAP DATA SOURCES

AQUIFERS: USGS-WRD/MassGIS, 1:48,000. Automated by MassGIS from the USGS Water Resources Div. Hydrologic Atlas series manuscripts. The definitions of high and medium yield vary among basins. (1977 to 1988.)

SOLE SOURCE AQUIFERS: US EPA/MA DEP/MassGIS, various scales. They are defined by EPA as aquifers that are the 'sole or principal source' of drinking water for a given aquifer service area. Last updated July 1993.

DEP APPROVED ZONE IIS: MA DEP, 1:25,000. As stated in 310 CMR 22.02 'that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated.' Digitized from the DEP Water Supply Protection Atlas by DEP-DWS (Division of Water Supply) staff. (1983 to January 1995.)

POTENTIALLY PRODUCTIVE AQUIFERS: DEP-BWSC (Bureau of Waste Site Cleanup. These aquifers are defined as all medium or high yield aquifers except for that portion of the aquifers surface area that falls within a city or town that has a population density of greater than 4400 people per square mile, based on the most recent US. Census.

INTERIM WELLHEAD PROTECTION AREAS: DEP-DWS (Division of Water Supply), 1:25,000. Half-mile buffers zones were created using the Community Public Water Supplies point coverage (see below). These polygons represent an interim Zone II for a groundwater source until an actual one is approved by the DEP Division of Water Supply. (January 1995.)

HYDROGRAPHY: USGS/MassGIS. Nearly half of the state is available as 1:24000/1:25000 USGS Digital Line Graph (DLG) data. In addition, for 40% of the state, USGS 1:100000 DLG hydrography has been enhanced with 1:25000 hydrographic features. The remainder were digitized at 1:25000 by MassGIS. Source dates vary for DLG's and USGS quadrangles.

WETLANDS: UMass Amherst RMP/MassGIS, 1:25,000. Includes nonforested wetlands extracted from the 1971-1984 Land Use datalayer which was photointerpreted from Summer CIR photography. Interpretation was not done in stereo. Also includes, in some areas, forested wetlands from USGS Digital Line Graph (DLG) data.

PROTECTED & RECREATIONAL OPEN SPACE: EOEA (Executive Office of Environmental Affairs) MassGIS, 1:25,000. Includes federal, state, county, municipal, non profit, private conservation and recreation lands and facilities. Geographic data sources are predominately town tax assessor maps and existing open space plans. Most of these maps have been recompiled onto a 1:25000 basemap provided by MASSGIS. The data are then digitized from these maps, which contain registration points. Ongoing updates.

ACECs: CZM and DEM, 1:25,000. Areas of Critical Environmental Concern are areas designated by the Secretary of EOEA as having a number of valuable environmental features coexisting. Projects in ACECs are subject to the highest standards of review and performance. Last updated October 1992.

ROADS: USGS/MassGIS, 1:100,000. MassGIS created from the USGS Transportation DLG files. They generalized, modified, and updated this coverage. Major roads are part of the state US. or interstate highway systems. Circa 1985.

DRAINAGE BASINS: USGS-WRD/MassGIS, 1:24,000. Automated by MassGIS from USGS Water Resources Division manuscripts with approximately 2400 sub-basins as interpreted from 1:24,000 USGS quadrangle contour lines. Individual basins for surface Community Public Water Supplies were added by DEP in 1993. 1987 - 1993.

POLITICAL BOUNDARIES: MassGIS/USGS, 1:25,000 datalayer was digitized by MassGIS from mylar USGS quads. Source date is approximately 1985.

QUADRANGLE INDEX: MassGIS. Generated from USGS minute quadrangle corner coordinates converted from lat/long to Mass. State Plane coordinates. 1985.

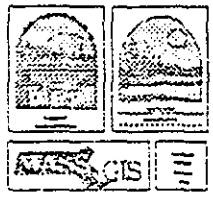
DEP PERMITTED SOLID WASTE FACILITIES: DEP-DSW (Division of Solid Waste), 1:25,000. Includes only facilities regulated since 1971. Most are sanitary landfills, though transfer stations and recycling or composting facilities are included. Either facility boundaries were compiled or approximate facility point locations drafted onto USGS quadrangles and automated by the Division of Solid Waste. Last updated 1994.

PUBLIC WATER SUPPLIES: DEP-DWS, 1:25,000. Community and non-community surface and groundwater withdrawal points were field collected using Global Positioning System receivers and attributes were added from the DEP Division of Water Supply database. Last updated January 1995.

SITE LOCATION: Location coordinates were converted to state plane coordinates from user supplied longitude and latitude or UTM. Coordinates are site specific and source dates vary.

NHESP Estimated Habitats of Rare Wetlands Wildlife: Polygons show estimated habitats for all processed occurrences of rare wetlands wildlife. Data collected by Natural Heritage & Endangered Species Program and compiled at 1:24000 or 1:25000 scale. For use with Wetlands Protection Act Only. Effective Jan. 1, 1995 through Dec. 31 1995.

NHESP Certified Vernal Pools: Points show all vernal pools certified by NHESP/MADFW (Fisheries and Wildlife) as of January 1, 1993. Data compiled at 1:24000 or 1:25000 scale. Effective January 1, 1995 through December 31, 1995



Last Revised FEBRUARY 6, 1995

APPENDIX B

VISTA INFORMATION SOLUTIONS, INC., POPULATION DENSITY REPORT

POPULATION REPORT

PROPERTY INFORMATION	CLIENT INFORMATION
Project Name/Ref#: Not Provided CPL. Gordon Craig USACE 915 W CHESTNUT ST BROCKTON MA, 02301-5542	Thom Davidson

FACILITY LOCATION	
Facility Latitude:	42.055153
Facility Longitude:	-71.050522

POPULATION SUMMARY	
Estimated Residential Population within 0.50 miles:	1347

LIMITATION OF LIABILITY

This Checklist provides publicly available data that is compiled to assist in information needs. Customer proceeds at its own risk in choosing to rely on VISTA services, in whole or in part, prior to proceeding with any transaction. VISTA cannot be an insurer of the accuracy of the information, errors occurring in conversion of data, or for customer's use of data. VISTA and its affiliated companies, officers, agents, employees and independent contractors cannot be held liable for accuracy, storage, delivery, loss or expense suffered by customer resulting directly or indirectly from any information provided by VISTA.

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POPULATION REPORT

1990 CENSUS TRACTS

AREA INFORMATION

Map ID#	Tract Number	Population	Area (sq. miles)
1	5117.02	3066	1.78
2	5241.01	2644	10.60
3	5117.01	4863	1.22

vistainfo

POPULATION REPORT

DATABASE REFERENCES

DATABASES SEARCHED

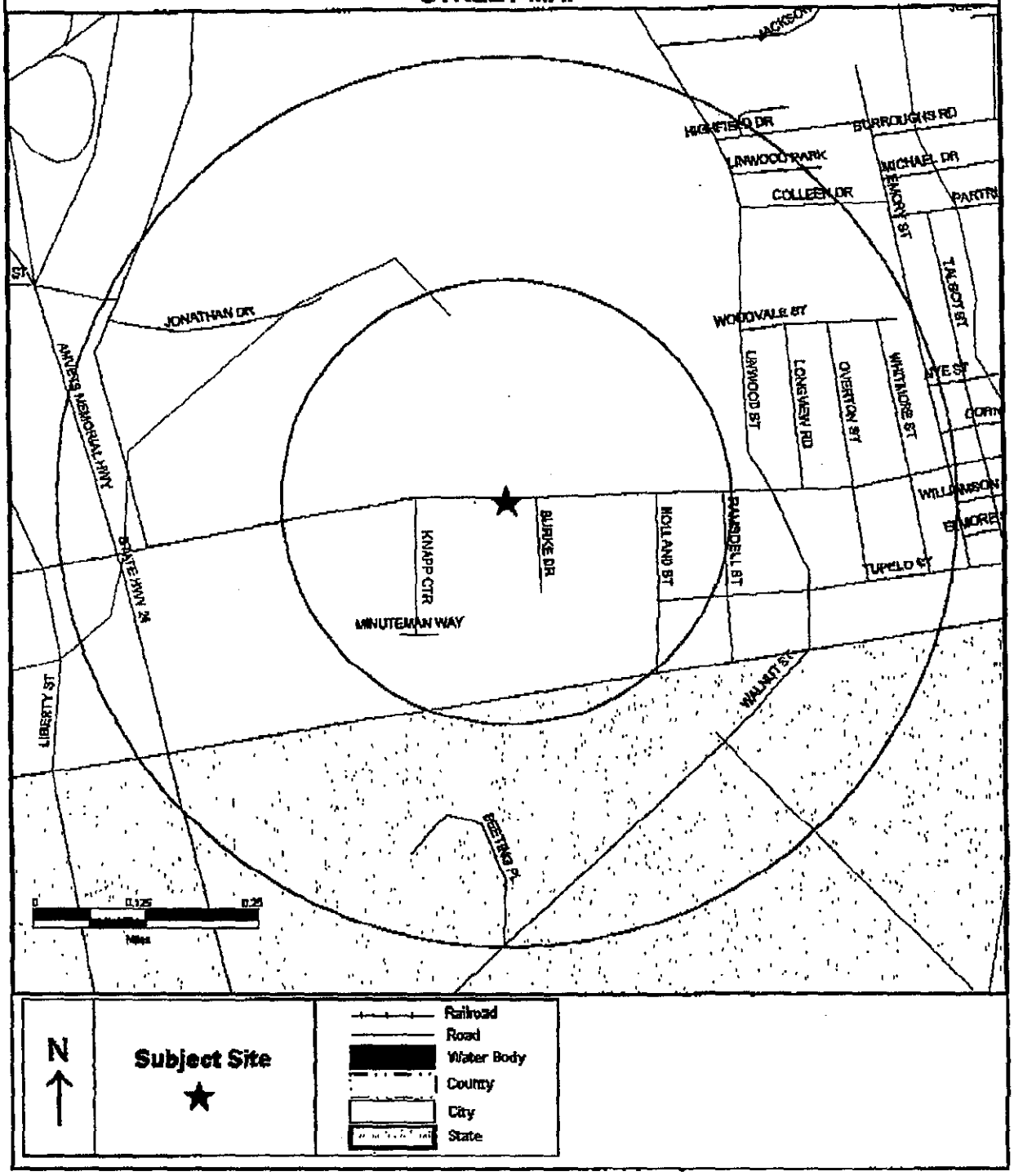
POPULATION DATA: UNITED STATES CENSUS BUREAU

Population was determined using the US Census Bureau 1990 Census information.

vistainfo

POPULATION REPORT

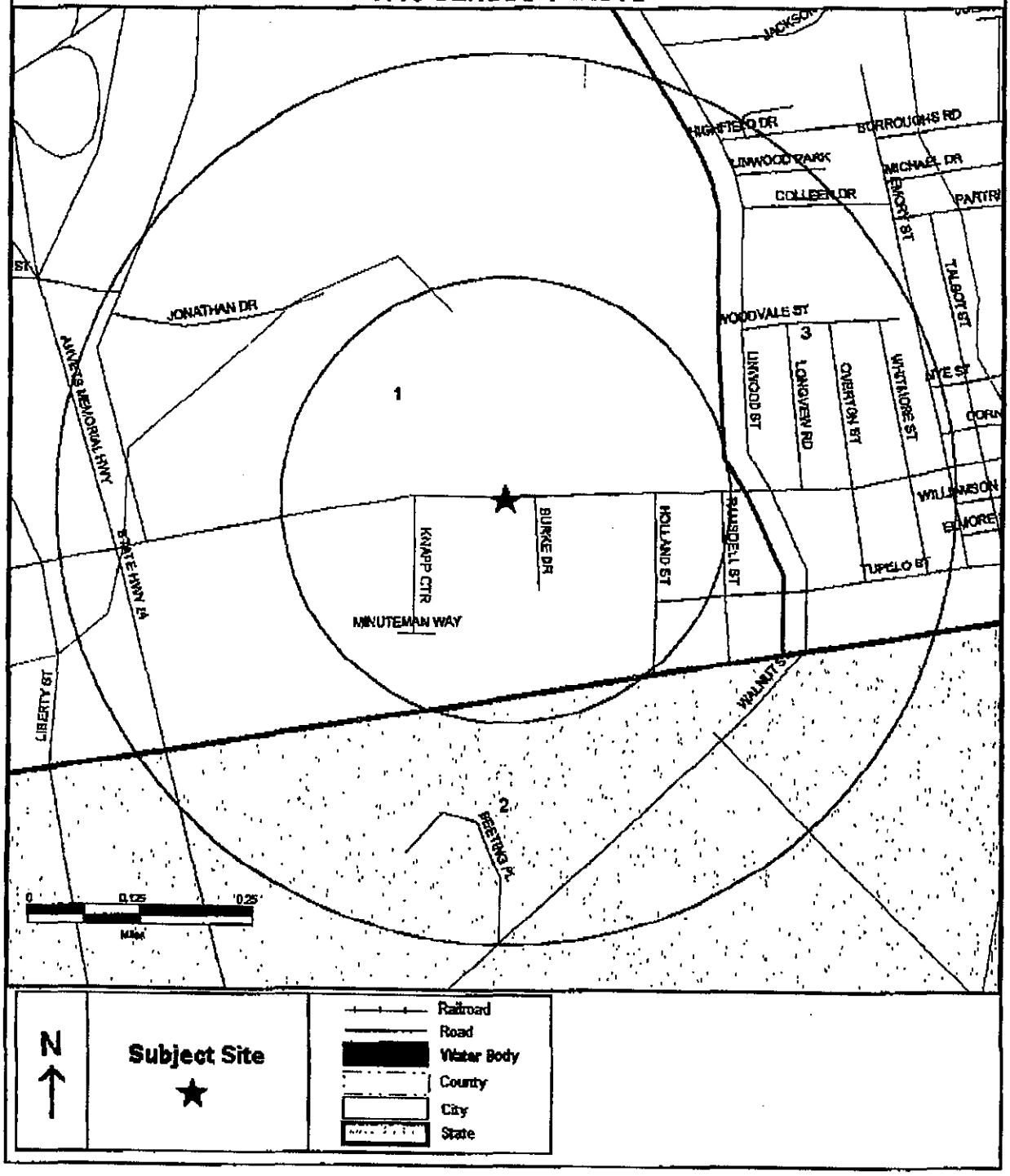
STREET MAP



vistainfo

POPULATION REPORT

1990 CENSUS TRACTS



APPENDIX C

ATEC ASSOCIATES, INC. MARCH 4, 1994 TECHNICAL REPORT – UNDERGROUND STORAGE TANK CLOSURE – UST 153

Technical Report
Underground Storage Tank Closure
UST No. 153
Corporal Craig USARC, Brockton, MA

ATEC File: 37.04.92.08713

Contract No. DAKF31-92-D-0033

Prepared for:

United States Army
Directorate of Contracting
Building 227
Fort Devens, Massachusetts

Attn: Ms. Phyllis M. Loiselle
Contracting Officer

March 2, 1994

ATEC Associates, Inc.
Environmental Consultants
55 Accord Park Drive
Rockland, Massachusetts 02370
(617) 878-6200, FAX (617) 871-6781

Solid & Hazardous Waste Site Assessments
Remedial Design & Construction
Underground Tank Management
Asbestos Surveys & Analysis
Hydrogeologic Investigations & Monitoring
Analytical Testing / Chemistry
Industrial Hygiene / Hazard Communication
Environmental Audits & Permitting
Exploratory Drilling & Monitoring Wells

March 2, 1994

Ms. Phyllis M. Loiselle, Contracting Officer
United States Army
Building 227
Fort Devens, Massachusetts 01433-5340

RE: *Technical Report*
UST No. 153 - Corporal Craig USARC
Brockton, Massachusetts
ATEC File No. 37.04.92.08713

Ms. Loiselle:

Attached is a Technical Report detailing the closure of one 5,000 gallon No. 2 fuel oil underground storage tank referenced as UST No. 153 located at the Corporal Craig USARC in Brockton, MA. This report describes work performed under Contract No. DAKF31-92-D-0033 as part of the U.S. Army Project "Underground Storage Tank Removal, Fort Devens, MA and Various Locations Throughout New England".

ATEC appreciates the opportunity to be of service to you. If you have any questions, please do not hesitate to contact our office.

Sincerely,

ATEC Associates, Inc.

James Kenny
Contractor Quality Control Manager

James Regan
Sr. Project Manager

Ronald Lawson
Assistant Vice President

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TECHNICAL REPORT

UST No. 153

United States Army

Fort Devens, Massachusetts

ATEC Project No. 37.04.92.08713

1.0 TANK REMOVAL

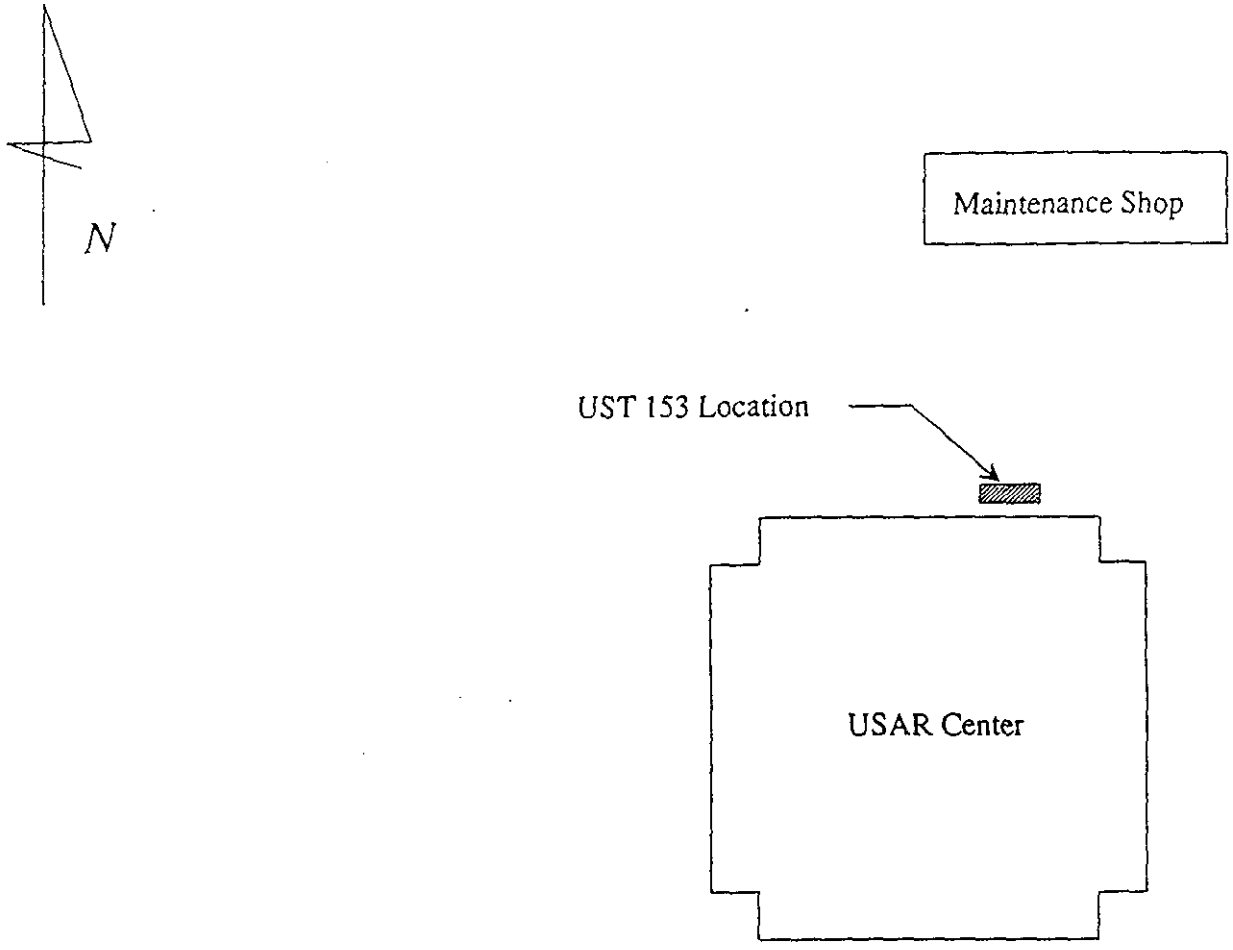
This report details the removal of an 5,000 gallon underground storage tank (UST) referenced as UST No. 153. The tank was utilized to store No. 2 fuel oil and was located just north of the main building at the Corporal Craig USARC, Brockton, MA (the site). This Technical Report documents work performed under Contract No. DAKF31-D-92-0033 as part of the "Underground Storage Tank Removal, Fort Devens, MA and Various Locations Throughout New England". It has been prepared in accordance with Appendix 3 - Technical Report Format within the Contract Specifications.

1.1 Site Description

UST 153 existed approximately five feet north of the main building. Refer to section 1.2 for a site plan. The topography is flat. Wetlands exist adjacent to the northern boundary of the site.

1.2 Site Plan

A site plan showing UST 153 is provided below as Figure 1.



SITE SCHEMATIC

U.S.T. 153 TANK REMOVAL
CRAIG USARC

PROJECT: 37.07.93.08713

SCALE: NOT TO SCALE

Figure 1

ATEC

1.3 Tank Closure Procedures

Prior to tank closure procedures, ATEC confirmed the tank was empty of pumpable liquids on September 1, 1993. Additionaly, ATEC undertook measures to prevent damage to underground utilities. Dig Safe No. 93342987 was obtained on August 17, 1993 specifically for the Craig USARC. ATEC also requested information from personnel at the Craig USARC regarding the location of possible onsite underground utilities. In response, a site plan was provided that showed a water main but, no other underground utilities.

UST 153 was removed on September 14, 1993. Soil lying above the tank was removed by a backhoe. The associated piping was drained, tank connections were removed and tank openings were plugged. The tank was removed utilizing a crane, chains, and hooks. Once the tank was free of the excavation, it was placed on double lined polyethylene plastic sheeting and chocked.

ATEC personnel prepared the tank for entry. The tank was cut open after venting and confirming the tank vapors were below 10% LEL and contained an oxygen concentration from 19.5% to 25%. Prior to entering the tank on September 14, 1993, ATEC personnel donned Level B personal protective equipment (PPE) and a safety harness. The interior of the tank was scraped and wiped clean. The tank sludge and contaminated PPE were placed in a drum for proper disposal. One drum of tank residues was generated during the cleaning of UST 153.

On September 15, 1993 ATEC transported UST 153 to James G. Grant Co., Inc., Readville MA, a state approved scrap yard for permanent disposal. The tank was shipped via a permit issued by the Brockton Fire Department.

1.4 Tank Specifications

The tank had a 5,000 gallon capacity, measured 17.5' x 7', and the UL number is C959955. After the tank was removed, it was inspected and found to be in good condition. The tank was coated and it contained no holes or severe corrosion.

1.5 Laboratory Analytical Results of Sludge/Liquid in the Tank

See Appendix A - Part 1.

1.6 Manifests and Disposal Certifications of the Tank Removal

The tank disposal certifications are provided in Appendix B - Part 1.

1.7 Photographs of Tank Removal Process and Tank

Photographic documentation of the tank and removal process is included in Appendix C - Part 1.

2.0 CONTAMINATED SOIL EXCAVATION/DISPOSAL

2.1 Description of the Soil Excavation

The initial excavation (i.e., the excavation after tank removal and prior to additional contaminated soil removal) measured 22' x 13' with an average depth of approximately 8.1 feet below ground surface (bgs). A concrete pad used to anchor the UST was encountered nine feet bgs. The concrete pad was abandoned in place. Refusal was not encountered in this excavation however, water was encountered nine feet bgs.

Per the instructions of the contracting officer's representative (COR), Ronald DeFillipo, excavation 153 was not to be sampled at ten locations and analyzed for TPH utilizing the Horiba OCMA 220. Instead the removal of contaminated soil was to take place immediately.

Following the removal and subsequent cleaning of the UST, additional contaminated soil was removed from the excavation. This process continued on September 15, 1993. At approximately 4:00 PM an abandoned sewer line was ruptured releasing approximately 1,600 gallons of water and free product into the excavation. A representative from Cyn Oil sampled the liquid in the excavtion on September 16, 1993. On September 17, 1993 ATEC personnel succesfully repaired the sewer line. Cyn Oil then arrived on-site to VAC out 1,560 gallons from the excavation. The material was disposed at their treatment, storage, and disposal facility located in Stoughton, Massachusetts on September 17, 1993 and shipped via manifest number MA G110665. ATEC then proceeded to complete the contaminated soil removal process on September 17, 1993. On September 20, 1993 the excavation was backfilled with the approval of Jonathan Hobill (MADEP) and Ronald DeFilippo (COR).

Upon completion of the soil removal, the excavation was sampled in six locations (figure 2). All six samples were screened with the photoionization detector (PID) for volatile organic compounds (VOCs). Sample PE1 was obtained from the base of the north sidewall approximately five feet east of the west sidewall. No laboratory analyses were conducted on sample PE1. PID results are presented in Table 2.1.1. Three samples (LRS1 - LRS3) were laboratory analyzed for TPH. LRS1 was obtained from the center of the excavation. LRS2 and LRS3 were obtained from the base and center of the eastern and southern sidewalls, respectively. LRS4 was obtained from the base and center of the western sidewall. LRS4 was laboratory analyzed for TPH, VOCs, and base neutral/acid extractable compounds (BNAs). LRS5 was obtained at the base of the north sidewall approximately five feet west of the east sidewall. Sample LRS5 was located so that some of the most potentially contaminated soil on the north side of the excavation was sampled.

This determination was based on in-situ soil screening conducted with the HNu and visual observations. LRS5 was laboratory analyzed for TPH, VOCs, and BNAs. Laboratory results are presented in Table 2.1.2.

All samples were obtained and screened in accordance with the Sampling and Analysis Plan described in Modification P0001 and the approved CQC Plan. Sampling parameters and locations followed the directives of the contacting officer representative and MADEP.

TABLE 2.1.1 - SOIL SAMPLE PID RESULTS

SAMPLE NUMBER	VOCs - PID (ppm)
PE1	5
LRS1	20
LRS2	3
LRS3	4
LRS4	2
LRS5	45

TABLE 2.1.2 LABORATORY REMEDIATION SOIL SAMPLE RESULTS

SAMPLE NUMBER	TPH (ppm)	VOCs (ppb)	BNAs (ppb)
LRS1	1,400	NA	NA
LRS2	ND	NA	NA
LRS3	54	NA	NA
LRS4	ND	ND	ND
LRS5	680	acetone - 110 ethylbenzene - 77 xylenes - 95	flourene - 660 phenanthrene - 1,140

ND - not detected
NA - not analyzed
ppm - parts per million
ppb - parts per billion

The stratigraphy in excavation 153 is as follows:

(0 - 1.5' bgs) - orange light brown fine grain sand with silt, some clay and pebbles;

(1.5' - 2.5' bgs) - whitish orange fine grain - med. grain sand with pebbles, few stones;

(2.5' - 3' bgs) - brown fine grain sand and silt, little clay and pebbles;

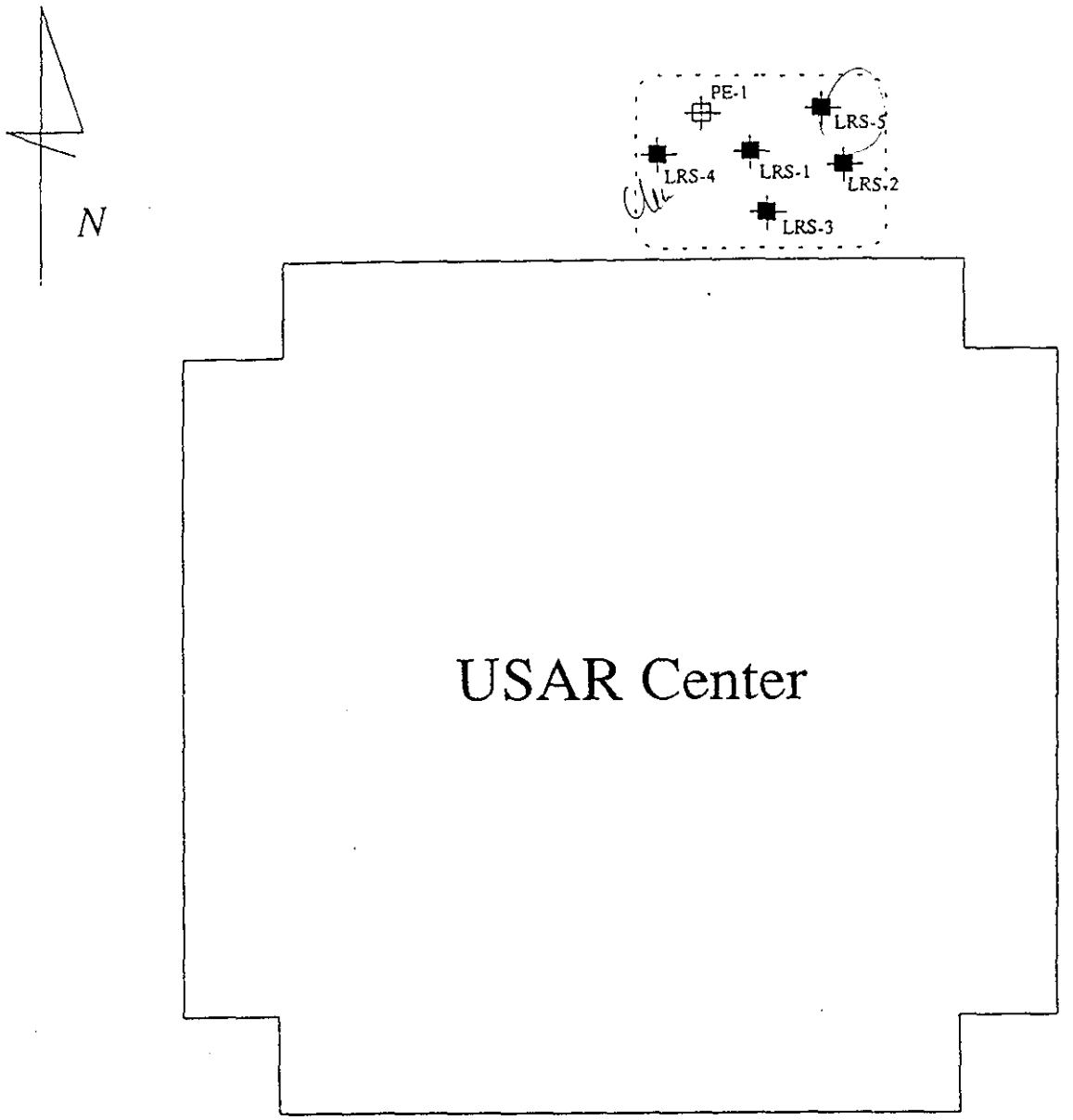
(3' - 4' bgs) - brown, purplish, greyish silt and clay (mostly silt);

(4' - 7' bgs) - brown, green, grey purple silt and clay (mostly silt);

(7' - 8.5' bgs) - grey-brown silt and clay (mostly silt), some fg sand, few pebbles and stones.

2.2 Sampling Plan

A sampling diagram showing all soil sample locations taken at excavation 153 is provided below as Figures 2.



NOTES:

Post Excavation Sample

Confirmatory Soil Sample

POST EXCAVATION AND CONFIRMATORY SAMPLING LOCATIONS U.S.T. 153 TANK REMOVAL CRAIG USARC	PROJECT: 37.07.93.08713 SCALE: NOT TO SCALE Figure 2	ATEC

2.3 Description of Soil Removal/Disposal

177.76 tons of contaminated soil was removed. This amount is confirmed by weight receipts obtained during soil disposal. The contaminated soil was stockpiled on double lined polyethylene sheeting and covered by a heavy duty tarpaulin. Sandbags were placed on the tarpaulin to secure it. The stockpile was surrounded by absorbent booms. Hazardous waste characterization sampling of the soil stockpile was performed on September 17, 1993.

2.4 Laboratory Analytical Results of Soils Remaining in the Excavation

See Appendix A - Part 2 for soil sample results.

2.5 Laboratory Analytical Results of Soil Removed/Disposal

See Appendix A - Part 3 for soil sample results.

2.6 Manifests and Disposal Certifications of Soil Removal

See Appendix B - Part 2 for bills of lading and the weight slips associted with the soil disposal.

2.7 Photographs of Removed Soils and Tank Excavations

Photographic Documentation of the excavation process are attached in Appendix C - Part 2.

3.0 ON SITE REMEDIATION

On site remediation was not performed at this site.

4.0 HYDROGEOLOGICAL SERVICES

4.1 Monitoring Well/Boring Description

No monitoring wells or soil borings were completed at the site.

4.2 Hydrogeologic Plan

Not Applicable.

4.3 Summary and Conclusions

During the tank removal procedures, water was detected nine feet bgs (ref. Appendix C - part 1). The water contained a sheen and free product floating on the surface. On September 16, 1993, approximately 1600 gallons of water and free product were released into the excavation from a ruptured sewer line. The water was sampled on September 16, 1993 and analyzed for total halogens, flashpoint, pH, PCBs, arsenic, cadmium, chromium, and lead (total concentrations). Section 4.4 contains the analytical results of the water sample.

Based on free product existing on the groundwater, the groundwater appears contaminated. Therefore, the installation of monitoring wells to further investigate the groundwater condition is warranted. ATEC recommends the installation of three monitoring wells for this purpose.

4.4 Chemical Analyses of the Subsurface Soil and Groundwater

Other than the sampling normally associated with the excavation, the subsurface soil was not sampled. Results of the water sample obtained from excavation 153 by Cyn Oil are presented in Table 4.4.1.

TABLE 4.4.1 EXCAVATION WATER SAMPLE RESULTS

PARAMETER	RESULTS
PCBs	ND
Total Arsenic	ND
Total Cadmium	ND
Total Chromium	ND
Total Lead	ND
Total Halogens	55 ppm
Flashpoint	> 140 F
pH	8.3

ND - none detected
ppm - parts per million

5.0 BACKFILL

5.1 Description of Backfill Operations

Excavation 153 was backfilled on September 20, 1993 using clean fill. Prior to backfilling, the excavation was lined with polyethylene plastic sheeting. Backfilling of excavation 153 was approved by the COR and MADEP.

5.2 Site Restoration

The site will be asphalted in the Spring of 1994.

5.3 Photographs of the Backfilling Operation

Photographic documentation of the backfilling process will be provided in an addendum to this report.

6.0 STORAGE TANK INSTALLATION

Underground storage tank installation was not performed at this site.

7.0 DELIVERY ORDER DOCUMENTATION

7.1 Removal of Bituminous Concrete

Approximately one to two tons of bituminous concrete was removed from this location.

7.2 Removal of Reinforced Concrete

No reinforced concrete was removed from this location.

7.3 Excavation of Uncontaminated Materials

A cement ring and manway were removed from this location (reference Appendix C - Part 1).

7.4 Disposal of Uncontaminated/Unsuitable Materials

Weight slips can not be provided for the disposal of the one to two tons of uncontaminated material.

7.5 Environmental Services

Documentation of on-site hours have been furnished to the Government with the appropriate invoice.

7.6 Furnish and Install Pea Gravel

No pea gravel was installed at this site.

7.7 Bituminous Concrete Restoration

As of this date no bituminous concrete was restored at this site. This will be conducted in the Spring of 1994.

7.8 Turf Restoration

No turf has been or will be restored at this site.

7.9 Treatment, Storage or Disposal of Contaminated Soil

See Appendix B - Part 2 for weight slips of the disposed soil.

7.10 Backfill of Decontaminated Areas

Ron DeFilippo (EMO - ordering officer) and James Kenny (ATEC - CQC manager), during the June 18, 1993 CQC meeting agreed upon 1.45 tons/cubic yards (cy) as the conversion factor to be used for backfill.

The final excavation had a volume of 143 cy. Applying the conversion factor 1.45 tons/cy yields 207 tons of soil backfilled into excavation 153.

APPENDIX A

PART I

LABORATORY ANALYTICAL RESULTS OF SLUDGE/LIQUID IN THE TANK

CERTIFICATE OF ANALYSIS

COMPANY Craig USAR Center - MAG 130811

PRODUCT Coolant

CHEMIST VM

DATE 10/26/93

TEST	RESULTS
GAS CHROMOGRAPH	NO SOLVENT DET
PCB's	<2
PH	6
PHYSICAL	HOMOGENOUS LIQUID
MISCIBILITY W/WATER	NONE
COLOR	BLACK

APPENDIX A
PART 2

LABORATORY ANALYTICAL RESULTS
OF SOILS REMAINING IN THE EXCAVATION

In Response To The Future

CERTIFICATE OF ANALYSIS

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: LRS-1 — ESS Sample ID: 932960-05

Date Sample Received: 9/20/93 — Date Reported: 10/05/93

Parameter	Results	Units	MRL	Method
Total Petroleum Hydrocarbon-IR	1,400	mg/Kg	54	418.1

MRL = Method Reporting Limit

Results reported on a dry weight basis, % solids=84%

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: LRS-2 — ESS Sample ID: 932960-01

Date Sample Received: 9/20/93 — Date Reported: 10/05/93

Parameter	Results	Units	MRL	Method
Total Petroleum Hydrocarbon-IR	ND	mg/Kg	25	418.1

ND = Not Detected above Method Reporting Limit (MRL)

Results reported on a dry weight basis, % solids=90%

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: LRS-3 — ESS Sample ID: 932960-02

Date Sample Received: 9/20/93 — Date Reported: 10/05/93

Parameter	Results	Units	MRL	Method
Total Petroleum Hydrocarbon-IR	54	mg/Kg	25	418.1

MRL = Method Reporting Limit

Results reported on a dry weight basis, % solids=91%

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: LRS-4 — ESS Sample ID: 932960-03

Date Sample Received: 9/20/93 — Date Reported: 10/05/93

Parameter	Results	Units	MRL	Method
Percent Solids	92	% w/w	1	160.3
Semivolatile Organics	ND	ug/Kg	Attached	8270
Total Petroleum Hydrocarbon	ND	mg/Kg	24	418.1
Volatile Organics	ND	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

VOLATILE ORGANICS
Method 8260

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

ESS Project ID: 932960

Client Sample ID: LRS-4

ESS Sample ID: 932960-03

Date Sampled: 9/17/93

Dilution Factor: 1x

Date Analyzed: 9/29/93

Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

Environmental Science Services

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES
EPA 8270 (Page 1 of 2)

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: LRS-4 — ESS Sample ID: 932960-03

Date Sampled: 9/17/93 — Date Extracted: 9/23/93

Date Analyzed: 9/24/93 — Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
2-Chlorophenol	ND	330
2-Nitrophenol	ND	330
Phenol	ND	330
2,4-Dimethylphenol	ND	330
2,4-Dichlorophenol	ND	330
2,4-Dinitrophenol	ND	1,650
Pentachlorophenol	ND	1,650
4-Nitrophenol	ND	1,650
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1,650
2-Methylphenol	ND	330
4-Methylphenol	ND	330
4-Chloro-3-Methylphenol	ND	330
4,6-Dinitro-2-Methylphenol	ND	1,650
Acenaphthylene	ND	330
1,2,4-Trichlorobenzene	ND	330
Hexachlorobenzene	ND	330
Bis(2-chloroethyl)ether	ND	330
2-Chloronaphthalene	ND	330
1,2-Dichlorobenzene	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
3,3-Dichlorobenzidine	ND	660
2,4-Dinitrotoluene	ND	330
2,6-Dinitrotoluene	ND	330
Fluoranthene	ND	330
4-Chlorophenyl phenyl ether	ND	330
Bis(2-chloroisopropyl) ether	ND	330
Bis(2-chloroethoxy) methane	ND	330
Hexachlorobutadiene	ND	330
Hexachlorocyclopentadiene	ND	330
Isophorone	ND	330
Naphthalene	ND	330

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES
EPA 8270 (Page 2 of 2)

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: LRS-4 — ESS Sample ID: 932960-03

Date Sampled: N/A — Date Extracted: 9/23/93

Date Analyzed: 9/24/93 — Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
Nitrobenzene	ND	330
N-nitrosodiphenylamine	ND	330
N-nitrosodi-n-propylamine	ND	330
Bis(2-ethylhexyl)phthalate	ND	330
Di-n-butylphthalate	ND	330
Di-n-octylphthalate	ND	330
Diethyl phthalate	ND	330
Dimethyl phthalate	ND	330
Benzo(a)anthracene	ND	330
Benzo(a)pyrene	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Chrysene	ND	330
Acenaphthene	ND	330
Anthracene	ND	330
Benzo(ghi)perylene	ND	330
Fluorene	ND	330
Phenanthrene	ND	330
Dibenzo(a,h)anthracene	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Pyrene	ND	330
Hexachloroethane	ND	330
4-Bromophenyl-phenylether	ND	330
Benzyl Alcohol	ND	330
Benzoic Acid	ND	1,650
Bis(2-Chloroethoxy)methane	ND	330
4-Chloroaniline	ND	330
2-Methylnaphthalene	ND	330
2-Nitroaniline	ND	1,650
3-Nitroaniline	ND	330
Dibenzofuran	ND	330
4-Nitroaniline	ND	1,650
Butylbenzylphthalate	ND	330

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: LRS-5 — ESS Sample ID: 932960-06

Date Sample Received: 9/20/93 — Date Reported: 10/05/93

Parameter	Results	Units	MRL	Method
Percent Solids	91	% w/w	1	160.3
Semivolatile Organics				
Fluorene	660	ug/Kg	Attached	8270
Phenanthrene	1,140	ug/Kg	Attached	8270
Total Petroleum Hydrocarbon	680	mg/Kg	25	418.1
Volatile Organics				
Acetone	110	ug/Kg	Attached	8260
Ethylbenzene	77	ug/Kg	Attached	8260
Xylenes (Total)	95	ug/Kg	Attached	8260

MRL = Method Reporting Limit

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

VOLATILE ORGANICS
Method 8260

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton
ESS Project ID: 932960

Client Sample ID: LRS-5
ESS Sample ID: 932960-06

Date Sampled: 9/17/93
Dilution Factor: 1x

Date Analyzed: 10/01/93
Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	110	50
Carbon Disulfide	ND	5
ethylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	77	5
Xylenes (Total)	95	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
ichlorobenzene (Total)	ND	10

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: Bill Hall
Date: 10/7/93

Science Services

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES
EPA 8270 (Page 1 of 2)

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

ESS Project ID: 932960

Client Sample ID: LRS-5

ESS Sample ID: 932960-06

Date Sampled: 9/17/93

Date Extracted: 10/6/93

Date Analyzed: 10/7/93

Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
2-Chlorophenol	ND	330
2-Nitrophenol	ND	330
Phenol	ND	330
2,4-Dimethylphenol	ND	330
2,4-Dichlorophenol	ND	330
?,4-Dinitrophenol	ND	1,650
entachlorophenol	ND	1,650
-Nitrophenol	ND	1,650
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1,650
2-Methylphenol	ND	330
4-Methylphenol	ND	330
4-Chloro-3-Methylphenol	ND	330
4,6-Dinitro-2-Methylphenol	ND	1,650
Acenaphthylene	ND	330
1,2,4-Trichlorobenzene	ND	330
Hexachlorobenzene	ND	330
Bis(2-chloroethyl)ether	ND	330
2-Chloronaphthalene	ND	330
1,2-Dichlorobenzene	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
3,3-Dichlorobenzidine	ND	660
2,4-Dinitrotoluene	ND	330
2,6-Dinitrotoluene	ND	330
Fluoranthene	ND	330
4-Chlorophenyl phenyl ether	ND	330
Bis(2-chloroisopropyl) ether	ND	330
Bis(2-chloroethoxy) methane	ND	330
Hexachlorobutadiene	ND	330
Hexachlorocyclopentadiene	ND	330
Isophorone	ND	330
Naphthalene	ND	330

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES
EPA 8270 (Page 2 of 2)

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: LRS-5 — ESS Sample ID: 932960-06

Date Sampled: 9/17/93 — Date Extracted: 10/6/93

Date Analyzed: 10/7/93 — Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
Nitrobenzene	ND	330
N-nitrosodiphenylamine	ND	330
N-nitrosodi-n-propylamine	ND	330
Bis(2-ethylhexyl)phthalate	ND	330
Di-n-butylphthalate	ND	330
Di-n-octylphthalate	ND	330
Diethyl phthalate	ND	330
Dimethyl phthalate	ND	330
Benzo(a)anthracene	ND	330
Benzo(a)pyrene	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Chrysene	ND	330
Acenaphthene	ND	330
Anthracene	ND	330
Benzo(ghi)perylene	ND	330
Fluorene	660	330
Phenanthrene	1,140	330
Dibenzo(a,h)anthracene	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Pyrene	ND	330
Hexachloroethane	ND	330
4-Bromophenyl-phenylether	ND	330
Benzyl Alcohol	ND	330
Benzoic Acid	ND	1,650
Bis(2-Chloroethoxy)methane	ND	330
4-Chloroaniline	ND	330
2-Methylnaphthalene	ND	330
2-Nitroaniline	ND	1,650
3-Nitroaniline	ND	330
Dibenzofuran	ND	330
4-Nitroaniline	ND	1,650
Butylbenzylphthalate	ND	330

U = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

QUALITY CONTROL SECTION

In Response To The Future

CERTIFICATE OF ANALYSIS

ACID SURROGATE RECOVERY

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

Date Sample Analyzed: 9/24/93

ESS Project ID: 932960

SAMPLE ID	(2CP) (33-110)*	(PHL) (10-110%)*	(2FP) (21-110%)*	(TBP) (10-123%)*
SV0923B1	74%	82%	100%	83%
932960-03	67	84	87	64

* QC Limits

Acceptance criteria: Three of four surrogates must be within QC Limits.

2CP = 2-CHLOROPHENOL-D4
PHL = PHENOL-D5
2FP = 2-FLUOROPHENOL
TBP = 2,4,6 TRIBROMOPHENOL

Approved by: [signature] Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL SURROGATE RECOVERY

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

Date Sample Analyzed: 9/24/93

ESS Project ID: 932960

SAMPLE ID	(DCB) (16-110)*	(NBZ) (35-114%)*	(FBP) (43-116%)*	(TPH) (33-141%)*
SV0923B1	90%	89%	102%	128%
932960-03	90	88	101	140

* QC Limits

Acceptance criteria: Three of four surrogates must be within QC Limits.

DCB = 1,2-DICHLOROBENZENE-D4
NBZ = NITROBENZENE-D5
FBP = 2-FLUOROBIPHENYL
TPH = P-TERPHENYL-D14

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES
EPA 8270 (Page 1 of 2)

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton ESS Project ID: 932960

Client Sample ID: Method Blank ESS Sample ID: SV0923B1

Date Sampled: N/A Date Extracted: 9/23/93

Date Analyzed: 9/24/93 Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
2-Chlorophenol	ND	330
2-Nitrophenol	ND	330
Phenol	ND	330
2,4-Dimethylphenol	ND	330
2,4-Dichlorophenol	ND	330
`,4-Dinitrophenol	ND	1,650
entachlorophenol	ND	1,650
4-Nitrophenol	ND	1,650
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1,650
2-Methylphenol	ND	330
4-Methylphenol	ND	330
4-Chloro-3-Methylphenol	ND	330
4,6-Dinitro-2-Methylphenol	ND	1,650
Acenaphthylene	ND	330
1,2,4-Trichlorobenzene	ND	330
Hexachlorobenzene	ND	330
Bis(2-chloroethyl)ether	ND	330
2-Chloronaphthalene	ND	330
1,2-Dichlorobenzene	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
3,3-Dichlorobenzidine	ND	660
2,4-Dinitrotoluene	ND	330
2,6-Dinitrotoluene	ND	330
Fluoranthene	ND	330
4-Chlorophenyl phenyl ether	ND	330
Bis(2-chloroisopropyl) ether	ND	330
Bis(2-chloroethoxy) methane	ND	330
Hexachlorobutadiene	ND	330
Hexachlorocyclopentadiene	ND	330
Isophorone	ND	330
Naphthalene	ND	330

/A = Not Applicable
ND = Not Detected above Method Reporting Limit (MRL)

Approved by: [signature] Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES
EPA 8270 (Page 2 of 2)

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: Method Blank — ESS Sample ID: SV0923B1

Date Sampled: N/A — Date Extracted: 9/23/93

Date Analyzed: 9/24/93 — Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
Nitrobenzene	ND	330
N-nitrosodiphenylamine	ND	330
N-nitrosodi-n-propylamine	ND	330
Bis(2-ethylhexyl)phthalate	ND	330
Di-n-butylphthalate	ND	330
Di-n-octylphthalate	ND	330
Diethyl phthalate	ND	330
Dimethyl phthalate	ND	330
Benzo(a)anthracene	ND	330
Benzo(a)pyrene	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Chrysene	ND	330
Acenaphthene	ND	330
Anthracene	ND	330
Benzo(ghi)perylene	ND	330
Fluorene	ND	330
Phenanthrene	ND	330
Dibenzo(a,h)anthracene	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Pyrene	ND	330
Hexachloroethane	ND	330
4-Bromophenyl-phenylether	ND	330
Benzyl Alcohol	ND	330
Benzoic Acid	ND	1,650
Bis(2-Chloroethoxy)methane	ND	330
4-Chloroaniline	ND	330
2-Methylnaphthalene	ND	330
2-Nitroaniline	ND	1,650
3-Nitroaniline	ND	330
Dibenzofuran	ND	330
4-Nitroaniline	ND	1,650
Butylbenzylphthalate	ND	330

N/A = Not Applicable
ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

FORM F.P. 292
(rev. 9/90)

CONTAMINATION found on site
Being Handled by Dep. Jonathan Hobill
Site # 4-1303

The Commonwealth of Massachusetts

Department of Public Safety
Division of Fire Prevention and Regulation

APPLICATION FOR PERMIT, AND PERMIT, FOR REMOVAL AND TRANSPORTATION TO APPROVED TANK YARD

FDID# 23044 Permit # 661-FD3 Date Sept. 14 1993

Brockton
City, Town or District

C.82 S.40 M.G.L.

Fee Paid: $ 200.00

DIG SAFE NUMBER
9334 2987
start date Sept. 13, 1993

In accordance with the provisions of Chapter 148, Sec. 38A, M.G.L., 527 CMR 9.00 application is hereby made by: ATEC Associates, Inc.

Street Address & City or Town: W. Chestnut St., Brockton, MA

Signature of applicant: James M. Kenny

Applicants name printed: James M. Kenny

For permission to remove and transport one underground storage tank from.

Owner: U.S. Army Street Address: Corporal Craig USARC, W. Chestnut St. Brockton, MA

Firm transporting waste: Lincoln Environmental, Inc. State Lic.# RI 496

Hazardous waste manifest # _____ E.P.A.# _____

Approved tank yard: ~~John C. Tombarello & Sons~~ Grants # 14901

Tank yard Address: ~~207 Marston St. Lawrence, MA 01841~~ UL#

Type of inert gas: CO_2 UL tank #: C 959955

Tank capacity: 5000 G Substance last stored: No. 2 FO

Date of issue: Sept. 13 1993 Date of expiration: Sept 20 1993

Signature/Title of Officer granting permit: INSP [signature]

KEEP ORIGINAL AS APPLICATION AND ISSUE DUPLICATE AS PERMIT

FORM F.P. 292
(rev. 9/90)

CONTAMINATION found on site
Being Handled by Dep. Jonathan Hobill
Site # 4-1303

The Commonwealth of Massachusetts

Department of Public Safety
Division of Fire Prevention and Regulation

APPLICATION FOR PERMIT, AND PERMIT, FOR REMOVAL AND TRANSPORTATION TO APPROVED TANK YARD

FDID# 23044 Permit # 661-FP3 Date Sept. 14 1993

Brockton
City, Town or District

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Firm transporting waste: Lincoln Environmental, Inc. State Lic.# RI 496

Hazardous waste manifest # _____ E.P.A.# _____

Approved tank yard: ~~John C. Tombarello & Sons~~ Grants # 14901

Tank yard Address: ~~207 Marston St. Lawrence, MA 01841~~ UL#

Type of inert gas: CO_2 UL tank #: C 959955

Tank capacity: 5000 G Substance last stored: No. 2 FO

Date of issue: Sept. 13 1993 Date of expiration: Sept 20 1993

Signature/Title of Officer granting permit: INSP [signature]

KEEP ORIGINAL AS APPLICATION AND ISSUE DUPLICATE AS PERMIT

FORM F.P. 292
(rev. 9/90)

CONTAMINATION found on site
Being Handled by Dep. Johnathan Hobill
site # 4-1303

The Commonwealth of Massachusetts

Department of Public Safety
Division of Fire Prevention and Regulation

APPLICATION FOR PERMIT, AND PERMIT, FOR REMOVAL AND TRANSPORTATION TO APPROVED TANK YARD

FDID# 23044 Permit # 661-FP3 Date Sept. 14 1993

Brockton
City, Town or District

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Signature of applicant: James M. Kenny

Applicants name printed: James M. Kenny

For permission to remove and transport one underground storage tank from.

Owner: U.S. Army Street Address: Corporal Craig USARC, W. Chestnut St. Brockton, MA

Firm transporting waste: Lincoln Environmental, Inc. State Lic.# RI 446

Hazardous waste manifest # _____ E.P.A.# _____

Approved tank yard: ~~John C. Tombarello & Sons~~ Grants # 14901

Tank yard Address: ~~207 Marston St. Lawrence, MA 01841~~ UL#

Type of inert gas: CO_2 UL tank #: C 959955

Tank capacity: 5000 G Substance last stored: No. 2 FO

Date of issue: Sept. 13 1993 Date of expiration: Sept 20 1993

Signature/Title of Officer granting permit: Insp. [signature]

KEEP ORIGINAL AS APPLICATION AND ISSUE DUPLICATE AS PERMIT

FORM F.P. 292
(rev. 9/90)

CONTAMINATION found on site
Being Handled by Dep. Jonathan Hobill
Site # 4-1303

The Commonwealth of Massachusetts

Department of Public Safety
Division of Fire Prevention and Regulation

APPLICATION FOR PERMIT, AND PERMIT, FOR REMOVAL AND TRANSPORTATION TO APPROVED TANK YARD

FDID# 23044 Permit # 661-FP3 Date Sept. 14 1993

Brockton
City, Town or District

C.82 S.40 M.G.L.

Fee Paid: $ 200.00

DIG SAFE NUMBER
9334 2987
start date Sept. 13, 1993

In accordance with the provisions of Chapter 148, Sec. 38A, M.G.L., 527 CMR 9.00 application is hereby made by: ATEC Associates, Inc.

Street Address & City or Town: W. Chestnut St., Brockton, MA

Signature of applicant: James M. Kenny

Applicants name printed: James M. Kenny

For permission to remove and transport one underground storage tank from.

Owner: U.S. Army Street Address: Corporal Craig USARC, W. Chestnut St. Brockton, MA

Firm transporting waste: Lincoln Environmental, Inc. State Lic.# RI 446

Hazardous waste manifest # _____ E.P.A.# _____

Approved tank yard: ~~John C. Tombarello & Sons~~ Grants # 14901

Tank yard Address: ~~207 Marston St. Lawrence, MA 01841~~ UL#

Type of inert gas: CO_2 UL tank #: C 459455

Tank capacity: 5000 G Substance last stored: No. 2 FO

Date of issue: Sept. 13 1993 Date of expiration: Sept 20 1993

Signature/Title of Officer granting permit: [signature]

KEEP ORIGINAL AS APPLICATION AND ISSUE DUPLICATE AS PERMIT

FORM F.P. 292
(rev. 9/90)

CONTAMINATION found on site
Being Handled by Dep. Jonathan Hobill
Site # 4-1303

The Commonwealth of Massachusetts

Department of Public Safety
Division of Fire Prevention and Regulation

APPLICATION FOR PERMIT, AND PERMIT, FOR REMOVAL AND TRANSPORTATION TO APPROVED TANK YARD

FDID# 23044 Permit # 661-FP3 Date Sept. 14 1993

Brockton
City, Town or District

C.82 S.40 M.G.L.

Fee Paid: $ 200.00

DIG SAFE NUMBER
9334 2987
start date Sept. 13, 1993

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Street Address & City or Town: W. Chestnut St., Brockton, MA

Signature of applicant: James M. Kenny

Applicants name printed: James M. Kenny

For permission to remove and transport one underground storage tank from.

Owner: U.S. Army Street Address: Corporal Craig USARC, W. Chestnut St. Brockton, MA

Firm transporting waste: Lincoln Environmental, Inc. State Lic.# RI 496

Hazardous waste manifest # _____ E.P.A.# _____

Approved tank yard: ~~John C. Tombarello & Sons~~ Grants # 14901

Tank yard Address: ~~207 Marston St. Lawrence, MA 01841~~ UL#

Type of inert gas: CO_2 UL tank #: C 959955

Tank capacity: 5000 G Substance last stored: No 2 FO

Date of issue: Sept. 13 1993 Date of expiration: Sept 20 1993

Signature/Title of Officer granting permit: Insp. [signature]

KEEP ORIGINAL AS APPLICATION AND ISSUE DUPLICATE AS PERMIT

FORM F.P. 292
(rev. 9/90)

CONTAMINATION found on site
Being Handled by Dep. Jonathan Hobill
site #4-1303

The Commonwealth of Massachusetts

Department of Public Safety
Division of Fire Prevention and Regulation

APPLICATION FOR PERMIT, AND PERMIT, FOR REMOVAL AND TRANSPORTATION TO APPROVED TANK YARD

FDID# 23044 Permit # 661-FP3 Date Sept. 14 1993

Brockton
City, Town or District

C.82 S.40 M.G.L.

Fee Paid: $ 200.00

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Applicants name printed: James M. Kenny

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Owner: U.S. Army Street Address: Corporal Craig USARC, W. Chestnut St. Brockton, MA

Firm transporting waste: Lincoln Environmental, Inc. State Lic.# RI 446

Hazardous waste manifest # _____ E.P.A.# _____

Approved tank yard: ~~John C. Tombarello & Sons~~ Grants # 14901

Tank yard Address: ~~207 Marston St. Lawrence, MA 01841~~ UL#

Type of inert gas: CO_2 UL tank #: C 959955

Tank capacity: 5000 G Substance last stored: No 2 FO

Date of issue: Sept. 13 1993 Date of expiration: Sept 20 1993

Signature/Title of Officer granting permit: [signature]

KEEP ORIGINAL AS APPLICATION AND ISSUE DUPLICATE AS PERMIT

CERTIFICATE OF ANALYSIS

ACID SURROGATE RECOVERY

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

Date Sample Analyzed: 10/7/93

ESS Project ID: 932960

SAMPLE ID	(2CP) (33-110)*	(PHL) (10-110%)*	(2FP) (21-110%)*	(TBP) (10-123%)*
SV1006B1	84%	102%	99%	107%
932960-06	58	66	75	63

* QC Limits

Acceptance criteria: Three of four surrogates must be within QC Limits.

2CP = 2-CHLOROPHENOL-D4
PHL = PHENOL-D5
2FP = 2-FLUOROPHENOL
TBP = 2,4,6 TRIBROMOPHENOL

Approved by: _____ Date: 10/7/93

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL SURROGATE RECOVERY

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

Date Sample Analyzed: 10/7/93

ESS Project ID: 932960

SAMPLE ID	(DCB) (16-110)*	(NBZ) (35-114%)*	(FBP) (43-116%)*	(TPH) (33-141%)*
SV1006B1	90%	93%	94%	82%
932960-06	67	71	79	85

* QC Limits

Acceptance criteria: Three of four surrogates must be within QC Limits.

DCB = 1,2-DICHLOROBENZENE-D4
NBZ = NITROBENZENE-D5
FBP = 2-FLUOROBIPHENYL
TPH = P-TERPHENYL-D14

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES
EPA 8270 (Page 1 of 2)

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: Method Blank — ESS Sample ID: SV1006B1

Date Sampled: N/A — Date Extracted: 10/6/93

Date Analyzed: 10/7/93 — Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
2-Chlorophenol	ND	330
2-Nitrophenol	ND	330
Phenol	ND	330
2,4-Dimethylphenol	ND	330
2,4-Dichlorophenol	ND	330
2,4-Dinitrophenol	ND	1,650
Pentachlorophenol	ND	1,650
4-Nitrophenol	ND	1,650
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1,650
2-Methylphenol	ND	330
4-Methylphenol	ND	330
4-Chloro-3-Methylphenol	ND	330
4,6-Dinitro-2-Methylphenol	ND	1,650
Acenaphthylene	ND	330
1,2,4-Trichlorobenzene	ND	330
Hexachlorobenzene	ND	330
Bis(2-chloroethyl)ether	ND	330
2-Chloronaphthalene	ND	330
1,2-Dichlorobenzene	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
3,3-Dichlorobenzidine	ND	660
2,4-Dinitrotoluene	ND	330
2,6-Dinitrotoluene	ND	330
Fluoranthene	ND	330
4-Chlorophenyl phenyl ether	ND	330
Bis(2-chloroisopropyl) ether	ND	330
Bis(2-chloroethoxy) methane	ND	330
Hexachlorobutadiene	ND	330
Hexachlorocyclopentadiene	ND	330
Isophorone	ND	330
Naphthalene	ND	330

N/A = Not Applicable
ND = Not Detected above Method Reporting Limit (MRL)

Approved by: [signature] Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES
EPA 8270 (Page 2 of 2)

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: Method Blank — ESS Sample ID: SV1006B1

Date Sampled: N/A — Date Extracted: 10/6/93

Date Analyzed: 10/7/93 — Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
Nitrobenzene	ND	330
N-nitrosodiphenylamine	ND	330
N-nitrosodi-n-propylamine	ND	330
Bis(2-ethylhexyl)phthalate	ND	330
Di-n-butylphthalate	ND	330
Di-n-octylphthalate	ND	330
Diethyl phthalate	ND	330
Dimethyl phthalate	ND	330
Benzo(a)anthracene	ND	330
Benzo(a)pyrene	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Chrysene	ND	330
Acenaphthene	ND	330
Anthracene	ND	330
Benzo(ghi)perylene	ND	330
Fluorene	ND	330
Phenanthrene	ND	330
Dibenzo(a,h)anthracene	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Pyrene	ND	330
Hexachloroethane	ND	330
4-Bromophenyl-phenylether	ND	330
Benzyl Alcohol	ND	330
Benzoic Acid	ND	1,650
Bis(2-Chloroethoxy)methane	ND	330
4-Chloroaniline	ND	330
2-Methylnaphthalene	ND	330
2-Nitroaniline	ND	1,650
3-Nitroaniline	ND	330
Dibenzofuran	ND	330
4-Nitroaniline	ND	1,650
Butylbenzylphthalate	ND	330

N/A = Not Applicable
ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

VOA SOIL SURROGATE RECOVERY

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

Date Sample Analyzed: 9/29/93

ESS Project ID: 932960

SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%)*	TOLUENE-D8 (81-117%)*	BFB (74-121%)*
V0929B1	109%	91%	87%
932960-03	99	88	90
932960-04	96	90	82

* Acceptance criteria

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

VOA SOIL SURROGATE RECOVERY

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

Date Sample Analyzed: 10/01/93

ESS Project ID: 932960

SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%)*	TOLUENE-D8 (81-117%)*	BFB (74-121%)*
V1001B1	96%	90%	91%
932960-06	107	117	118

* Acceptance criteria

Approved by: [signature] Date: 10/7/93

Environmental Science Services
[illegible] Avenue, Providence, Rhode Island 02909 (401) 421-0398 Fax (401) 421-[illegible]

In Response To The Future

CERTIFICATE OF ANALYSIS

VOLATILE ORGANICS
Method 8260

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: Method Blank — ESS Sample ID: V1001B1

Date Sampled: N/A — Dilution Factor: 1x

Date Analyzed: 10/01/93 — Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

N/A = Not Applicable
ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

PCB SOIL SURROGATE RECOVERY

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton

Date Sample Analyzed: 9/22/93

ESS Project ID: 932960

SAMPLE ID	DIBUTYLCHLORENDATE (50-150%)*
P0922B1	88%
2960-04	71

* Advisory Limits

Approved by: John Shale

Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

POLYCHLORINATED BIPHENYLS
Method 8081

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: Method Blank — ESS Sample ID: P0922B1

Date Sample Received: N/A — Date Reported: 10/05/93

Parameter	Result (mg/Kg)	MRL
Arochlor 1016	ND	1
Arochlor 1221	ND	1
Arochlor 1232	ND	1
Arochlor 1242	ND	1
Arochlor 1248	ND	1
Arochlor 1254	ND	1
Arochlor 1260	ND	1

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

MATRIX SPIKE ANALYSIS SUMMARY

TCLP METALS

EPA METHOD 1311

Client: ATEC Environmental Consultants

TCLP Batch ID: 295301 Concentration in: mg/L

Target Analyte	Result	Spike Added	Spiked Result	Percent Recovery
Arsenic	ND	2.00	2.02	101%
Barium	0.6	2.00	2.44	92
Cadmium	ND	0.5	0.53	106
Chromium	ND	1.0	1.24	124
Lead	ND	1.0	1.10	110
Mercury	ND	0.02	0.020	100
Selenium	ND	2.00	2.73	137
Silver	ND	1.0	0.80	80

This matrix spike analysis summary applies to the following samples: 932960-04

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

CHAIN OF CUSTODY RECORD

PROJ. NO. 08713 | PROJECT NAME | CLIENT Ft. Devens - Brockton

SAMPLERS: (Signature) Jana Kenny (CAC)

SAMPLING METHOD Grab

LAB PROJ. NO.

LABORATORY ANALYSIS

	SAMPLE I.D. NO.	DATE	TIME	COMPOSITE	GRAB	WATER	SOIL		FILTERED	ACIDIFIED	ICED		NUMBER OF CONTAINERS	LAB I.D. NUMBER	VOLATILE ORGANICS	BTX & E	TOTAL HYDROCARBONS	PCB'S	E.P. TOXIC METALS	~~TOTAL~~ METALS (TCLP)	~~IGNITABILITY~~ Paint Filter	DNA (8270)	Flash/pH	CN + Su react	SAMPLE LOCATION / REMARKS
1	LRS2	9/17/93	1145		✓		✓				✓		1x500				✓								
2	LRS3	9/17/93	1150		✓		✓				✓		1x500				✓								
3	LRS4	9/17/93	1200		✓		✓				✓		2x40 1x950		✓		✓					✓			
4	STK.153	9/17/93	1230		✓		✓				✓		2x40 1x950		✓		✓	✓		✓	✓		✓	✓	
5	LRS1	9/17/93	1350		✓		✓				✓		1x500				✓								
6	LRS5	9/17/93	1510		✓		✓				✓		2x40 1x950		✓		✓					✓			

Turnaround = 2 Weeks

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Jana Kenny	9/20/93 12:55	9/20/93 12:55		9/20/93 1:55	Jan Ripa

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Project Manager / Phone #:

ATEC Environmental Consultants
Division of ATEC Associates, Inc.
62 Accord Park Drive
Norwell, MA 02061
(617) 878-6200

APPENDIX A

PART 3

LABORATORY ANALYTICAL RESULTS OF SOILS REMOVED FROM THE EXCAVATION

In Response To The Future

CERTIFICATE OF ANALYSIS

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: STK 153 — ESS Sample ID: 932960-04

Date Sample Received: 9/20/93 — Date Reported: 10/05/93

Parameter	Results	Units	MRL	Method
Corrosivity (pH)	7.7	S.U.	N/A	9045
Flashpoint	No Flash	°F	200	1010
aint Filter Test	ND	mLs/5 min.	0.5	9095
Percent Solids	92	% w/w	1	160.3
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Reactive Cyanide	ND	mg/Kg	2	7.3.3.2
Reactive Sulfide	ND	mg/Kg	2	7.3.4.1
Total Petroleum Hydrocarbon	560	mg/Kg	49	418.1
Volatile Organics	ND	ug/Kg	Attached	8260
Toxicity Characteristic Leaching Procedure				1311
Metals				
Barium	0.6	mg/L	Attached	6010

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

VOLATILE ORGANICS
Method 8260

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: STK 153 — ESS Sample ID: 932960-04

Date Sampled: 9/17/93 — Dilution Factor: 1x

Date Analyzed: 9/29/93 — Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

Environmental Science Services

In Response To The Future

CERTIFICATE OF ANALYSIS

TOXICITY CHARACTERISTICS LEACHING PROCEDURE (TCLP)

METALS

EPA METHOD 1311

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — Date Sampled: 9/17/93

Client Sample ID: STK 153 — Date TCLP Performed: 9/21/93

ESS Sample ID: 932960-04 — Date Extract Analyzed: 9/22/93

Date Sample Received: 9/20/93 — Date Reported: 10/05/93

Target Analyte	Result	Units	MRL	Method
TCLP Extraction				1311
Arsenic	ND	mg/L	0.2	6010
Barium	0.6	mg/L	0.2	6010
Cadmium	ND	mg/L	0.02	6010
Chromium	ND	mg/L	0.05	6010
Lead	ND	mg/L	0.1	6010
Mercury	ND	mg/L	0.005	7470
Selenium	ND	mg/L	0.3	6010
Silver	ND	mg/L	0.05	6010

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

In Response To The Future

CERTIFICATE OF ANALYSIS

POLYCHLORINATED BIPHENYLS
Method 8081

Client: ATEC Environmental Consultants

Client Project ID: Ft. Devens Brockton — ESS Project ID: 932960

Client Sample ID: STK 153 — ESS Sample ID: 932960-04

Date Sample Received: 9/20/93 — Date Reported: 10/05/93

Parameter	Result (mg/Kg)	MRL
Arochlor 1016	ND	1
Arochlor 1221	ND	1
Arochlor 1232	ND	1
Arochlor 1242	ND	1
Arochlor 1248	ND	1
Arochlor 1254	ND	1
Arochlor 1260	ND	1

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: _____ Date: 10/7/93

Environmental Science Services

CHAIN OF CU[illegible]DY RECORD

PROJ. NO. 08713 | [illegible]OJECT NAME | CLIENT Ft. Devens - Brockton

SAMPLERS: (Signature) Jana Kenny (CQC)

SAMPLING METHOD Grab

LAB PROJ. NO.

LABORATORY ANALYSIS

	SAMPLE I.D. NO.	DATE	TIME	COMPOSITE	GRAB	WATER	SOIL		FILTERED	ACIDIFIED	ICED		NUMBER OF CONTAINERS	LAB I.D. NUMBER	VOLATILE ORGANICS	BTX & E	TOTAL HYDROCARBONS	PCB'S	E.P. TOXIC METALS	~~TOTAL~~ METALS ~~IGNITABILITY~~ TCLP	~~IGNITABILITY~~ Paint Filter	BNA (8270)	Flash/pH	CN + Su React	SAMPLE LOCATION / REMARKS
1	LRS2	9/17/93	1145		✓		✓				✓		1x500				✓								
2	LRS3	9/17/93	1150		✓		✓				✓		1x500				✓								
3	LRS4	9/17/93	1200		✓		✓				✓		2x40 1x950		✓		✓					✓			
4	STK.153	9/17/93	1230		✓		✓				✓		2x40 1x950		✓		✓	✓		✓	✓		✓	✓	
5	LRS1	9/17/93	1350		✓		✓				✓		1x500				✓								
6	LRS5	9/17/93	1510		✓		✓				✓		2x40 1x950		✓		✓					✓			

Turnaround = 2 Weeks

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Jana Kenny	9/20/93 12:55	[signature] 9/20/93 12:55	[signature]	9/20/93 1:55	Jan Ripa
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Project Manager / Phone #:	

ATEC Environmental Consultants
Division of ATEC Associates, Inc.
62 Accord Park Drive
Norwell, MA 02061
(617) 878-6200

APPENDIX B
PART 1

MANIFESTS AND DISPOSAL CERTIFICATIONS OF TANK REMOVAL

APR-12-94 TUE 8:50 PETRO LINK 4012321130 P.03

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF HAZARDOUS WASTE
One Winter Street
Boston, Massachusetts 02108

SD2027BB0

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator US EPA ID No. MAS365614141	Manifest Document No.	2. Page 1 of 1	Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
Craig USAR Center
915 West Chestnut Street, Brockton, MA 02401

4. Generator's Phone (508) 586-8147

A. State Manifest Document Number: MA 613281

B. State Gen. ID:

5. Transporter 1 Company Name: Lincoln Environmental Inc.

6. US EPA ID Number: RID982192627

C. State Trans. ID: 31R/16045

7. Transporter 2 Company Name:

8. US EPA ID Number:

D. Transporter's Phone: 401 232-3353

E. State Trans. ID:

9. Designated Facility Name and Site Address
General Chemical Corp.
133-138 Leland Street
Framingham, MA 01701

10. US EPA ID Number: MAD019371079

F. Transporter's Phone:

G. State Facility's ID: Not Required

H. Facility's Phone: 508 872-5000

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. R.Q. Crude Petroleum Oil, Combustible Liquid, UN1270, PG III ERG #27	001	DM	00208	L	MA-01
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above (Include physical state and hazard class)
Crude Petroleum Oil, 10X RQ

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
In case of emergency, contact Lincoln Environmental Inc. at 401-232-3353 (24hrs.)

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Date (Month Day Year)
[illegible]	[signature]	11 12 93

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date (Month Day Year)
Thomas [illegible]	[signature] Thomas [illegible]	11 12 93

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date (Month Day Year)

19. Discrepancy Indication Space
LINE 1A SHOULD READ: FD CONSUMER LIQUID NOS (OIL/WAX)
CONTAINER LIQUID NOS, PGIII

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Date (Month Day Year)
Donald T. McGrath Jr.	[signature] Donald T. McGrath Jr.	11 12 93

OMB No. 2050-0039 Expires 9-30-94

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

COPY>5: TRANSPORTER 1 RETAINS

GENERATOR

In case of emergency or spill, immediately call National Response Center (800) 424-8802.

TRANSPORTER

FACILITY

MA G132611 COPY>5: TRANSPORTER 1 RETAINS

LUGIT
AR 293

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF HAZARDOUS WASTE
One Winter Street
Boston, Massachusetts 02108

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator US EPA ID No. MP 508586814746 Manifest Document No. 7492

2. Page 1 of 1 — Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: CRAIG U.S.AR. CENTER, 915 WEST CHESTNUT ST BROCKTON MA 02401-5597

A. State Manifest Document Number: MA 6110665

4. Generator's Phone: 508 586-8147

B. State Gen. ID: SAME

5. Transporter 1 Company Name: CYN OIL CORPORATION

6. US EPA ID Number: MAD082303777

C. State Trans. ID: 25648

7. Transporter 2 Company Name:

8. US EPA ID Number:

D. Transporter's Phone: 617 344-02

E. State Trans. ID:

9. Designated Facility Name and Site Address: CYN OIL CORPORATION, 1771 WASHINGTON STREET, STOUGHTON, MA 02072

10. US EPA ID Number: MAD082303777

F. Transporter's Phone:

G. State Facility's ID: Not Required

H. Facility's Phone: 617 344-026

GENERATOR

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)

	12. Containers No.	Type	13. Total Quantity	14. Unit Wt./Vol.	15. Waste No.
a. WASTE PETROLEUM OIL COMBUSTIBLE LIQUID UN1270 P.G. III	001	TT	1560	G	MA9
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above (Include physical state and hazard code): OIL + WATER

K. Handling Codes for Wastes Listed Above: S02 T50

15. Special Handling Instructions and Additional Information: 24 HOUR EMERGENCY SPILL RESPONSE 617-344-0265

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

If I am a large quantity generator I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which I have determined to be the best waste management OR if I am a small quantity generator I have made a good faith effort to minimize the quantity and toxicity of waste generated.

Printed/Typed Name: JOHN J. McGRATH — Signature: [signature] — Date: Month 09 Day 17 Year 9

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: David Borofski — Signature: David Borofski — Date: Month 09 Day 17 Year 9

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name: — Signature: — Date: Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name: Gale Jarvis — Signature: [signature] — Date: Month 09 Day 17 Year 9

In case of emergency or spill, immediately call the National Response Center (800) 424-8802.

COPY>1: FACILITY MAILS TO DESTINATION STATE

TANK SERVICE

James G. Grant Co., Inc

(617) 361-2716

MASS LICENSE #03501

28 WOLCOTT STREET
P.O. BOX 54
READVILLE, MA 02137

CUSTOMER: AIEC ASSOC DATE: 9-15-93

ADDRESS: REF. #:

CUSTOMER P.O. #	F. D. I. D. #	SIZE	DESCRIPTION	PRICE
	23044	5,000	# 4689	100.00
	17155	500	# 4688	10.00
				$110.00

TANK MUST BE ABSOLUTELY CLEAN AND DRY, ACCOMPANIED BY THE REQUIRED FIRE PERMIT.

SIGNATURE

NAME AND ADDRESS OF APPROVED TANK YARD: JAMES G. GRANT CO., INC. R 28 WOLCOTT ST. READVILLE, MA 02137

APPROVED TANK YARD NO. 03501

Tank Yard Ledger 502 CMR 3.03(4) Number: 931468 9

I certify under penalty of law I have personally examined the underground steel storage tank delivered to this "approved tank yard" by firm, corporation or partnership AIEC ASSOC and accepted same in conformance with Massachusetts Fire Prevention Regulation 502 CMR 3.00 Provisions for Approving Underground Steel Storage Tank dismantling yards. A valid permit was issued by LOCAL Head of Fire Department FDID# 23044 to transport this tank to this yard.

Name and official title of approved tank yard owner or owners authorized representative:

SIGNATURE TITLE 9-15-93 DATE SIGNED

This signed receipt of disposal must be returned to the local head of the fire department FDID# 23044 pursuant to 502 CMR 3:00. (EACH TANK MUST HAVE A RECEIPT OF DISPOSAL)

FORM F.P. 291 (rev. 9/88) (OVER) MASSACHUSETTS STATE FIRE MARSHAL'S OFFICE

DIMENSIONS

	Width		Length
Tank 1	-----	X	-----
Tank 2	-----	X	-----
Tank 3	-----	X	-----
Tank 4	-----	X	-----
Tank 5	-----	X	-----
	(feet)		(feet)

5,000gl

Tank Removed From
11 Chestnut St
(no. street)
Brockton
(city or town)

Fire Department Permit # 6661-FP3
(if applicable)

UL# C 959955

APPENDIX B

PART 2

MANIFESTS AND DISPOSAL CERTIFICATIONS OF SOIL REMOVAL

...rdon Trimount, Inc.
...0 Blanchard Road
... Box 39
...n
...usetts
...303 - ...

Tel: 6... - 8400
...c 617 ... - 8452

Operating as:

...n Sand & Stone
...mpany

McNamara Concrete

Bardon Trimount

RECEIVED DEC 2 7 1993

December 22, 1993

Mr. Jim Kenny
ATEC Associates
55 Accord Park Drive
Rockland, MA 02370

Re: Soil, US ARC
West Chestnut Street
Brockton, MA
Release Tracking # 4-1303

Dear Mr. Kenny:

The recyclable soil from the above address was received at our facility on December 20, 1993. Attached are the shipper's log of soil receipts which total 177.76 tons along with the Bill of Lading and receipt documentation.

We will issue a "Certificate of Recycling" upon processing.

Thank you for recycling soil at our Stoughton facility.

Yours truly,

David M. Peter

David M. Peter, Manager
Environmental Services

BTES/1400

Subsidiary of
...rdon Group, Inc.

RECEIVED DEC 15 1993

RECEIVED DEC 10 1993

Comm 12/20

Massachusetts Department of Environmental Protection **BWSC-012A**
Bureau of Waste Site Cleanup

Release Tracking Number*: 4-1303

BILL OF LADING (pursuant to 310 CMR 40.0030)

A. LOCATION OF SITE OR DISPOSAL SITE WHERE REMEDIATION WASTE WAS GENERATED:

Release Name (optional): Craig USARC
Street: W. Chestnut - Location Aid:
City/Town: Brockton Zip Code: 02401 -
Date/Period of Generation: 9/21/93 to 9/24/93
Additional Release Tracking Numbers Associated with this Bill of Lading:

*Note: If this Bill of Lading is the result of a Limited Removal Action (LRA) taken prior to Notification, a Release Tracking Number is not needed.

B. PERSON CONDUCTING RESPONSE ACTION ASSOCIATED WITH BILL OF LADING:

Name of Organization: ATEC Associates, Inc.
Name of Contact: James Kenny Title: Project Manager
Street: 55 Accord Park Dr.
City/Town: Rockland, State: MA Zip Code: 02370 -
Telephone: 617 - 878 - 6200 Ext.

C. RELATIONSHIP TO RELEASE OR THREAT OF RELEASE OF PERSON CONDUCTING RESPONSE ACTION ASSOCIATED WITH BILL OF LADING:

(check one/specify)

- ☐ RP Specify (circle one): Owner Operator Generator Transporter Other RP:
- ☐ PRP Specify (circle one): Owner Operator Generator Transporter Other PRP:
- ☐ Fiduciary/Secured Lender
- ☐ Agency/Public Utility on a Right of Way
- ☒ Other Person: Private consulting firm contracted by owner

If an owner and/or operator is not conducting the response action associated with the Bill of Lading, provide on an attachment the name, contact person, address and telephone number, including any area code and extension, for each, if known.

D. TRANSPORTER/COMMON CARRIER INFORMATION:

Transporter/Common Carrier Name: Bardon Trimount
Contact Person: David Peter Title: Manager
Street: 70 Blanchard Road
City/Town: Burlington State: MA Zip Code: 01803 -
Telephone: 617 - 221 - 8400 Ext.

E. RECEIVING FACILITY/TEMPORARY STORAGE LOCATION:

Operator/Facility Name: Bardon Trimount
Contact Person: David Peter Title: Manager
Street: 1101 Turnpike St.
City/Town: Stoughton State: MA Zip Code: 02072 -
Telephone: 617 - 221 - 8400 Ext.

Type of Facility: (check one)
- ☒ Asphalt Batch/Cold Mix
- ☒ Asphalt Batch/Hot Mix
- ☐ Thermal Processing
- ☐ Landfill/Disposal
- ☐ Landfill/Daily Cover
- ☐ Landfill/Structural Fill
- ☐ Incinerator
- ☐ Temporary Storage
- ☐ Other:

Division of Hazardous Waste/Class A Permit #: 590-020 Division of Solid Waste Management Permit #: EPA Identification #: MA0981213531

Actual/Anticipated Period of Temporary Storage (specify dates if applicable): __/__/__ to __/__/__ N/A

Reason for Temporary Storage (if applicable): N/A

Massachusetts Department of Environmental Protection **BWSC-012A**
Bureau of Waste Site Cleanup

Release Tracking Number: 4-1303

BILL OF LADING (pursuant to 310 CMR 40.0030)

E. RECEIVING FACILITY/TEMPORARY STORAGE LOCATION (continued):

Temporary Storage Address: N/A
Street: _____
City/Town: _____ State: _____ Zip Code: _____ – _____

F. DESCRIPTION OF REMEDIATION WASTE:

(check all that apply)

☒ Contaminated Media (circle all that apply): (Soil) Groundwater Surface Water Other: _____

☐ Contaminated Debris (circle all that apply): Demolition/Construction Waste Vegetation/Organic Materials
Inorganic Absorbant Materials Other: _____

☐ Non-hazardous Uncontainerized Waste (circle all that apply): Non-aqueous Phase Liquid Other: _____

☐ Non-hazardous Containerized Waste (circle all that apply): Tank Bottoms/Sludges Containers Drums
Engineered Impoundments Other: _____

Type of Contamination (circle all that apply): Gasoline Diesel Fuel (#2 Oil) #4 Oil #6 Oil Waste Oil
Kerosene Jet Fuel Other: _____

Estimated Volume of Materials: Cubic Yards: 90 Tons: 120 Other: _____

Contaminant Source (check one/specify): ☐ Transportation Accident ☒ Underground Storage Tank ☐ Other: _____

Response Action Associated with Bill of Lading (circle one): Immediate Response Action Release Abatement Measure
Utility-Related Abatement Measure (Limited Removal Action (LRA)) Comprehensive Response Action
Other (specify): _____

Remediation Waste Characterization Support Documentation attached:

☐ Site History Information ☐ Sampling and Analytical Methods and Procedures ☒ Laboratory Data ☐ Field Screening Data

If supporting documentation is not appended, provide an attachment stating the date and in connection with what document such information was previously submitted to DEP.

G. LICENSED SITE PROFESSIONAL (LSP) OPINION:

Name of Organization: _____ _____
LSP Name: _____ Title: _____
Telephone: _____ – _____ – _____ Ext. _____

I have personally examined and am familiar with the information contained on and submitted with this form. Based on this information, it is my Opinion that the testing and assessment actions undertaken were adequate to characterize the Remediation Waste, in accordance with 310 CMR 40.0030, and that the facility or location can accept remediation wastes with the characteristics described in this submittal. I am aware that significant penalties including, but not limited to, possible fines and imprisonment may result if I wilfully submit information which I know to be false, inaccurate, or materially incomplete.

Signature: Richard F. Pollard Seal: Mass. DEP. - Sero
Date: 12/13/93
License Number: _____

H. CERTIFICATION OF PERSON CONDUCTING RESPONSE ACTION ASSOCIATED WITH THIS BILL OF LADING:

I certify under penalties of law that I have personally examined and am familiar with the information contained in this submittal, including any documents accompanying this certification, and that, based on my inquiry of those individuals immediately responsible for obtaining information, the material information contained herein is, to the best of my knowledge and belief, true, accurate and complete. I am aware there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

Signature: James Kenny Date: 12/8/93
Name of Person (print): James Kenny

Massachusetts Department of Environmental Protection BWSC-0120
Bureau of Waste Site Cleanup

BILL OF LADING (pursuant to 310 CMR 40.0030)
SUMMARY SHEET 1 **OF** 1

Release Tracking Number: 4-1303

K. SUMMARY OF SHIPMENTS:

DATE OF SHIPMENT:	DATE OF RECEIPT:	NUMBER OF LOADS SHIPPED:	DAILY VOLUME SHIPPED (CU. YDS./TONS):
12/20/83	12/20/83	6	177.76

SUMMARY SHEET TOTAL SHIPPED:	6	177.76
BILL OF LADING TOTALSHIPPED (only if different):		

Massachusetts Department of Environmental Protection BWSC-012C
Bureau of Waste Site Cleanup

BILL OF LADING (pursuant to 310 CMR 40.0030)
SUMMARY SHEET

Release Tracking Number: 4-1303

L. ACKNOWLEDGEMENT OF RECEIPT OF REMEDIATION WASTE AT RECEIVING FACILITY OR TEMPORARY STORAGE LOCATION:

Receiving Facility/Temporary Location Representative (print): DAVID M. PETER Title: MANAGER

Signature: David M. Peter Date: 12/22/93

M. ACKNOWLEDGEMENT OF SHIPMENT AND RECEIPT OF REMEDIATION WASTE BY PERSON CONDUCTING RESPONSE ACTION ASSOCIATED WITH THIS BILL OF LADING:

I certify under penalties of law that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this certification, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained herein is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for wilfully submitting false, inaccurate, or incomplete information.

Signature: _____ Date: __/__/__

Name of Person (print): _____

Shippers Log 12:10:57 pm Dec 20, 1993
Product !
Plant 01
Customer !
Job 303
A.T.E.C.
W. CHESTNUT ST.
BROCKTON, MA
DEP # 4-1303
Shippers Log 12:10:58 pm Dec 20, 1993

Truck	Ticket#	LBS	Tons	Acc/Tons	Time & Date	Fob/Del
MUR2	00083944	66,900	33.450	33.450	09:15:21 12/20/93	D
MUR3	00083945	59,060	29.530	62.980	09:17:09 12/20/93	D
MUR2	00083949	64,900	32.450	95.430	10:26:20 12/20/93	D
MUR3	00083951	62,070	31.035	126.465	10:32:57 12/20/93	D
MUR2	00083956	59,920	29.960	156.425	11:34:58 12/20/93	D
MUR3	00083959	42,670	21.335	177.760	12:09:16 12/20/93	D

Massachusetts Department of Environmental Protection

Bureau of Waste Site Cleanup

BWSC-012B

Release Tracking Number: 4-1303

BILL OF LADING (pursuant to 310 CMR 40.0030)

LOG SHEET 1 **OF** 1

AD INFORMATION:

LOAD 1: Signature of Transporter Representative:

Date of Shipment: 12/20/93 Time of Shipment: 8:55 (circle one) am/pm

Truck/Tractor Registration: AA622 MA Trailer Registration (if any): 34394 MA

Receiving Facility/Temporary Storage Representative:

Date of Receipt: 12/20/93 Time of Receipt: 9:17 (circle one) am/pm

83945 Load Size (cu. yds./tons): 29.53

LOAD 2: Signature of Transporter Representative:

Date of Shipment: 12/20/93 Time of Shipment: 9:15 (circle one) am/pm

Truck/Tractor Registration: AA622 MA Trailer Registration (if any): 34394 MA

Receiving Facility/Temporary Storage Representative:

Date of Receipt: 12/20/93 Time of Receipt: 10:32 (circle one) am/pm

83951 Load Size (cu. yds./tons): 31.035

LOAD 3: Signature of Transporter Representative:

Date of Shipment: 12/20/93 Time of Shipment: 11:50 (circle one) am/pm

Truck/Tractor Registration: AA622 Trailer Registration (if any): 34394 MA

Receiving Facility/Temporary Storage Representative:

Date of Receipt: 12/20/93 Time of Receipt: 12:09 (circle one) am/pm

83959 Load Size (cu. yds./tons): 31.335

LOAD 4: Signature of Transporter Representative:

Date of Shipment: __/__/__ Time of Shipment: __:__ (circle one) am/pm

Truck/Tractor Registration: Trailer Registration (if any):

Receiving Facility/Temporary Storage Representative:

Date of Receipt: __/__/__ Time of Receipt: __:__ (circle one) am/pm

Load Size (cu. yds./tons):

LOAD 5: Signature of Transporter Representative:

Date of Shipment: __/__/__ Time of Shipment: __:__ (circle one) am/pm

Truck/Tractor Registration: Trailer Registration (if any):

Receiving Facility/Temporary Storage Representative:

Date of Receipt: __/__/__ Time of Receipt: __:__ (circle one) am/pm

Load Size (cu. yds./tons):

LOAD 6: Signature of Transporter Representative:

Date of Shipment: __/__/__ Time of Shipment: __:__ (circle one) am/pm

Truck/Tractor Registration: Trailer Registration (if any):

Receiving Facility/Temporary Storage Representative:

Date of Receipt: __/__/__ Time of Receipt: __:__ (circle one) am/pm

Load Size (cu. yds./tons):

LOAD 7: Signature of Transporter Representative:

Date of Shipment: __/__/__ Time of Shipment: __:__ (circle one) am/pm

Truck/Tractor Registration: Trailer Registration (if any):

Receiving Facility/Temporary Storage Representative:

Date of Receipt: __/__/__ Time of Receipt: __:__ (circle one) am/pm

Load Size (cu. yds./tons):

J. LOG SHEET VOLUME INFORMATION:

Total Volume This Page (cu.yds./tons):

Total Carried Forward (cu.yds./tons):

Total Carried Forward and This Page(cu.yds./tons):

BARDON TRIMOUNT INC.

70 BLANCHARD RD.
BURLINGTON, MA. 01803
TEL: (617) 221-8400
STOUGHTON PLANT (617) 344-2211

CUSTOMER	JOB	
********	***	Cust# 30001
STOUGHTON PLANT	A.T.E.C.	Job# 303
CASH SALE W/TAX	W. CHESTNUT ST.	Truck# MUR3
	BROCKTON, MA	Mix# 76
CK # Jes	DEP # 4-1303	Name REC SOIL OIL
Becky		Operator

Ticket# 83945

Tare	Net	Gross	TOTAL
33500.0	59060.0	92560.0	29.530Tons

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost
43.00		1269.79		0.00	1269.79

	Load Tons	Fob/Del	LOCATION
1	29.530	D	SCALE

9:17:06 am Dec 20, 1993

RECEIVED BY: [signature]

BARDON TRIMOUNT INC.

70 BLANCHARD RD.
BURLINGTON, MA. 01803
TEL:(617) 221-8400
STOUGHTON PLANT(617)344-2211

CUSTOMER	JOB	
********	***	Cust# 30001
STOUGHTON PLANT	A.T.E.C.	Job# 303
CASH SALE W/TAX	W. CHESTNUT ST.	Truck# MUR3
	BROCKTON, MA	Mix# 76
CK # Sue	DEP # 4-1303	Name REC SOIL OIL
Becky		Operator

Ticket# 83951

Tare	Net	Gross	TOTAL
33500.0	62070.0	95570.0	31.035Tons

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost
43.00		1334.50		0.00	1334.50

	Load Tons	Fob/Del	LOCATION
1	31.035	D	SCALE

10:32:54 am Dec 20, 1993

RECEIVED BY: Joe

BARDON TRIMOUNT INC.

70 BLANCHARD RD.
BURLINGTON, MA. 01803
TEL: (617) 221-8400
STOUGHTON PLANT (617) 344-2211

CUSTOMER	JOB	
********	***	Cust# 30001
STOUGHTON PLANT	A.T.E.C.	Job# 303
CASH SALE W/TAX	W. CHESTNUT ST.	Truck# MUR3
	BROCKTON, MA	Mix# 76
CK # See Becky	DEP # 4-1303	Name REC SOIL OIL
		Operator

Ticket# 83959

Tare	Net	Gross	TOTAL
33500.0	42670.0	76170.0	21.335Tons

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost
43.00		917.40		0.00	917.40

	Load Tons	Fob/Del	LOCATION
1	21.335	D	SCALE

12:09:13 pm Dec 20, 1993

RECEIVED BY:

Massachusetts Department of Environmental Protection **BWSC-012B**
Bureau of Waste Site Cleanup

Release Tracking Number: 4 - 1303

BILL OF LADING (pursuant to 310 CMR 40.0030)
LOG SHEET 1 **OF** 1

I. LOAD INFORMATION:

LOAD 1: Signature of Transporter Representative: [signature]
Date of Shipment: 12/20/93 Time of Shipment: 8:50 (circle one) am/pm
Truck/Tractor Registration: 2322 Trailer Registration (if any): 42256

Receiving Facility/Temporary Storage Representative: [signature]
Date of Receipt: 12/20/93 Time of Receipt: 9:15 (circle one) am/pm
#83944
Load Size (cu. yds./tons): 33.45

LOAD 2: Signature of Transporter Representative: [signature]
Date of Shipment: 12/20/93 Time of Shipment: 10:10 (circle one) am/pm
Truck/Tractor Registration: 2322 Trailer Registration (if any): 42256

Receiving Facility/Temporary Storage Representative: [signature]
Date of Receipt: 12/20/93 Time of Receipt: 10:26 (circle one) am/pm
#83949
Load Size (cu. yds./tons): 32.45

LOAD 3: Signature of Transporter Representative: [signature]
Date of Shipment: 12/20/93 Time of Shipment: 11:15 (circle one) am/pm
Truck/Tractor Registration: 2322 Trailer Registration (if any): 42256

Receiving Facility/Temporary Storage Representative: [signature]
Date of Receipt: 12/20/93 Time of Receipt: 11:34 (circle one) am/pm
#83956
Load Size (cu. yds./tons): 29.96

LOAD 4: Signature of Transporter Representative:
Date of Shipment: __/__/__ Time of Shipment: __:__ (circle one) am/pm
Truck/Tractor Registration: Trailer Registration (if any):

Receiving Facility/Temporary Storage Representative:
Date of Receipt: __/__/__ Time of Receipt: __:__ (circle one) am/pm
Load Size (cu. yds./tons):

LOAD 5: Signature of Transporter Representative:
Date of Shipment: __/__/__ Time of Shipment: __:__ (circle one) am/pm
Truck/Tractor Registration: Trailer Registration (if any):

Receiving Facility/Temporary Storage Representative:
Date of Receipt: __/__/__ Time of Receipt: __:__ (circle one) am/pm
Load Size (cu. yds./tons):

LOAD 6: Signature of Transporter Representative:
Date of Shipment: __/__/__ Time of Shipment: __:__ (circle one) am/pm
Truck/Tractor Registration: Trailer Registration (if any):

Receiving Facility/Temporary Storage Representative:
Date of Receipt: __/__/__ Time of Receipt: __:__ (circle one) am/pm
Load Size (cu. yds./tons):

LOAD 7: Signature of Transporter Representative:
Date of Shipment: __/__/__ Time of Shipment: __:__ (circle one) am/pm
Truck/Tractor Registration: Trailer Registration (if any):

Receiving Facility/Temporary Storage Representative:
Date of Receipt: __/__/__ Time of Receipt: __:__ (circle one) am/pm
Load Size (cu. yds./tons):

II. LOG SHEET VOLUME INFORMATION:

Total Volume This Page (cu.yds./tons):

Total Carried Forward (cu.yds./tons):

Total Carried Forward and This Page(cu.yds./tons):

BARDON TRIMOUNT INC.

70 BLANCHARD RD.
BURLINGTON, MA. 01803
TEL: (617) 221-8400
STOUGHTON PLANT (617) 344-2211

CUSTOMER	JOB	
********	***	Cust# 30001
STOUGHTON PLANT	A.T.E.C.	Job# 303
CASH SALE W/TAX	W. CHESTNUT ST.	Truck# MUR2
	BROCKTON, MA	Mix# 76
CK # See	DEP # 4-1303	Name REC SOIL OIL
Becky		Operator

Ticket# 83944

Tare	Net	Gross	TOTAL
32600.0	66900.0	99500.0	33.450Tons

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost
43.00		1438.35		0.00	1438.35

	Load Tons	Fob/Del	LOCATION
1	33.450	D	SCALE

9:15:18 am Dec 20, 1993

RECEIVED BY: [signature]

BARDON TRIMOUNT INC.

70 BLANCHARD RD.
BURLINGTON, MA. 01803
TEL: (617) 221-8400
STOUGHTON PLANT (617) 344-2211

CUSTOMER	JOB		
********	***	Cust#	30001
STOUGHTON PLANT	A.T.E.C.	Job#	303
CASH SALE W/TAX	W. CHESTNUT ST.	Truck#	MUR2
	BROCKTON, MA	Mix#	76
CK # 4ee	DEP # 4-1303	Name	REC SOIL OIL
Becky		Operator	

Ticket# 83949

Tare	Net	Gross	TOTAL
32600.0	64900.0	97500.0	32.450Tons

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost
43.00		1395.35		0.00	1395.35

	Load Tons	Fob/Del	LOCATION
1	32.450	D	SCALE

10:26:17 am Dec 20, 1993

RECEIVED BY: R Berry

BARDON TRIMOUNT INC.

70 BLANCHARD RD.
BURLINGTON, MA. 01803
TEL: (617) 221-8400
STOUGHTON PLANT (617) 344-2211

CUSTOMER	JOB	
********	***	Cust# 30001
STOUGHTON PLANT	A.T.E.C.	Job# 303
CASH SALE W/TAX	W. CHESTNUT ST.	Truck# MUR2
	BROCKTON, MA	Mix# 76
CK # Joe	DEP # 4-1303	Name REC SOIL OIL
Becky		Operator

Ticket# 83956

Tare	Net	Gross	TOTAL
32600.0	59920.0	92520.0	29.960Tons

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost
43.00		1288.28		0.00	1288.28

	Load Tons	Fob/Del	LOCATION
1	29.960	D	SCALE

11:34:55 am Dec 20, 1993

RECEIVED BY: R Barry

TOTAL 156.4

APPENDIX C
PART 1

PHOTOGRAPHS OF TANK REMOVAL PROCESS AND REMOVED TANK

PHOTOGRAPHIC DOCUMENTATION

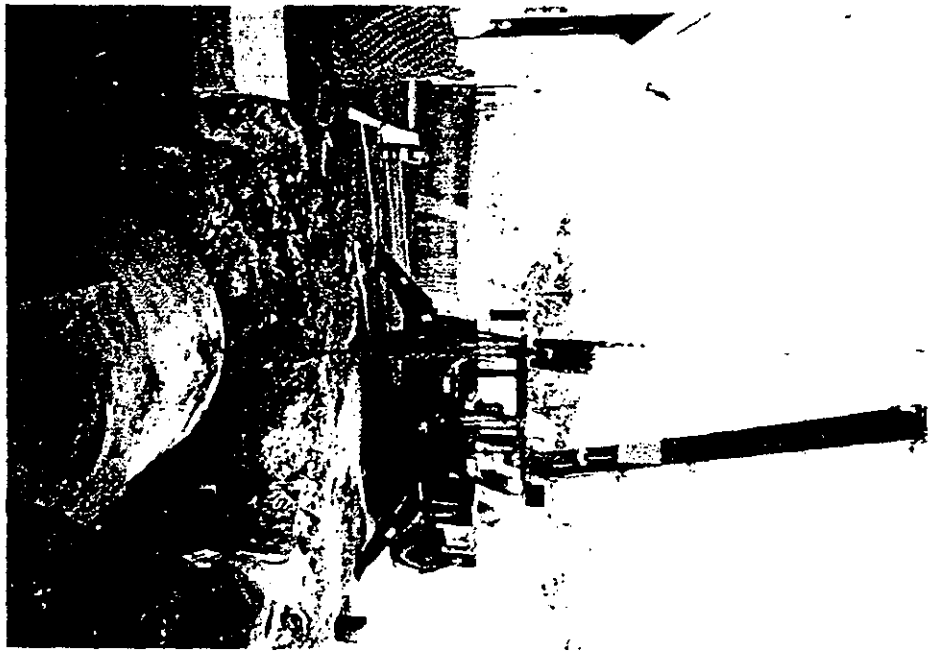
UST 153, Corporal Craig USARC, Brockton, Massachusetts

C-1.1: UST removal procedures

C-1.2: UST removal procedures

C-1.1

C-1.2



PHOTOGRAPHIC DOCUMENTATION UST No. 153 CRAIG USARC MASSACHUSETTS	PROJECT: 37.07.92.00713 SCALE: NOT TO SCALE	ATEC

APPENDIX C
PART 2

PHOTOGRAPHS OF REMOVED SOILS AND TANK EXCAVATION

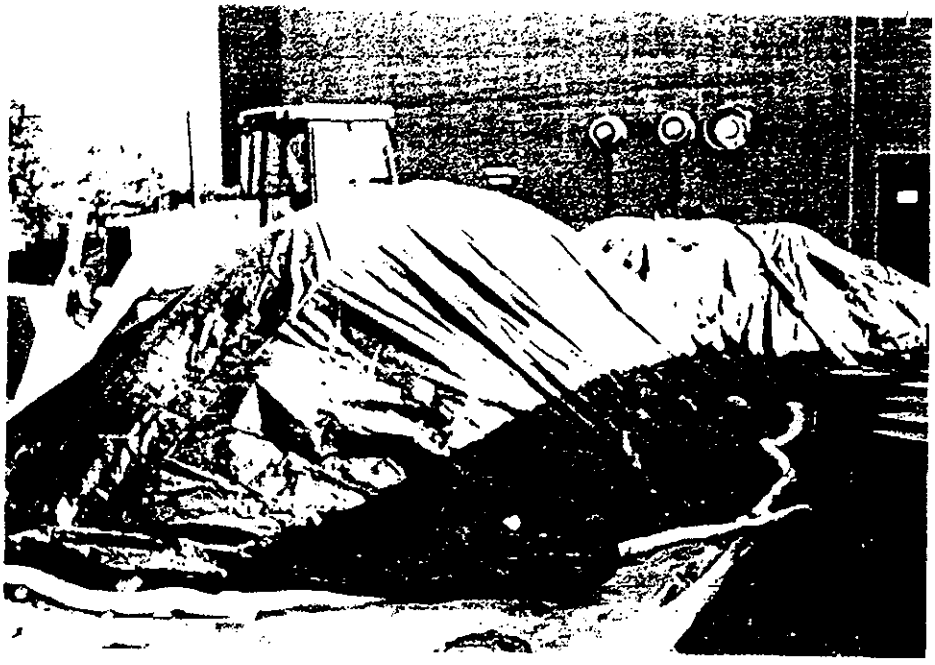
PHOTOGRAPHIC DOCUMENTATION

UST 153, Corporal Craig USARC, Brockton, Massachusetts

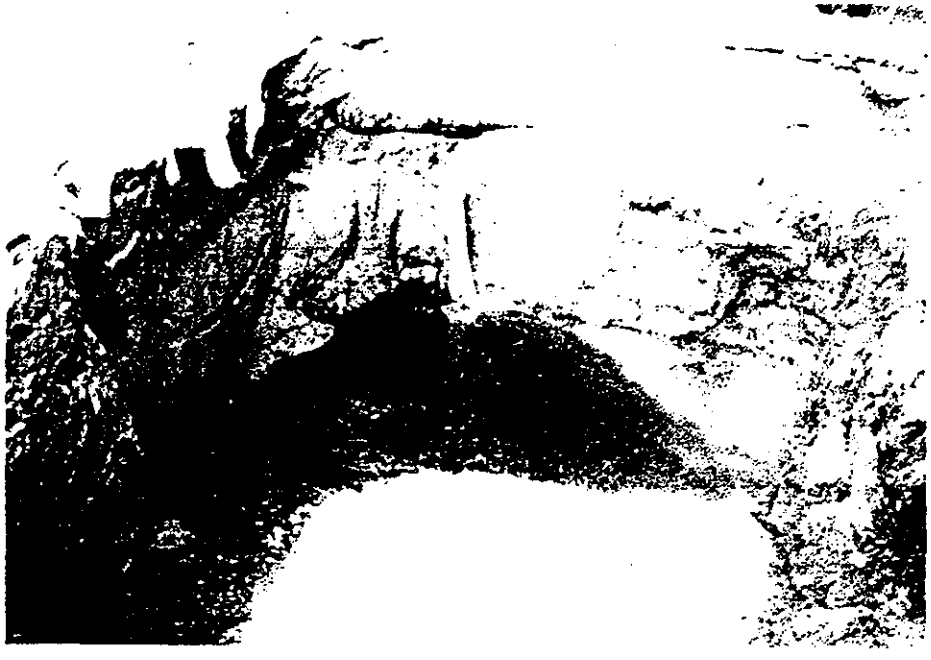
C-2.1: Stockpiled soil

C-2.2: Excavation 153: note the broken sewer line in the left corner of the excavtion and the water abd oily free product

C-2.1



C-2.2



PHOTOGRAPHIC DOCUMENTATION USTN 153 CRAIG USARC MASSACHUSETTS	PROJECT: 37.07.02.00713 SCALE: NOT TO SCALE	ATEC

APPENDIX D

HAGER GEOSCIENCE, INC. – GROUND PENETRATING RADAR SURVEY

GROUND PENETRATING RADAR SURVEY
CPL. GORDON CRAIG
U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS
SUBCONTRACT NO.: 05000-328349-6736

Prepared for:

Stone & Webster Engineering Corporation
245 Summer Street
Boston, Massachusetts 02210

Prepared by:

Hager GeoScience, Inc.
174 Lexington Street
Waltham, Massachusetts 02452-4644

File 99038
November 1999

Hager GeoScience, Inc.

1.0 INTRODUCTION

In November 1999, Hager GeoScience, Inc. (HGI) performed a ground penetrating radar (GPR) survey for Stone & Webster Engineering Corporation (S&W) at the Cpl. Gordon Craig U.S. Army Reserve Center in Brockton, Massachusetts. The site is located on West Chestnut Street near its intersection with Knapp Shoes Road. The objective of the survey was to determine the depth and orientation of an abandoned sewer line known to traverse the site, to enable S&W to site borings adjacent to it to investigate possible contamination. The location of the site is shown in Figure 1.

2.0 PROCEDURE

HGI personnel performed the GPR survey on November 12, 1999. The survey was coordinated with an S&W representative, who was present during the fieldwork. GPR traverses were laid out perpendicular to the approximate location of the abandoned sewer line, with cross lines added in the area of the Former Gasoline Fuel Pod Storage Area. Traverses were referenced to a fence post and the Maintenance Shop and USAR Center building. The locations of the traverses are shown in Figure 2.

Data were collected using a Geophysical Survey Systems, Inc., SIR System 2 digital ground penetrating radar system. The technique and its limitations are discussed at the end of this report.

GPR data were collected using an antenna with a center frequency of 400 MHz; the antenna was connected to the SIR 2 System by a 100-foot control cable. A survey wheel mounted on the rear of the antenna recorded distance in one-foot increments along each traverse. The data were displayed on a color monitor in real time and simultaneously recorded on a hard drive for later processing and interpretation, as necessary. The GPR signal range was set at 80 nanoseconds (ns) to reach a depth of 15+ feet.

3.0 RESULTS AND CONCLUSIONS

Abandoned Sewer Line Orientation

The abandoned sewer line produced clear reflections in the GPR records of traverses that crossed it, and HGI personnel marked its location in the field at the time of the survey. The orientation of the abandoned sewer line is plotted on Figure 2. A preliminary version of this plot was faxed to S&W on November 15. Figure 3 shows the GPR record of a portion of a traverse across the line in the Former Gasoline Fuel Pod Storage Area.

Abandoned Sewer Line Depth

The GPR records show that the top of the sewer line varies considerably in depth across the site: It is deepest near the northwest corner of the USAR Center building (approximately 10 to 11 feet) and becomes shallower toward both the northeast and southwest. Along the easternmost GPR traverse in the east Parking Lot, the top of the sewer line is at an approximate depth of 3 to 4 feet; along the westernmost GPR traverse in the west Parking Lot, the top of the sewer line is at a depth of approximately 5 feet. The pipe could not be detected in the Tank Grave Area adjacent to the USAR Center Boiler Room; we judge that it was destroyed during excavation to remove the UST at that location.

Additional Information

The GPR survey identified several additional utilities near the abandoned sewer line; their locations have also been plotted on Figure 2. Figure 3 shows the reflections produced by two of these utilities along a traverse in the Former Gasoline Fuel Pod Storage Area, north and south of the abandoned sewer line.

GROUND PENETRATING RADAR

DESCRIPTION

The principle of ground penetrating radar (GPR) is the same as that of weather or police radar, except that GPR transmits electromagnetic energy into the ground, and the energy is reflected back to the surface from interfaces between materials with contrasting electrical (dielectric and conductivity) and physical properties. The greater the contrast between two materials in the subsurface, the stronger the reflection observed on the GPR record. The depth of GPR signal penetration depends on the properties of the subsurface materials and the frequency of the antenna used to collect radar data. The lower the antenna frequency, the deeper the signal penetration but the lower the signal resolution.

We collect GPR data using a Geophysical Survey Systems SIR System 2 digital ground penetrating radar unit, which consists of a 486 computer connected to a transmit/receive antenna. Radar data are collected in discrete measurements (stacking) or continuous profile mode while moving the antenna across the ground and displayed in color on the computer monitor; they are simultaneously recorded on a 500 Mbyte hard drive for later processing and interpretation using proprietary RADAN® software. Hard copies of the data may also be printed out in the field on a thermal printer.

The horizontal scale of the GPR record shows distance along the survey traverse. In the continuous data collection mode, the horizontal scale on each GPR record is determined by the antenna speed. When a survey wheel is used, as at this site, the GPR record is automatically marked at specified intervals (chosen as one foot for this survey) along the survey line. The vertical scale of the radar records is determined by the recording interval. The recording interval represents the maximum two-way travel time in which data are recorded. The conversion of two-way travel time to depth depends on the propagation velocity of the GPR signal, which is site specific.

The size, shape, and amplitude of GPR reflections are used to interpret GPR data. Metal objects such as USTs and utilities produce reflections with high amplitude and distinctive hyperbolic shapes in GPR records when traverses are made perpendicular to their long axes. Clay or concrete pipes and boulders may produce radar signatures of similar shape but lower amplitude. The boundaries between saturated and unsaturated materials, sand and clay, and bedrock and overburden, generally also produce strong reflections.

LIMITATIONS

GPR signal penetration is site specific, determined by the dielectric properties of local soil and fill materials. GPR signals propagate well in resistive materials such as sand and gravel; however, soils containing clay, ash- or cinder-laden fill, or fill saturated with brackish or otherwise conductive groundwater cause GPR signal attenuation and loss of target resolution (i.e., limited detection of small objects). Concrete containing rebar or mesh also inhibits signal penetration.

Interpreted depths of objects detected using GPR are based on on-site calibration, handbook values, and/or estimated GPR signal propagation velocities from similar sites. GPR velocities and depth estimates may vary if the medium of investigation or soil water content is not uniform throughout the site. (Electromagnetic waves do not travel as fast through water as air, so the distance to a reflector below the water table may appear farther than in actuality.)

Utilities are interpreted on the basis of reflectors of similar size and depth that show a linear trend, but GPR cannot unambiguously determine that all such reflectors are related. Fiberglass USTs or utilities composed of plastic or clay may be difficult to detect, as well as objects underneath reinforced concrete pads.

Changes in the speed at which the GPR antenna is moved between stations causes slight variations in distance interpolations, and hence in interpreted object positions.

The GPR antenna produces a cone-shaped signal pattern that emanates approximately 45 degrees from horizontal fore and aft of the antenna. Therefore, buried objects may be detected before the antenna is located directly over them, and GPR anomalies may appear larger than actual target dimensions.

GPR is an interpretive method, based on the subjective identification of reflection patterns that may not uniquely identify a subsurface target. Borings, test pits, or site utility plans must be used to verify the results.

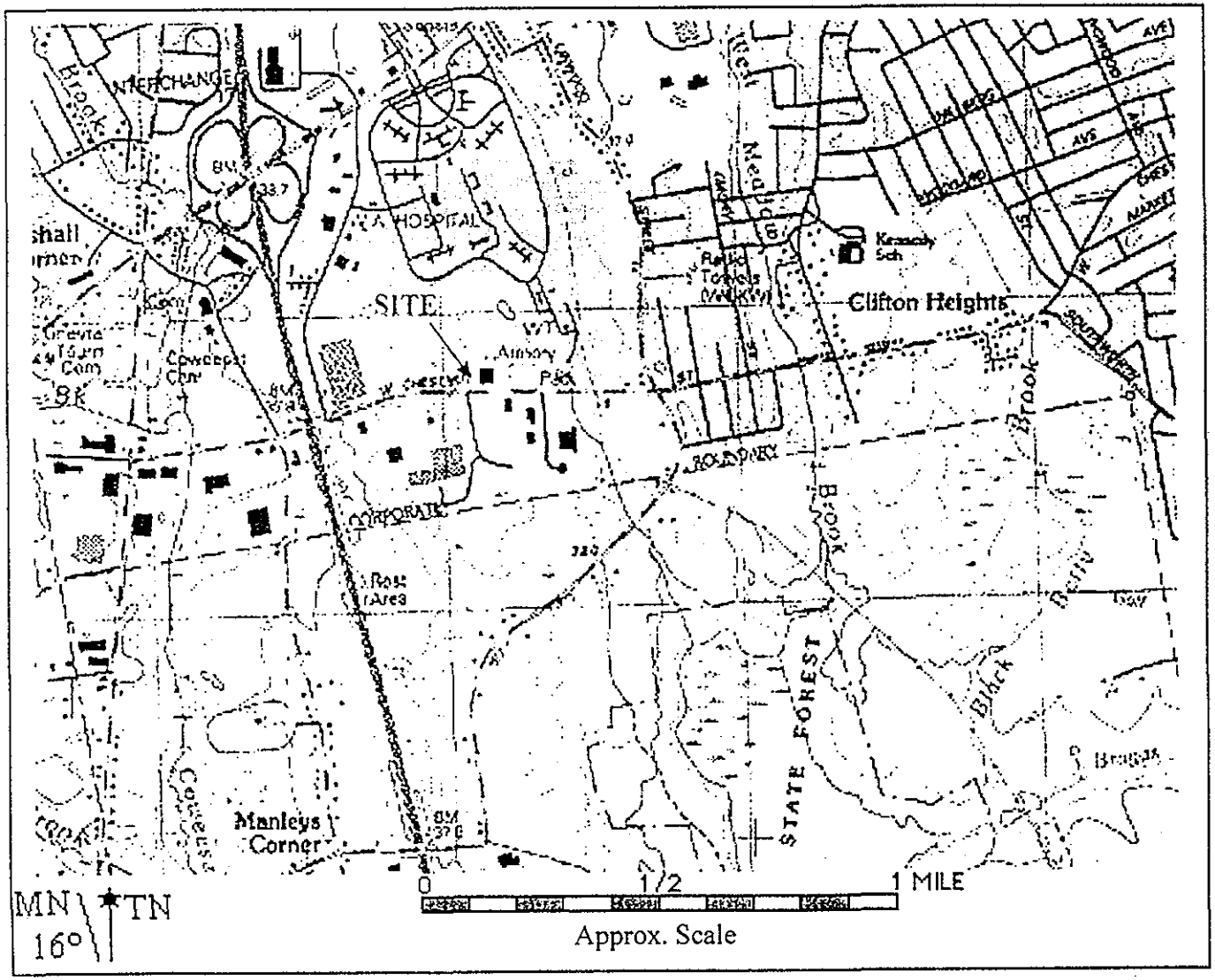
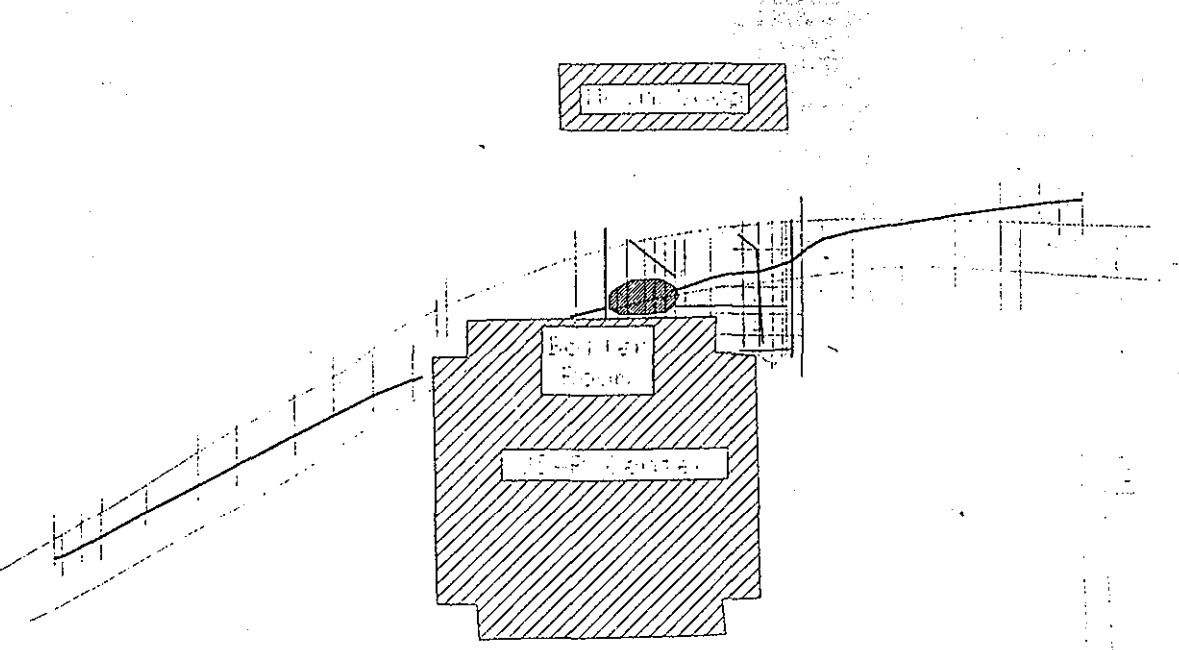


Figure 1. Location of Cpl. Gordon Craig U.S. Army Reserve Center, Brockton, Massachusetts.



LEGEND

- GPR Traverse
- Sewer Line
- Other Utility
- Sewer Line Missing
- Fence

0 50 100

APPROXIMATE SCALE IN FEET

Abandoned Sewer Line, S&W Approx. Location

FIGURE 2

NOVEMBER 1999	FILE NO 99036

ABANDONED SEWER LINE
INTERPRETATION MAP
CPL. GORDON CRAIG
U.S. ARMY RESERVE CENTER
BROCKTON, MASSACHUSETTS

Ground Penetrating Radar Survey
Cpl. Gordon Craig U.S. Army Reserve Center
Brockton, Massachusetts

File 99038

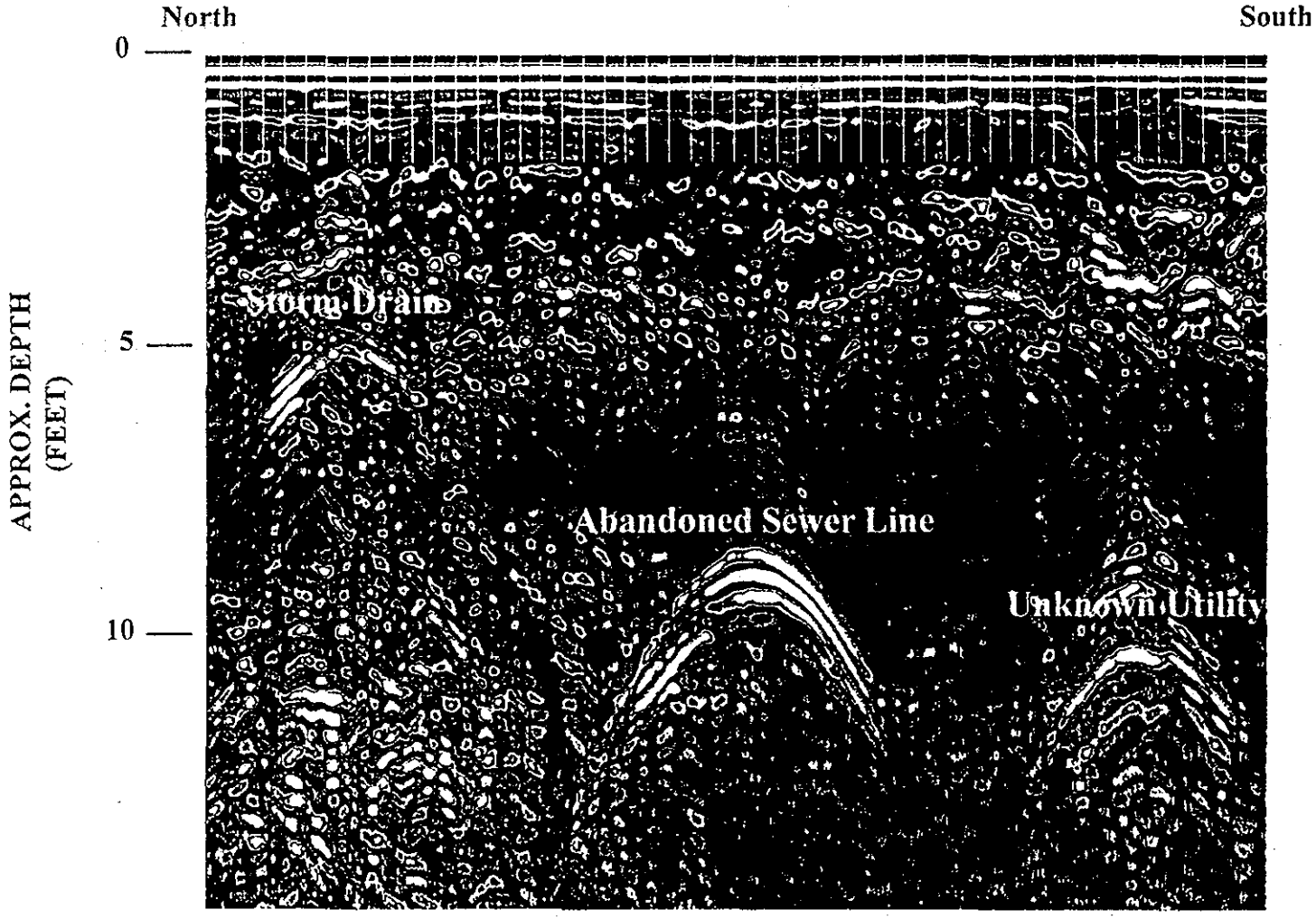


Figure 3. GPR record for a portion of a traverse across the Former Gasoline Fuel Pod Storage Area. Anomalies caused by three utilities are visible, all at different depths. The ticks at the top of the record are one-foot distance marks produced by the survey wheel attachment. Depths are not necessarily linear and are approximate, based on GPR signal velocities calculated for similar sites.

Hager GeoScience, Inc.

APPENDIX E

VISTA INFORMATION SOLUTIONS, INC., SITE ASSESSMENT

SITE ASSESSMENT REPORT

PROPERTY INFORMATION	CLIENT INFORMATION
Project Name/Ref #: 0500033 Brockton-CPL. Gordon Craig USACE 915 West Chestnut St. Brockton, MA 02401 Latitude/Longitude: (42.055053, 71.051032)	Thomas Davidson Stone Webster 245 Summer St. Boston, MA 02210

Site Distribution Summary Agency / Database - Type of Records			within 1/8 mile	1/8 to 1/4 mile	1/4 to 1/2 mile	1/2 to 1 mile
A) Databases searched to 1 mile:						
US EPA	NPL	National Priority List	0	0	0	0
US EPA	CORRACTS (TSD)	RCRA Corrective Actions and associated TSD	0	0	0	0
STATE	SPL	State equivalent priority list	0	0	0	0
B) Databases searched to 1/2 mile:						
STATE	SCL	State equivalent CERCLIS list	3	0	0	-
US EPA	CERCLIS / NFRAP	Sites currently or formerly under review by US EPA	0	0	0	-
US EPA	TSD	RCRA permitted treatment, storage, disposal facilities	0	0	0	-
STATE	LUST	Leaking Underground Storage Tanks	3	0	0	-
STATE	SWLF	Permitted as solid waste landfills, incinerators, or transfer stations	1	0	0	-
C) Databases searched to 1/4 mile:						
STATE	UST	Registered underground storage tanks	3	0	-	-
D) Databases searched to 1/8 mile:						
US EPA	ERNS	Emergency Response Notification System of spills	2	-	-	-
US EPA	LG GEN	RCRA registered large generators of hazardous waste	0	-	-	-
US EPA	SM GEN	RCRA registered small generators of hazardous waste	0	-	-	-
STATE	SPILLS	State spills list	5	-	-	-

This report meets the ASTM standard E-1527 for standard federal and state government database research in a Phase I environmental site assessment. A (-) indicates a distance not searched because it exceeds these ASTM search parameters.

LIMITATION OF LIABILITY
Customer proceeds at its own risk in choosing to rely on VISTA services, in whole or in part, prior to proceeding with any transaction. VISTA cannot be an insurer of the accuracy of the information, errors occurring in conversion of data, or for customer's use of data. VISTA and its affiliated companies, officers, agents, employees and independent contractors cannot be held liable for accuracy, storage, delivery, loss or expense suffered by customer resulting directly or indirectly from any information provided by VISTA.

NOTES

SITE ASSESSMENT REPORT

Map of Sites within 1 Mile

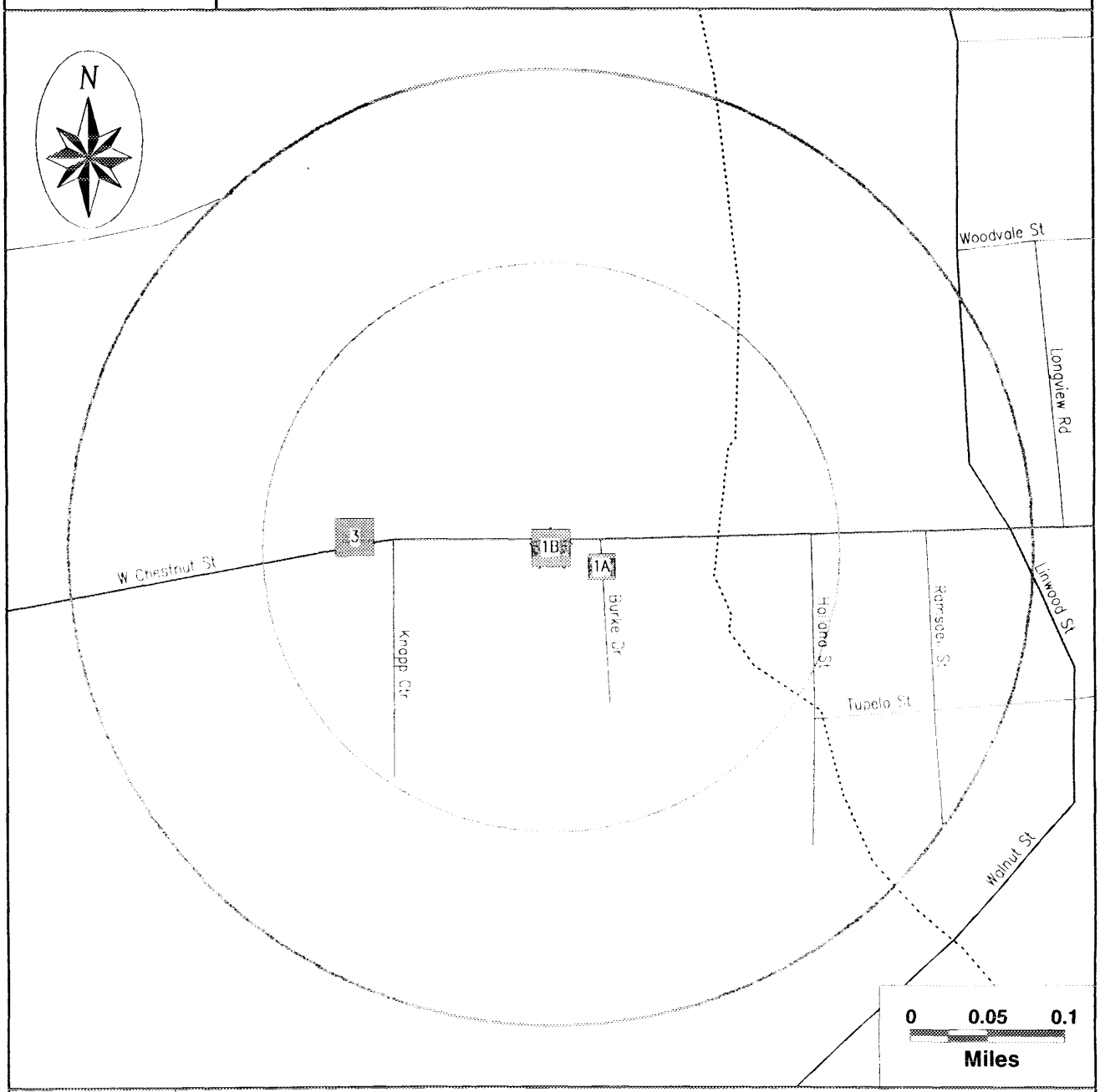
Category:	A	B	C	D
Databases Searched to:	1 mi.	1/2 mi.	1/4 mi.	1/8 mi.
Single Sites	◆	■	△	○
Multiple Sites	◆	■	▲	●
	NPL, SPL, CORRACTS (TSD)	CERCLIS\ NFRAP, TSD, LUST, SWLF, SCL	UST	ERNS, GENERATORS

Subject Site ★

- Highways and Major Roads
- Roads
- Railroads
- Rivers or Water Bodies
- Utilities

SITE ASSESSMENT REPORT

Map of Sites within 1/4 Mile



Subject Site	Category:	A	B	C	D
	Databases Searched to:	1 mi.	1/2 mi.	1/4 mi.	1/8 mi.
★	Single Sites	◆	■	△	○
	Multiple Sites	◆	■	△	○

Highways and Major Roads	NPL, SPL, CORRACTS (TSD)	CERCLIS\ NFRAP, TSD, LUST, SWLF, SCL	UST	ERNS, GENERATORS
Roads				
Railroads				
Rivers or Water Bodies				
Utilities				

SITE ASSESSMENT REPORT

Sites Represented as Polygons

These boundaries are approximated from agency records or other sources such as published maps. They may represent property boundaries, impact zones, or study areas. For more information contact the agency referenced by source number in the site listing.

Subject Site

Highways and Major Roads
Roads
Railroads
Rivers or Water Bodies
Utilities

For More Information Call VISTA Information Solutions, Inc. at **1 - 800 - 767 - 0403**

Report ID: **556901901**

Date of Report: **January 5, 2000**

SITE ASSESSMENT REPORT

Street Map

SITE ASSESSMENT REPORT

SITE INVENTORY

MAP ID	PROPERTY AND THE ADJACENT AREA (within 1/8 mile)	VISTA ID / DISTANCE / DIRECTION	A			B						C	D				
			NPL	CORRACTS(TSD)	SPL	SCL	CERCLIS/NFRAP	TSD	LUST	SWLF		UST	ERNS	LG GEN	SM GEN	SPILLS
1A	MERCURY COMPANY OF NORWOOD 10 BURKE DR BROCKTON, MA 02401	*1859051* *0.00 MI* *NA*				X			X			X				
1B	GORDON M. CRAIG USA CENTER 915 WEST CHESTNUT STREET BROCKTON, MA 02401	*847707* *0.00 MI* *NA*										X				
1B	ROADWAY 915 W CHESTNUT ST BROCKTON, MA 02401	*2985396* *0.00 MI* *NA*														X
1B	US ARMY RESERVE CTR W CHESTNUT ST BROCKTON, MA 02401	*2694172* *0.00 MI* *NA*				X			X							X
1B	PROPERTY 915 W CHESTNUT ST BROCKTON, MA 02401	*3572369* *0.00 MI* *NA*														X
1B	USAR CENTER 915 W CHESTNUT ST BROCKTON, MA 02401	*846872* *0.00 MI* *NA*											X			X
2	BROCKTON LANDFILL WEST CHESTNUT ST BROCKTON, MA 02401	*3568792* *0.04 MI*								X						
3	CIRELLI FOODS 970 W CHESTNUT ST BROCKTON, MA 02401	*85157* *0.07 MI* *W*							X			X	X			X
3	PROPERTY 970 WEST CHESTNUT ST BROCKTON, MA 02401	*5731046* *0.07 MI* *W*				X										

MAP ID	SITES IN THE SURROUNDING AREA (within 1/8 - 1/4 mile)	VISTA ID / DISTANCE / DIRECTION	A			B						C	D				
			NPL	CORRACTS(TSD)	SPL	SCL	CERCLIS/NFRAP	TSD	LUST	SWLF		UST	ERNS	LG GEN	SM GEN	SPILLS
No Records Found																	

MAP ID	SITES IN THE SURROUNDING AREA (within 1/4 - 1/2 mile)	A			B					C	D			
	VISTA ID / DISTANCE / DIRECTION	NPL	CORRACTS(TSD)	SPL	SCL	CERCLIS/NFRAP	TSD	LUST	SWLF	UST	ERNS	LG GEN	SM GEN	SPILLS
No Records Found														

MAP ID	SITES IN THE SURROUNDING AREA (within 1/2 - 1 mile)	A			B					C	D			
	VISTA ID / DISTANCE / DIRECTION	NPL	CORRACTS(TSD)	SPL	SCL	CERCLIS/NFRAP	TSD	LUST	SWLF	UST	ERNS	LG GEN	SM GEN	SPILLS
No Records Found														

UNMAPPED SITES	VISTA ID	A			B						C	D				
		NPL	CORRACTS(TSD)	SPL	SCL	CERCLIS/NFRAP	TSD	LUST	SWLF	UST	ERNS	LG GEN	SM GEN	SPILLS
MUPAC CORP 10 MUPAC DR BROCKTON, MA 02401	287889												X	
TRIAL COURT MAIN ST BROCKTON, MA	8679618							X						
ANTON'S CLEANERS, INC. OAK VILLAGE SHOPPING CENTER OAK BROCKTON, MA 02401	23399									X				
GREEN STREET BROCKTON, MA	2696804							X						
BROWNING-FERRIS INDUSTRIES BROCKTON, MA	5147506								X					
MERIT OIL CO ELLIOTSOUTH MAIN ST BROCKTON, MA	2699357							X						
721 WALLEN AVE BROCKTON, MA	2705975							X						
EASTERN EDISON DUPONT SUBSTA (OFF SUMMER ST) BROCKTON, MA 02401	2695404							X						
NEW COURTHOUSE MAIN WEST ELM ST BROCKTON, MA	7241867							X						
50 SPARK STREET ALVIN HOLLIS CO. INC. BROCKTON, MA	2694572							X						
MAIN ST INTERSECTION OF NORTH MAIN/ EA BROCKTON, MA	2697917							X						
ASHLAND INTERSECTION OF N. PLEASANT AN BROCKTON, MA	2697916							X						
KES BROCKTON WOOD L.P. LOT 6B BROCKTON, MA 02401	6546862								X					
MERIT GAS STATION 261 N. STREET/ELLIOT STREET BROCKTON, MA	2704920							X						
TEXACO STATION SHAW'S W SHPING CTR/BELMONT WS BROCKTON, MA 02403	1867748									X				
CITGO STATION SHAW'S SOUTH SHOPPING CENTER WEST BRIDGEWATER, MA 02379	1861980									X				

UNMAPPED SITES	VISTA ID	A			B						C	D				
		NPL	CORRACTS(TSD)	SPL	SCL	CERCLIS/NFRAP	TSD	LUST	SWLF		UST	ERNS	LG GEN	SM GEN	SPILLS
SHAW'S PLAZA RTE 28 WEST BRIDGEWATER, MA 02379	*2703443*							X							
CHARTER ELM SQUARE WEST BRIDGEWATER, MA 02379	*5364929*										X				
CHARTER MKTG STN #2573 CENTER N ELM STS WEST BRIDGEWATER, MA 02379	*2987845*							X							

SITE ASSESSMENT REPORT

DETAILS

PROPERTY AND THE ADJACENT AREA (within 1/8 mile)

VISTA Address*:	MERCURY COMPANY OF NORWOOD 10 BURKE DR BROCKTON, MA 02401	VISTA ID#:	1859051
		Distance/Direction:	0.00 MI / NA
		Plotted as:	Point

Map ID **1A**

STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A
Agency Address:	*MERCURY COMPANY OF NORWOOD 10 BURKE DR BROCKTON, MA*		
Leak ID#:	*S91-0795*		
Leak Report Date:	*12/06/1991*		
Leak Cause:	*TANK REMOVAL*		
Leak Source:	*U.S.T.*		
Substance:	*GASOLINE*		
Quantity / Units:	*UNKNOWN*	**Units:**	*GALLONS*
Remediation Status:	*CLOSED: YES*		
Lead Agency:	*BRENNAN, S*		
Contact:	*BRENNAN, S*		
Referral:	*NO*		

STATE UST - State Underground Storage Tank / SRC# 6038		Agency ID:	13024
Agency Address:	*MERCURY COMPANY OF NORWOOD, INC. 10 BURKE DRIVE BROCKTON, MA 02403*		
Underground Tanks:	*2*		
Aboveground Tanks:	*NOT REPORTED*		
Tanks Removed:	*2*		
Tank ID:	*1U*	**Tank Status:**	*REMOVED*
Tank Contents:	*GASOLINE (UNSPECIFIED)*	**Leak Monitoring:**	
Tank Age:	*20*	**Tank Piping:**	*BARE STEEL*
Tank Size (Units):	*5000 (GALLONS)*	**Tank Material:**	*BARE STEEL*
Tank ID:	*2U*	**Tank Status:**	*REMOVED*
Tank Contents:	*GASOLINE (UNSPECIFIED)*	**Leak Monitoring:**	
Tank Age:	*20*	**Tank Piping:**	*BARE STEEL*
Tank Size (Units):	*5000 (GALLONS)*	**Tank Material:**	*BARE STEEL*

STATE LUST - State Leaking Underground Storage Tank / SRC# 6362		EPA/Agency ID:	N/A
Agency Address:	*MERCURY CO OF NORWOOD/FMR 10 BURKE DR BROCKTON, MA*		
Leak ID#:	*4-0001217*		
Contamination Confirmed Date:	*10/15/92*		
Substance:	*,GASOLINE,PETROLEUM*		
Remediation Event:	*RELEASE ABATEMENT MEASURE*		

PROPERTY AND THE ADJACENT AREA (within 1/8 mile) CONT.

Remediation Event:	*RELEASE ABATEMENT MEASUREACTION DATE: 9/30/94ACTION BY: RP ONLY*
Media Affected:	*,GROUNDWATER RELEASE,SOIL RELEASE,*
Region / District:	*4*
Referral:	*WAIV*
Description / Comment:	*SITE STATUS: RAOFACILITY TYPE: , MANUFACTURER,SITE CLASSIFICATION: 21E*

SCL - State Equivalent CERCLIS List / SRC# 6362	EPA/Agency ID:	N/A

Agency Address:	*MERCURY COMPANY OF NORWOOD, INC.* *10 BURKE DRIVE* *BROCKTON, MA 02403*
Status:	*NOT ON NPL*
Facility Type:	*MANUFACTURING PLANT*
Lead Agency:	*NO DETERMINATION*
State Status:	*WAIVER (MASSACHUSETTS)*
Pollutant 1:	*GASOLINE (UNSPECIFIED)*
Pollutant 2:	*UNKNOWN*
Pollutant 3:	*UNKNOWN*

VISTA Address*:	**GORDON M. CRAIG USA CENTER** **915 WEST CHESTNUT STREET** **BROCKTON, MA 02401**	VISTA ID#:	847707
		Distance/Direction:	0.00 MI / NA
		Plotted as:	Point

Map ID **1B**

STATE UST - State Underground Storage Tank / SRC# 6038		Agency ID:	12993

Agency Address:	*SAME AS ABOVE*
Underground Tanks:	*1*
Aboveground Tanks:	*NOT REPORTED*
Tanks Removed:	*NOT REPORTED*

Tank ID:	*1U*	**Tank Status:**	*ACTIVE/IN SERVICE*
Tank Contents:	*WASTE OIL*	**Leak Monitoring:**	
Tank Age:	*15*	**Tank Piping:**	*NOT AVAILABLE*
Tank Size (Units):	*1000 (GALLONS)*	**Tank Material:**	*BARE STEEL*

VISTA Address*:	**ROADWAY** **915 W CHESTNUT ST** **BROCKTON, MA 02401**	VISTA ID#:	2985396
		Distance/Direction:	0.00 MI / NA
		Plotted as:	Point

Map ID **1B**

State Spills / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	*ROADWAY* *915 W CHESTNUT ST* *BROCKTON, MA*
Spill ID#:	*S91-0773*
Spill Date:	*12/03/1991*
Spill Time:	*01:30*
Contact:	*MORAN, M*
Caller Name:	*MARK BOSER/US ARMY*
Call / Report Date:	*12/03/1991*
Call / Report Time:	*02:30PM*
Spiller Company:	*ROADWAY*
Substance:	*HYDRAULIC FLUID*

Quantity Spilled:	*NOT REPORTED*	**Spilled Units:**	*GALLONS*

Spill Cause:	*RUPTURE*		
Spill Source:	*VEH. FUEL TANK*		
Cleanup Finish Date:	*NOT REPORTED*	**Classification:**	*PETROLEUM*
Enforcement Date:	*NOT REPORTED*	**Referral:**	*NO*
Remedial Status:	*CLOSED: YES*	**Damages:**	*NOT REPORTED*

VISTA Address*:	**US ARMY RESERVE CTR** **W CHESTNUT ST** **BROCKTON, MA 02401**	VISTA ID#:	2694172
		Distance/Direction:	0.00 MI / NA
		Plotted as:	Point

Map ID **1B**

STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A
Agency Address:	*US ARMY RESERVE CTR* *W CHESTNUT ST* *BROCKTON, MA*		
Leak ID#:	*S92-0163*		
Leak Date:	*03/12/1992*		
Leak Report Date:	*03/13/1992*		
Who Reported:	*LARRY MANGO/US ARMY*		
Leak Cause:	*LEAK*		
Leak Source:	*U.S.T.*		
Substance:	*#2 FUEL OIL*		
Quantity / Units:	*UNKNOWN*	**Units:**	*GALLONS*
Remediation Event:	*---*		
Remediation Status:	*CLOSED: YES*		
Lead Agency:	*MORAN, M*		
Contact:	*MORAN, M*		
Referral:	*NO*		

State Spills / SRC# 4778		EPA/Agency ID:	N/A
Agency Address:	*US ARMY RESERVE CENTER* *915 W CHESTNUT ST* *BROCKTON, MA*		
Spill ID#:	*S91-0173*		
Spill Date:	*04/01/1991*		
Contact:	*BRENNAN, S*		
Caller Name:	*STEVE HOPKINS/FORT DEVENS*		
Call / Report Date:	*04/03/1991*		
Call / Report Time:	*09:10AM*		
Spiller Company:	*US ARMY RESERVE CENTER*		
Substance:	*OTHER MATERIAL* -->		
Substance:	*ABANDONED TANK*		
Quantity Spilled:	*NONE*	**Spilled Units:**	*NOT REPORTED*
Spill Cause:	*OTHER RELEASE >*		
Spill Source:	*ABOVEGRND TANK*		
Cleanup Finish Date:	*NOT REPORTED*	**Classification:**	*UNKNOWN*
Enforcement Date:	*NOT REPORTED*	**Referral:**	*NO*
Remedial Status:	*CLOSED: YES*	**Damages:**	*NOT REPORTED*

SCL - State Equivalent CERCLIS List / SRC# 6362		Agency ID:	4-0001303
Agency Address:	*US ARMY RESERVE CENTER* *915 W. CHESTNUT ST* *BROCKTON, MA*		
Status:	*NOT ON NPL*		
Facility Type:	*NOT AVAILABLE*		
Lead Agency:	*STATE*		
State Status:	*SITE TO BE INVESTIGATED*		
Pollutant 1:	*OTHER*		
Pollutant 2:	*UNKNOWN*		
Pollutant 3:	*UNKNOWN*		

VISTA Address*:	**PROPERTY** **915 W CHESTNUT ST** **BROCKTON, MA 02401**	VISTA ID#:	3572369
		Distance/Direction:	0.00 MI / NA
		Plotted as:	Point

Map ID **1B**

State Spills / SRC# 4778		EPA/Agency ID:	N/A
Agency Address:	*PROPERTY* *915 W CHESTNUT ST* *BROCKTON, MA*		
Spill ID#:	*S92-0674*		
Spill Date:	*09/18/1992*		
Spill Time:	*04:00PM*		
Contact:	*PACKARD, R*		
Caller Name:	*LT COL PORRIER/USAR*		
Call / Report Date:	*09/18/1992*		
Call / Report Time:	*06:05PM*		
Spiller Company:	*PROPERTY*		
Substance:	*OTHER MATERIAL* -->		
Substance:	*UN2857 COOLANT*		
Spill Cause:	*DUMPING*		
Spill Source:	*OTHER SOURCE >*		
Cleanup Finish Date:	*NOT REPORTED*	**Classification:**	*HAZARDOUS*
Enforcement Date:	*NOT REPORTED*	**Referral:**	*NO*
Remedial Status:	*CLOSED: YES*	**Damages:**	*NOT REPORTED*

VISTA Address*:	**USAR CENTER** **915 W CHESTNUT ST** **BROCKTON, MA 02401**	VISTA ID#:	846872
		Distance/Direction:	0.00 MI / NA
		Plotted as:	Point

Map ID **1B**

State Spills / SRC# 4778		EPA/Agency ID:	N/A
Agency Address:	*USAR CENTER* *915 W CHESTNUT ST* *BROCKTON, MA*		
Spill ID#:	*S93-0013*		
Contact:	*PACKARD, R*		
Caller Name:	*GAIL MILLER/USAF/FT DEVEN*		
Call / Report Date:	*01/08/1993*		
Call / Report Time:	*03:45PM*		
Spill Facility ID:	*4-1303*		

Spiller Company:	*USAR CENTER*		
Substance:	*#2 FUEL OIL*		
Spill Cause:	*OTHER RELEASE >*		
Cleanup Finish Date:	*NOT REPORTED*	**Classification:**	*PETROLEUM*
Enforcement Date:	*NOT REPORTED*	**Referral:**	*SA*
Remedial Status:	*CLOSED: YES*	**Damages:**	*NOT REPORTED*

ERNS - Emergency Response Notification System / SRC# 6181	Agency ID:	152335

Agency Address:	*ARMY-USAR CENTER* *915 WEST CHESTNUT ST* *BROCKTON, MA 02401*
Spill Date Time:	*JANUARY 8, 1993 UNKNOWN*
Case Number:	*152335*
Spill Location:	*915 WEST CHESTNUT ST*
Source Agency:	*N*
Discharger Name:	*MILLER, GAIL*
Discharger Org:	*ARMY-USAR CENTER*
Material Spilled:	*OIL, FUEL: NO. 2-D, 0.00 (UNK)*
Waterway Affected:	*SOIL*
Fields Not Reported:	*Discharger Phone*

Air Release:	Land Release:	Water Release:	Ground Release:	Facility Release:	Other Release:
NO	*NO*	*NO*	*NO*	*NO*	*NO*

ERNS - Emergency Response Notification System / SRC# 6181	Agency ID:	D30393A

Agency Address:	*ARMY-USAR CENTER* *915 WEST CHESTNUT ST.* *BROCKTON, MA 02401*
Spill Date Time:	*NOT REPORTED UNKNOWN*
Case Number:	*D30393A*
Spill Location:	*915 WEST CHESTNUT ST.*
Source Agency:	*E*
Discharger Org:	*ARMY-USAR CENTER*
Material Spilled:	*# 2 FUEL OIL, 1.00 (UNK)*
Fields Not Reported:	*Discharger Name, Discharger Phone, Waterway Affected*

Air Release:	Land Release:	Water Release:	Ground Release:	Facility Release:	Other Release:
YES	*NO*	*NO*	*NO*	*NO*	*NO*

PROPERTY AND THE ADJACENT AREA (within 1/8 mile) CONT.

ERNS - Emergency Response Notification System / SRC# 6181	Agency ID:	152335

Agency Address:	*ARMY-USAR CENTER* *915 WEST CHESTNUT ST* *BROCKTON, MA 02401*
Spill Date Time:	*JANUARY 8, 1993 UNKNOWN*
Case Number:	*152335*
Spill Location:	*915 WEST CHESTNUT ST*
Source Agency:	*N*
Discharger Org:	*ARMY-USAR CENTER*
Material Spilled:	*OIL, FUEL: NO. 2-D, 0.00 (UNK)*
Waterway Affected:	*SOIL*
Fields Not Reported:	*Discharger Name, Discharger Phone*

Air Release:	Land Release:	Water Release:	Ground Release:	Facility Release:	Other Release:
NO	*NO*	*NO*	*NO*	*NO*	*NO*

ERNS - Emergency Response Notification System / SRC# 6181	Agency ID:	D30393A

Agency Address:	*ARMY-USAR CENTER* *915 WEST CHESTNUT ST.* *BROCKTON, MA 02401*
Spill Date Time:	*NOT REPORTED UNKNOWN*
Case Number:	*D30393A*
Spill Location:	*915 WEST CHESTNUT ST.*
Source Agency:	*E*
Discharger Org:	*ARMY-USAR CENTER*
Material Spilled:	*# 2 FUEL OIL, 1.00 (UNK)*
Fields Not Reported:	*Discharger Name, Discharger Phone, Waterway Affected*

Air Release:	Land Release:	Water Release:	Ground Release:	Facility Release:	Other Release:
YES	*NO*	*NO*	*NO*	*NO*	*NO*

VISTA Address*:		VISTA ID#:	3568792	Map ID
BROCKTON LANDFILL **WEST CHESTNUT ST** **BROCKTON, MA 02401**		Distance	0.04 MI	**2**
		Plotted as:	Polygon	
STATE SWLF - Solid Waste Landfill / SRC# 6397		Agency ID:	SL0044.001	

Agency Address:	*BROCKTON LANDFILL* *WEST CHESTNUT ST* *BROCKTON, MA*
Facility Type:	*SANITARY LANDFILL/LANDFILL*
Facility Status:	*INACTIVE*
Facility Life:	*NOT REPORTED*
Permit Status:	*NOT AVAILABLE*
Waste:	*NOT REPORTED*

VISTA Address*:	CIRELLI FOODS 970 W CHESTNUT ST BROCKTON, MA 02401	VISTA ID#:	85157
		Distance/Direction:	0.07 MI / W
		Plotted as:	Point

Map ID **3**

STATE LUST - State Leaking Underground Storage Tank / SRC# 4778				EPA/Agency ID:	N/A
Agency Address:	*CIRELLI FOODS 970 W CHESTNUT ST BROCKTON, MA*				
Facility ID:	*4-6045*				
Leak ID#:	*S91-0313*				
Leak Date:	*06/03/1991*				
Leak Report Date:	*06/04/1991*				
Who Reported:	*WALTER HERMANEAU*				
Leak Cause:	*TANK REMOVAL*				
Leak Source:	*U.S.T.*				
Substance:	*GASOLINE*				
Quantity / Units:	*UNKNOWN*	Units:	---		
Remediation Event:	---				
Remediation Status:	*CLOSED: YES*				
Lead Agency:	*BRENNAN, S*				
Contact:	*BRENNAN, S*				
Referral:	*SA*				

State Spills / SRC# 4778				EPA/Agency ID:	N/A
Agency Address:	*CIRELLI FOODS INC 970 W CHESTNUT ST BROCKTON, MA*				
Spill ID#:	*S91-0123*				
Spill Date:	*02/22/1991*				
Spill Time:	*03:00PM*				
Contact:	*BRENNAN, S*				
Caller Name:	*BILL VERDONE/EPA*				
Call / Report Date:	*03/07/1991*				
Call / Report Time:	*08:35AM*				
Spiller Company:	*CIRELLI FOODS INC*				
Substance:	*MISCELLANEOUS OIL*				
Quantity Spilled:	*UNKNOWN*	Spilled Units:	*NOT REPORTED*		
Spill Cause:	*OTHER RELEASE >*				
Spill Source:	*OTHER SOURCE >*				
Cleanup Finish Date:	*NOT REPORTED*	Classification:	*PETROLEUM*		
Enforcement Date:	*NOT REPORTED*	Referral:	*NO*		
Remedial Status:	*CLOSED: YES*	Damages:	*NOT REPORTED*		

State Spills / SRC# 4778				EPA/Agency ID:	N/A
Agency Address:	*CIRELLI FOODS 970 W CHESTNUT ST BROCKTON, MA*				
Spill ID#:	*S91-0142*				
Spill Date:	*03/20/1991*				
Contact:	*BRENNAN, S*				

PROPERTY AND THE ADJACENT AREA (within 1/8 mile) CONT.

Caller Name:	*VICTOR FONKEM/NERO*		
Call / Report Date:	*03/21/1991*		
Call / Report Time:	*12:10PM*		
Spiller Company:	*CIRELLI FOODS*		
Substance:	*LUBRICATING OIL*		
Quantity Spilled:	*UNKNOWN*	**Spilled Units:**	*NOT REPORTED*
Spill Cause:	*LEAK*		
Spill Source:	*OTHER SOURCE >*		
Cleanup Finish Date:	*NOT REPORTED*	**Classification:**	*PETROLEUM*
Enforcement Date:	*NOT REPORTED*	**Referral:**	*NO*
Remedial Status:	*CLOSED: YES*	**Damages:**	*NOT REPORTED*

STATE UST - State Underground Storage Tank / SRC# 6038	Agency ID:	13069
Agency Address:	*CIRELLI FOODS, INC.* *970 WEST CHESTNUT STREET* *BROCKTON, MA 02401*	
Underground Tanks:	*4*	
Aboveground Tanks:	*NOT REPORTED*	
Tanks Removed:	*3*	

Tank ID:	*1U*	**Tank Status:**	*ACTIVE/IN SERVICE*
Tank Contents:	*DIESEL*	**Leak Monitoring:**	
Tank Age:	*14*	**Tank Piping:**	*BARE STEEL*
Tank Size (Units):	*10000 (GALLONS)*	**Tank Material:**	*BARE STEEL*
Tank ID:	*2U*	**Tank Status:**	*REMOVED*
Tank Contents:	*WASTE OIL*	**Leak Monitoring:**	
Tank Age:	*14*	**Tank Piping:**	*BARE STEEL*
Tank Size (Units):	*500 (GALLONS)*	**Tank Material:**	*BARE STEEL*
Tank ID:	*3U*	**Tank Status:**	*REMOVED*
Tank Contents:	*DIESEL*	**Leak Monitoring:**	
Tank Age:	*33*	**Tank Piping:**	*BARE STEEL*
Tank Size (Units):	*6000 (GALLONS)*	**Tank Material:**	*BARE STEEL*
Tank ID:	*4U*	**Tank Status:**	*REMOVED*
Tank Contents:	*GASOLINE (UNSPECIFIED)*	**Leak Monitoring:**	
Tank Age:	*33*	**Tank Piping:**	*BARE STEEL*
Tank Size (Units):	*4000 (GALLONS)*	**Tank Material:**	*BARE STEEL*

PROPERTY AND THE ADJACENT AREA (within 1/8 mile) CONT.

ERNS - Emergency Response Notification System / SRC# 6181	Agency ID:	62476

Agency Address:	*CIRELLI FOODS* *970 W. CHESTNUT* *BROCKTON, MA*
Spill Date Time:	*FEBRUARY 27, 1991 03:00:00 PM*
Case Number:	*62476*
Spill Location:	*970 W. CHESTNUT*
Source Agency:	*N*
Discharger Name:	*CIRELLI, JOESPH*
Discharger Org:	*CIRELLI FOODS*
Material Spilled:	*OIL: DIESEL, 0.00 (UNK)*
Waterway Affected:	*SOIL*
Fields Not Reported:	*Discharger Phone*

Air Release:	Land Release:	Water Release:	Ground Release:	Facility Release:	Other Release:
NO	*NO*	*NO*	*NO*	*NO*	*NO*

VISTA Address*:	**PROPERTY** **970 WEST CHESTNUT ST** **BROCKTON, MA 02401**	VISTA ID#:	5731046
		Distance/Direction:	0.07 MI / W
		Plotted as:	Point

Map ID **3**

SCL - State Equivalent CERCLIS List / SRC# 6362	Agency ID:	4-0006045

Agency Address:	*SAME AS ABOVE*
Status:	*NOT ON NPL*
Facility Type:	*NOT AVAILABLE*
Lead Agency:	*STATE*
State Status:	*REMEDIAL ACTION IN PROGRESS*
Pollutant 1:	*PETROLEUM*
Pollutant 2:	*UNKNOWN*
Pollutant 3:	*UNKNOWN*

SITES IN THE SURROUNDING AREA (within 1/8 - 1/4 mile)

No Records Found

SITES IN THE SURROUNDING AREA (within 1/4 - 1/2 mile)

No Records Found

SITES IN THE SURROUNDING AREA (within 1/2 - 1 mile)

No Records Found

UNMAPPED SITES

VISTA Address*:	**TRIAL COURT** **MAIN ST** **BROCKTON, MA**	VISTA ID#:	8679618
STATE LUST - State Leaking Underground Storage Tank / SRC# 6364		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*
Leak ID#:	*4-0013970*
Leak Date:	*06/19/1998*
Leak Source:	*UST,*
Remediation Event:	*STATUS DATE: 08/13/1998CATEGORY: 72 HRRELATED RTN#: 4-00012728*
Remediation Status:	*RESPONSE ACTION OUTCOME NOT REQUIRED*
Media Affected:	*STATE,*
Description / Comment:	*ACTION TAKEN/DATES: 08/13/1998-RAONR, 04/30/1999-IRA,SUBSTANCE: FUEL OIL #2- 100 PPM*

VISTA Address*:	**GREEN STREET** **BROCKTON, MA**	VISTA ID#:	2696804
STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*		
Leak ID#:	*S88-0570*		
Leak Date:	*09/05/1988*		
Leak Report Date:	*09/05/1988*		
Leak Cause:	*LEAK*		
Leak Source:	*U.S.T.*		
Substance:	*#2 FUEL OIL*		
Quantity / Units:	*10-50*	**Units:**	*GALLONS*
Remediation Status:	*CLOSED: YES*		
Lead Agency:	*LEARY, J*		
Contact:	*LEARY, J*		
Referral:	*NO*		

VISTA Address*:	**BROWNING-FERRIS INDUSTRIES** **BROCKTON, MA**	VISTA ID#:	5147506
STATE SWLF - Solid Waste Landfill / SRC# 2878		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*
Facility Type:	*RESOURCE RECOVERY (RECYCLING)*
Facility Status:	*NOT AVAILABLE*
Permit Status:	*NOT AVAILABLE*

STATE SWLF - Solid Waste Landfill / SRC# 2878		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*
Facility Type:	*RESOURCE RECOVERY (RECYCLING)*
Facility Status:	*NOT AVAILABLE*
Permit Status:	*NOT AVAILABLE*

UNMAPPED SITES CONT.

STATE SWLF - Solid Waste Landfill / SRC# 2878		EPA/Agency ID:	N/A
Agency Address:	SAME AS ABOVE		
Facility Type:	RESOURCE RECOVERY (RECYCLING)		
Facility Status:	NOT AVAILABLE		
Permit Status:	NOT AVAILABLE		

STATE SWLF - Solid Waste Landfill / SRC# 2878		EPA/Agency ID:	N/A
Agency Address:	SAME AS ABOVE		
Facility Type:	RESOURCE RECOVERY (RECYCLING)		
Facility Status:	NOT AVAILABLE		
Permit Status:	NOT AVAILABLE		

STATE SWLF - Solid Waste Landfill / SRC# 2878		EPA/Agency ID:	N/A
Agency Address:	SAME AS ABOVE		
Facility Type:	RESOURCE RECOVERY (RECYCLING)		
Facility Status:	NOT AVAILABLE		
Permit Status:	NOT AVAILABLE		

VISTA Address*:	MERIT OIL CO ELLIOTSOUTH MAIN ST BROCKTON, MA	VISTA ID#:	2699357

STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A
Agency Address:	SAME AS ABOVE		
Facility ID:	9-9999		
Leak ID#:	S89-0629		
Leak Date:	09/13/1989		
Leak Report Date:	09/13/1989		
Who Reported:	ROB GOOD		
Leak Cause:	SPILL		
Leak Source:	U.S.T.		
Substance:	GASOLINE		
Quantity / Units:	UNKNOWN	Units:	GALLONS
Remediation Event:	---		
Remediation Status:	CLOSED: YES		
Lead Agency:	MORAN, M		
Contact:	MORAN, M		
Referral:	NO		

VISTA Address*:	721 WALLEN AVE BROCKTON, MA	VISTA ID#:	2705975

STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A
Agency Address:	SAME AS ABOVE		
Facility ID:	4-0682		
Leak ID#:	S89-0275		
Leak Report Date:	04/25/1989		
Who Reported:	JULIUS VALLA		
Leak Cause:	OVERFILL		
Leak Source:	U.S.T.		

UNMAPPED SITES CONT.

Substance:	*GASOLINE*
Quantity / Units:	*UNKNOWN* **Units:** ———
Remediation Event:	—
Remediation Status:	*CLOSED: YES*
Lead Agency:	*OTHER*
Contact:	*OTHER*
Referral:	*SA*

VISTA Address*:	**EASTERN EDISON** **DUPONT SUBSTA (OFF SUMMER ST)** **BROCKTON, MA 02401**	VISTA ID#:	2695404
STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*
Facility ID:	*4-0997*
Leak ID#:	*S90-0273*
Leak Date:	*04/18/1990*
Leak Report Date:	*04/20/1990*
Who Reported:	*E JACOBS/EASTERN EDISON*
Leak Cause:	*LEAK*
Leak Source:	*U.S.T.*
Substance:	*#2 FUEL OIL*
Quantity / Units:	*UNKNOWN* **Units:** *GALLONS*
Remediation Event:	*--*
Remediation Status:	*CLOSED: YES*
Lead Agency:	*PINAUD, L*
Contact:	*PINAUD, L*
Referral:	*SA*

VISTA Address*:	**NEW COURTHOUSE** **MAIN WEST ELM ST** **BROCKTON, MA**	VISTA ID#:	7241867
STATE LUST - State Leaking Underground Storage Tank / SRC# 6364		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*
Leak ID#:	*4-0013469*
Leak Date:	*11/04/1997*
Leak Source:	*UST,*
Remediation Event:	*STATUS DATE: 04/28/1998CATEGORY: 72 HRRELATED RTN#: 4-00012728*
Remediation Status:	*RESPONSE ACTION OUTCOME NOT REQUIRED*
Media Affected:	*STATE,*
Description / Comment:	*ACTION TAKEN/DATES: 05/10/1999-IRA, 04/28/1998-RAONR,SUBSTANCE: OIL- 420 PPM*

VISTA Address*:	50 SPARK STREET ALVIN HOLLIS CO. INC. BROCKTON, MA	VISTA ID#:	2694572
STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	SAME AS ABOVE		
Leak ID#:	S87-0629		
Leak Report Date:	09/29/1987		
Leak Cause:	TANK REMOVAL		
Leak Source:	U.S.T.		
Substance:	#2 FUEL OIL		
Quantity / Units:	NONE	Units:	———
Remediation Status:	CLOSED: YES		
Lead Agency:	BOLSTER, H		
Contact:	BOLSTER, H		
Referral:	NO		

VISTA Address*:	MAIN ST INTERSECTION OF NORTH MAIN/ EA BROCKTON, MA	VISTA ID#:	2697917
STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	SAME AS ABOVE		
Leak ID#:	S87-0461		
Leak Date:	07/22/1987		
Leak Report Date:	07/22/1987		
Leak Source:	U.S.T.		
Substance:	#2 FUEL OIL		
Quantity / Units:	NONE	Units:	———
Remediation Status:	CLOSED: YES		
Lead Agency:	KEARNS, R		
Contact:	KEARNS, R		
Referral:	NO		

VISTA Address*:	ASHLAND INTERSECTION OF N. PLEASANT AN BROCKTON, MA	VISTA ID#:	2697916
STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	SAME AS ABOVE		
Leak ID#:	S88-0623		
Leak Date:	09/25/1988		
Leak Report Date:	09/25/1988		
Leak Cause:	OVERFILL		
Leak Source:	U.S.T.		
Substance:	GASOLINE		
Quantity / Units:	10-50	Units:	GALLONS
Remediation Status:	CLOSED: YES		
Lead Agency:	PACKARD, R		

Contact:	*PACKARD, R*
Referral:	*NO*

VISTA Address*:		VISTA ID#:	6546862
	KES BROCKTON WOOD L.P. **LOT 6B** **BROCKTON, MA 02401**		
STATE SWLF - Solid Waste Landfill / SRC# 6397		Agency ID:	RE0044.006

Agency Address:	*KES BROCKTON WOOD L.P.* *LOT 6B* *BROCKTON, MA*
Facility Type:	*RECYCLING /PAPER/PLASTICS/GLASS/CB*
Facility Status:	*ACTIVE*
Permit Status:	*NOT AVAILABLE*

VISTA Address*:		VISTA ID#:	2704920
	MERIT GAS STATION **261 N. STREET/ELLIOT STREET** **BROCKTON, MA**		
STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*		
Leak ID#:	*S88-0405*		
Leak Date:	*07/02/1988*		
Leak Report Date:	*07/02/1988*		
Leak Cause:	*OVERFILL*		
Leak Source:	*U.S.T.*		
Substance:	*GASOLINE*		
Quantity / Units:	*10-50*	**Units:**	*GALLONS*
Remediation Status:	*CLOSED: YES*		
Lead Agency:	*PINAUD, L*		
Contact:	*PINAUD, L*		
Referral:	*NO*		

VISTA Address*:		VISTA ID#:	2703443
	SHAW'S PLAZA **RTE 28** **WEST BRIDGEWATER, MA 02379**		
STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*		
Facility ID:	*9-9999*		
Leak ID#:	*S89-0760*		
Leak Report Date:	*10/27/1989*		
Who Reported:	*E JARDIN/JOHNSON PRODUCTS*		
Leak Cause:	*OVERFILL*		
Leak Source:	*U.S.T.*		
Substance:	*GASOLINE*		
Quantity / Units:	*UNKNOWN*	**Units:**	*GALLONS*
Remediation Event:	---		
Remediation Status:	*CLOSED: YES*		

Lead Agency:	*PACKARD, R*
Region / District:	*4*
Contact:	*PACKARD, R*
Referral:	*NO*

VISTA Address*:	**CHARTER MKTG STN #2573** **CENTER N ELM STS** **WEST BRIDGEWATER, MA 02379**	VISTA ID#:	2987845
STATE LUST - State Leaking Underground Storage Tank / SRC# 4778		EPA/Agency ID:	N/A

Agency Address:	*SAME AS ABOVE*		
Facility ID:	*4-0044*		
Leak ID#:	*S91-0607*		
Leak Date:	*09/27/1991*		
Leak Report Date:	*09/30/1991*		
Who Reported:	*STEVE BELIN, CHARTER MKTG*		
Leak Cause:	*LEAK*		
Leak Source:	*U.S.T.*		
Substance:	*GASOLINE*		
Quantity / Units:	*UNKNOWN*	**Units:**	---------
Remediation Event:	---		
Remediation Status:	*CLOSED: YES*		
Lead Agency:	*BRENNAN, S*		
Contact:	*BRENNAN, S*		
Referral:	*SA*		

SITE ASSESSMENT REPORT

DESCRIPTION OF DATABASES SEARCHED

A) DATABASES SEARCHED TO 1 MILE

NPL
SRC#: 6476

VISTA conducts a database search to identify all sites within 1 mile of your property.
The agency release date for NPL was November, 1999.

The National Priorities List (NPL) is the EPA's database of uncontrolled or abandoned hazardous waste sites identified for priority remedial actions under the Superfund program. A site must meet or surpass a predetermined hazard ranking system score, be chosen as a state's top priority site, or meet three specific criteria set jointly by the US Dept of Health and Human Services and the US EPA in order to become an NPL site.

SPL
SRC#: 6363

VISTA conducts a database search to identify all sites within 1 mile of your property.
The agency release date for Sites Plus Database- Confirmed Sites was August, 1999.

This database is provided by the Department of Environmental Protection, Bureau of Waste Sites Cleanup. The agency may be contacted at: 617-292-5990.

CORRACTS
SRC#: 6379

VISTA conducts a database search to identify all sites within 1 mile of your property.
The agency release date for HWDMS/RCRIS was September, 1999.

The EPA maintains this database of RCRA facilities which are undergoing "corrective action". A "corrective action order" is issued pursuant to RCRA Section 3008 (h) when there has been a release of hazardous waste or constituents into the environment from a RCRA facility. Corrective actions may be required beyond the facility's boundary and can be required regardless of when the release occurred, even if it predates RCRA.

B) DATABASES SEARCHED TO 1/2 MILE

CERCLIS
SRC#: 6474

VISTA conducts a database search to identify all sites within 1/2 mile of your property.
The agency release date for CERCLIS was October, 1999.

The CERCLIS List contains sites which are either proposed to or on the National Priorities List(NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL. The information on each site includes a history of all pre-remedial, remedial, removal and community relations activiies or events at the site, financial funding information for the events, and unrestricted enforcement activities.

NFRAP
SRC#: 6475

VISTA conducts a database search to identify all sites within 1/2 mile of your property.
The agency release date for CERCLIS-NFRAP was October, 1999.

NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly, or the contamination was not serious enough to require Federal Superfund action or NPL consideration.

SCL
SRC#: 6362

VISTA conducts a database search to identify all sites within 1/2 mile of your property. **The agency release date for Sites Plus Database- Sites to be Investigated was August, 1999.**

This database is provided by the Department of Environmental Protection, Bureau of Waste Sites Cleanup. The agency may be contacted at: 617-292-5578.

The Massachusetts List of Confirmed Disposal Sites and Locations contains the following facility types: (1) Remedial Sites-Sites where oil or hazardous materials have been released and an appropriate remedial action has been completed and no further action is planned; (2) Confirmed Sites-where oil or hazardous materials have been released and remedial response actions have not been completed; (3) Waiver Sites-A waiver allows those conducting cleanup actions at non- priority sites to proceed at an accelerated pace with no Departmental oversight; (4) Deleted Sites-Deleted locations for which Preliminary Assessments, Phase I Limited Site Investigations, or Phase II Comprehensive Site Assessments have been completed finding that no further investigations or response actions are required; (5) Locations to be Investigated-Locations where oil or hazardous materials may have been released to the environment, based on past or present uses of the property, conditions reported and any other information available to the DEP, which warrant an initial investigation. Some of these sites are leaking underground storage tank sites or state spill sites and may also appear on the Leaking Underground Storage Tank report or the State Spill report.

RCRA-TSD
SRC#: 6379

VISTA conducts a database search to identify all sites within 1/2 mile of your property. **The agency release date for HWDMS/RCRIS was September, 1999.**

The EPA's Resource Conservation and Recovery Act (RCRA) Program identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRA Facilities database is a compilation by the EPA of facilities which report generation, storage, transportation, treatment or disposal of hazardous waste. RCRA TSDs are facilities which treat, store and/or dispose of hazardous waste.

SWLF
SRC#: 2773

VISTA conducts a database search to identify all sites within 1/2 mile of your property. **The agency release date for Demolition Landfills List was August, 1994.**

This database is provided by the DEP, Division of Solid Waste, Bureau of Waste Prevention. The agency may be contacted at: .

SWLF
SRC#: 2878

VISTA conducts a database search to identify all sites within 1/2 mile of your property. **The agency release date for Recycling Services Directory was January, 1996.**

This database is provided by the DEP, Division of Solid Waste, Bureau of Waste Prevention. The agency may be contacted at: .

SWLF
SRC#: 6397

VISTA conducts a database search to identify all sites within 1/2 mile of your property. **The agency release date for Solid Waste Facilities List was October, 1999.**

This database is provided by the DEP, Division of Solid Waste, Bureau of Waste Prevention. The agency may be contacted at: 617-292-5990.

SWLF
SRC#: 6398

VISTA conducts a database search to identify all sites within 1/2 mile of your property.
The agency release date for Transfer Stations List was October, 1999.

This database is provided by the DEP, Division of Solid Waste, Bureau of Waste Prevention. The agency may be contacted at: 617-292-5578.

LUST
SRC#: 4778

VISTA conducts a database search to identify all sites within 1/2 mile of your property.
The agency release date for Spills Database (includes LUST) was March, 1996.

This database is provided by the Department of Environmental Protection, Bureau of Waste Site Cleanup. The agency may be contacted at: 617-292-5937.

LUST
SRC#: 6362

VISTA conducts a database search to identify all sites within 1/2 mile of your property.
The agency release date for Sites Plus Database-LUST Sites was August, 1999.

This database is provided by the Department of Environmental Protection, Bureau of Waste Site Cleanup. The agency may be contacted at: 617-292-5990.

The Massachusetts List of Confirmed Disposal Sites and Locations includes Leaking Underground Storage Tank sites. All facilities on this report also appear on the State Priority Sites report. Details contained in this report pertain only to the leaking tank reported at the site.

LUST
SRC#: 6364

VISTA conducts a database search to identify all sites within 1/2 mile of your property.
The agency release date for Release Database-LUST Sites was August, 1999.

This database is provided by the Department of Environmental Protection, Bureau of Waste Site Cleanup. The agency may be contacted at: 617-292-5937.

C) DATABASES SEARCHED TO 1/4 MILE

UST's
SRC#: 6038

VISTA conducts a database search to identify all sites within 1/4 mile of your property.
The agency release date for Underground Storage Tank Database was June, 1999.

This database is provided by the Department of Public Safety. The agency may be contacted at: 617-727-3200; Caution-Many states do not require registration of heating oil tanks, especially those used for residential purposes.

D) DATABASES SEARCHED TO 1/8 MILE

ERNS
SRC#: 6181

VISTA conducts a database search to identify all sites within 1/8 mile of your property.
The agency release date for was August, 1999.

The Emergency Response Notification System (ERNS) is a national database containing records from October 1986 to the release date above and is used to collect information for reported releases of oil and hazardous substances. The database contains information from spill reports made to federal authorities including the EPA, the US Coast Guard, the National Response Center and the Department of Transportation. The ERNS hotline number is (202) 260-2342.

RCRA-LgGen VISTA conducts a database search to identify all sites within 1/8 mile of your property.
SRC#: 6379 **The agency release date for HWDMS/RCRIS was September, 1999.**

The EPA's Resource Conservation and Recovery Act (RCRA) Program identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRA Facilities database is a compilation by the EPA of facilities which report generation, storage, transportation, treatment or disposal of hazardous waste. RCRA Large Generators are facilities which generate at least 1000 kg./month of non-acutely hazardous waste (or 1 kg./month of acutely hazardous waste).

RCRA-SmGen VISTA conducts a database search to identify all sites within 1/8 mile of your property.
SRC#: 6379 **The agency release date for HWDMS/RCRIS was September, 1999.**

The EPA's Resource Conservation and Recovery Act (RCRA) Program identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRA Facilities database is a compilation by the EPA of facilities which report generation, storage, transportation, treatment or disposal of hazardous waste. RCRA Small and Very Small generators are facilities which generate less than 1000 kg./month of non-acutely hazardous waste.

SPILL VISTA conducts a database search to identify all sites within 1/8 mile of your property.
SRC#: 4778 **The agency release date for Spills Database (includes LUST) was March, 1996.**

This database is provided by the Department of Environmental Protection, Bureau of Waste Sites Cleanup. The agency may be contacted at: 617-292-5937.

SPILL VISTA conducts a database search to identify all sites within 1/8 mile of your property.
SRC#: 6362 **The agency release date for Sites Plus Database-Spill Sites was August, 1999.**

This database is provided by the Department of Environmental Protection, Bureau of Waste Sites Cleanup. The agency may be contacted at: 617-292-5990.

SPILL VISTA conducts a database search to identify all sites within 1/8 mile of your property.
SRC#: 6364 **The agency release date for Release Database was August, 1999.**

This database is provided by the Department of Environmental Protection, Bureau of Waste Site Cleanup. The agency may be contacted at: 617-292-5937.

End of Report

APPENDIX F

SOIL BORING LOGS

Stone & Webster Engineering Corporation	**BORING LOG**	**Boring:** BRSWSB-01 **Job Number:** 05000.33 **Sheet:** 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999 **Date End:** 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 8.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/16/1999		3.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description / Unified Classification System	Remarks
	0	SS	S-1	7-8-11-14	19	0	SP	Sandy FILL, poorly sorted, angular to subround, 5-7% gravel upto 0.5 in. max., mainly coarse to	(1)
				(14"/24")				medium subround sand, 5-7% fines, loose to m. dense, brown	
		SS	S-2	4-4-3-3	7	0	SP	Same as S-1 except, looser and wet	
				(17"/24")					
	5	SS	S-3	1-1-1/12"	2	0	SP	Same as S-1 except very loose	
				(12"/24")					
		SS	S-4	1-1-1/12"	2	0	SP	Same as S-1 except very loose	
				(18"/24")					
									(2)
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 2" ASPHALT
(2) Auger Refusal @ 9.5' sent spoon down to confirm. Refusal of spoon. Possibly bottom of force main

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer Reading (tsf)

Approved	Date

N:\Hazwaste\BROCKTON\Field\Boring Logs\[Boring Log BR-01.xls]Sheet1

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB02 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/17/1999 Date End: 11/17/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 17.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/17/1999		3.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	6-8-8-10 (12"/24")	16	0.2	SP	Sandy FILL, poorly sorted, angular to subround, 0-5% gravel upto 0.25 in. max., mainly coarse t medium subround sand, 5-7% fines, moist, loose to m. dense, brown	(1)
		SS	S-2	10-8-10-12 (12"/24")	18	0.2	SP	Same as S-1 except 5-10% gravel, and coarser sand	(2)
	5	SS	S-3	5-3-4-2 (5"/24")	7	0.3	SP	Same as S-1 except very loose and wet with some plastic debris	
		SS	S-4	5-23-29-25 (16"/24")	52	11.8	SM	Silty SAND, subangular to subround, poorly sorted, 5-10% gravel upto 0.5 in. max, mainly coarse to fine sand, 10-15% fines,v. dense, wet, grayish green, petrolleum odor present	
	10	SS	S-5	24-25-27-21 (15"/24")	52	4.3	SM	Same as S-4 except slight petrolleum odor, moderately sorted with 20-25% fines	
	15	SS	S-6	23-33-43-39 (18"/24")	76	0.2	SM	Same as S-4 with a gradational change to a more fine sand, 25-30% fines, damp, very dense, tan t gray	
	20								
	25								
	30								

Remarks:
(1) Top 2" ASPHALT
(2) Rock lodged in spoon tip

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

N:\Hazwaste\BROCKTON\Field\Boring Logs\[Boring Log BR-02.xls]Sheet1

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB03 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/18/1999 **Date End:** 11/18/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 10.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/18/1999		4.0ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	10-20-21-43	41	0	SP	Sandy Fill, poorly sorted, angular to subround, 10-15% gravel upto 0.25 in. max., mainly coarse	(1)
				(12"/24")				medium subround sand, 5-7% fines, moist, dense, brown	
		SS	S-2	38-36-39-52	75	0	SP	Same as S-1 except 5-10% gravel, coarser sand, and v. dense	
				(14"/24")					
	5	SS	S-3	27-33-34-41	69	0.1	SM	Silty SAND, subround to round, moderately sorted, 5-7% fine gravel upto 0.2 in. max, mainly	
				(18"/24")				medium to fine sand, 15-20% fines, wet, v.dense, tanish gray	
		SS	S-4	45-33-32-33	65	0.0	SM	Same as S-3	(1)
				(5"/24")					
		SS	S-5	27-26-27-25	53	0.1	SM	Same as S-3 except gradational change with more fine sand and fines	
	10			(12"/24")					
	15								
	20								
	25								
	30								

Remarks:
(1) Rock lodged in spoon tip

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB04 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/18/1999 Date End: 11/18/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 8.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/18/1999		4.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	7-10-14-25 (17"/24")	24	0.5	SP	Gravelly FILL, poorly sorted, angular to subround, 10-15% gravel upto 1.5 in. max., mainly coa medium subround sand, 5-7% fines, moist, loose, brown	(1)
		SS	S-2	32-35-37-34 (16"/24")	72	0.7	SP/SM	Top 8" Same as S-1, Bottom 8" Silty SAND, moderately sorted, subround to round, 5-10% gravel upto 1.0 in. max, maily medium sand, 10-15% fines, moist, v. dense, tanish gray	
	5	SS	S-3	27-52-51-44 (20"/24")	103	0.4	SM	Same bottom 8" of S-2 except wet and v.dense	
		SS	S-4	44-50-31-30 (21"/24")	81	0.3	SM	Same as bottom of S-2 except gradational change towards bottom of sample, damp	
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) 3" of ASPHALT

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB05 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/18/1999 Date End: 11/18/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 8.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/18/1999		4.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	13-52-29-25 (16"/24")	81	0.7	SP	Gravelly FILL, poorly sorted, angular to subround, 10-15% gravel upto 1.5 in. max., mainly coa medium subround sand, 5-7% fines, moist, v. dense, brown	(1)
		SS	S-2	19-28-30-29 (19"/24")	58	0.3	SP/SM	Top 6" Same as S-1, Bottom 13" Silty SAND, moderately sorted, subround to round, 5-10% grave upto 0.25 in. max, maily medium sand, 10-15% fines, moist, v.dense, tanish gray	
	5	SS	S-3	25-27-25-28 (17"/24")	52	0.2	SM	Same bottom 13" of S-2 except wet	
		SS	S-4	45-43-39-40 (18"/24")	82	0.2	SM	Same as bottom of S-2 except gradational change towards bottom of sample, increase in fines v.dense	
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) 3" of ASPHALT

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB06 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/18/1999 **Date End:** 11/18/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 8.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/18/1999		4.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description / Unified Classification System	Remarks
	0	SS	S-1	20-25-24-30 (14"/24")	49	0	SP	Gravelly FILL, poorly sorted, angular to subround, 15-20% gravel upto 1.5 in. max., mainly coa medium subround sand, 5-7% fines, moist, v.dense, brown	(1)
		SS	S-2	18-52-80-61 (17"/24")	132	0	SP/SM	Top 8" Same as S-1, Bottom 9" Silty SAND, moderately sorted, subround to round, 5-10% gravel upto 0.25 in. max, maily medium sand, 10-15% fines, moist, v.dense, tanish gray	(2)
	5	SS	S-3	30-38-38-31 (21"/24")	76	0	SM	Same bottom 13" of S-2 except wet	
		SS	S-4	33-26-32-33 (24"/24")	58	0.1	SM	Same as bottom of S-2 except gradational change towards bottom of sample, increase in fines	
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) 3" of ASPHALT
(2) High blow count due to coarse gravel

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB07 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation:
Total Depth Drilled: 4.0'
Drill Rig Type: Mobile B-59

Date End: 11/16/1999
Depth to Bedrock:

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	8-15-43-41	58	0.2	SP	Sandy FILL, poorly sorted, angular to subround, 5-10% gravel upto 1.0 in. max., mostly coarse to medium subangular to subrounded, 5-10% fines, moist, v.dense, brown	(1)
				(3"/24")					
		SS	S-2	43-57-57-44	114	0.1	SP	Gravelly SAND, poorly sorted, angular to subround, 5-10% gravel upto 1.0 in. max., mostly subround to round, coarse to medium sand, 5-10% fines, moist, v.dense, light brown to gray.	
				(16"/24")					
	5								
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of Topsoil, grass, roots and organic debris

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

N:\Hazwaste\BROCKTON\Field\Boring Logs\[Boring Log BR-07.xls]Sheet1

Stone & Webster *Engineering Corporation*	**BORING LOG**	**Boring:** BRSWSB08 **Job Number:** 05000.33 **Sheet:** 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999 **Date End:** 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 4.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	5-18-43-48 (12"/24")	61	0.3	SP	Sandy FILL, poorly sorted, angular to subround, 5-7% gravel upto 0.5 in. max., mostly coarse to medium subangular to subrounded sand, 5-10% fines,v. dense, moist, brown	(1)
		SS	S-2	38-31-35-68 (16"/24")	66	0.1	SP	SAND, angular to subround, 5-7% gravel upto 1.0 in. max., mostly subround, poorly to moderate sorted, medium to fine sand, 5-7% fines, v.dense, moist, light brown to gray.	
	5								
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of Topsoil, grass, roots, and orgainic debris

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

N:\Hazwaste\BROCKTON\Field\Boring Logs\[Boring Log BR-08.xls]Sheet1

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB09 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999 **Date End:** 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 8.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/16/1999		6.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	10-19-32-100/1"	51	0.2	SP	Sandy FILL, poorly sorted, angular to subround, 5-7% gravel upto 0.5 in. max., mostly	(1)
				18"/24"				coarse to medium subangular to subrounded sand, 5-10% fines, v.dense, moist, brown	
		SS	S-2	36-52-45-49	97	0.1	SP	SAND, angular to subround, 5-7% gravel upto 1.5 in. max., mostly subround, moderately	
				(12"/24")				sorted, medium to fine sand, 5-7% fines, v.dense, moist, light brown to gray.	
	5	SS	S-3	52-53-21-38	74	0.5	SP	Gravelly SAND, poorly sorted, subangular, coarse gravel upto 1.5 in. max, subangular to	
				(13"/24")				subround, medium to fine sand, 5-10% fines,v. dense, damp, light brown to gray.	
		SS	S-4	21-38-41-42	79	0.5	SW	Silty SAND, moderately sorted, 5-7 % gravel, gradational change from sample S-3,	
				(11"/24")				medium to fine sand, 10-15% fines, wet, v. dense, tan to gray	
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of Topsoil, grass, roots, and organic debris

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB10 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999 **Date End:** 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 8.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/16/1999		6.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description / Unified Classification System	Remarks
	0								
		SS	S-1	8-18-25-32	43	0.1	SP	Sandy FILL, poorly graded, angular to subround, 5-7% gravel upto 1.5 in. max., mostly	(1)
				20"/24"				coarse to medium subangular to subrounded sand, 5-10% fines, v.dense, moist, brown	
		SS	S-2	61-62-62-47	124	0.2	SP	Gravelly SAND, angular to subround, 10-15% gravel upto 1.5 in. max., mostly subround,	
				(17"/24")				poorly sorted, coarse to fine sand, 5-10%% fines, v. dense, moist, brown to light brown	
	5	SS	S-3	55-63-65-64	128	0.1	SP	Same as S-2,	
				(13"/24")					
		SS	S-4	64-61-39-40	100	0.1	SW	Silty SAND, moderately sorted, 5-10 % gravel, gradational change from sample S-2,	
				(11"/24")				medium to fine sand, 10-15% fines, wet, v.dense, (tan to gray to orange) molted appearance	
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of Topsoil, grass, roots, and organic debris

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

N:\Hazwaste\BROCKTON\Field\Boring Logs\[Boring Log BR-10.xls]Sheet1

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB11 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999 Date End: 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 6.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/16/1999		4.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	10-15-20-28	35	0.1	SP	Sandy FILL, poorly sorted, angular to subround, 5-7% gravel upto 1.5 in. max., mostly	(1)
				(14"/24")				coarse to medium subangular to subrounded sand, 5-10% fines, dense, moist, brown	
		SS	S-2	28-33-25-14	58	0	SP	Gravelly SAND, angular to subround, 10-15% gravel upto 1.5 in. max., mostly subround,	
				(17"/24")				poorly sorted, coarse to fine sand, 5-10%% fines, v. dense, damp, brown to light brown	
	5	SS	S-3	6-9-13-11	22	0	SP	Same as S-2, but loose and wet	
				(13"/24")					
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of Topsoil, grass, roots, and organic debris

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB12 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999 **Date End:** 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 6.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/16/1999		3.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery / RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description / Unified Classification System	Remarks
	0	SS	S-1	6-8-11-8	19	0.1	SP	Sandy FILL, poorly sorted, angular to subround, 5-7% gravel upto 1.5 in. max., mostly	(1)
				17"/24"				coarse to medium subangular to subrounded sand, 5-10% fines, m.dense, moist, brown	
		SS	S-2	7-6-9-6	15	0.1	SP	Gravelly FILL, angular to subround, 10-15% gravel upto 1.5 in. max., mostly subround,	(2)
				(2"/24")				poorly sorted, coarse to fine sand, 5-10%% fines, loose, wet, light brown	
	5	SS	S-3	9-23--35-13	58	0.1	SP	Same as S-2, but higher gravel content, v.dense, and wet	
				(3"/24")					
				23-20-21-28	41	0.2	SW	Same as S-2 but denser until bottom 2" SAND, subangular to round, medium to fine	
				(13"/24")				5-10% fines, wet, tight dense, tan to gray	
	10								
	15								
	20								
	25								
	30								

Remarks:

(1) Top 3" inches consisted of Topsoil, grass, roots, and organic debris
(2) pushed rock or coble with spoon. Very low recovery very wet. Possible leak in water line pooling near boring location in Fill.

Legend/Notes: Datum:

Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB13 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999 Date End: 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 4.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/16/1999		3.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	9-19-20-41	39	0.1	SP	Sandy FILL, poorly sorted, angular to subround, 5-7% gravel upto 1.5 in. max., mostly coarse to medium subangular to subrounded sand, 5-10% fines, dense, moist, brown	(1)
				22"/24"					
		SS	S-2	14-17-16-13	33	0.1	SP	Gravelly FILL, angular to subround, 10-15% gravel upto 0.5 in. max., mostly subrounded, poorly sorted, coarse to fine sand, 5-10%% fines, dense, wet, light brown	
				20"/24"					
	5								
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of Topsoil, grass, roots, and organic debris

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB14 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client:
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/16/1999 **Date End:** 11/16/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 4.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/16/1999		6.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description / Unified Classification System	Remarks
	0	SS	S-1	18-28-31-15 22"/24"	59	0.1	SP	Sandy FILL, poorly sorted, subround to rounded, poorly sorted, 5-7% gravel upto 0.5 in., mainly medium grained subrounded sand, 5-10% fines, v.dense, moist, dark brown to brown	(1) (2)
	5	SS	S-2	4-4-14-24 9"/24"	18	0.3	SP	Gravelly FILL, poorly sorted, subangular to round,15-20% gravel upto 1.75 in. max., mainly subround to round, sand, coarse to medium grained, 5-7% fines, m.dense, damp, brown	(3)
		SS	S-3	24-28-31-29 24"/24"	59	0.1	SP	Gravelly SAND, moderately graded, subangular to round, 10-15% gravel upto 0.5in max., mainly subround to round medium grained sand, 5-10 % fines, v. dense, wet, tan	(4)
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of Topsoil, grass, roots, and organic debris (Background Sample)
(2) collected with a 3" spoon
(3) Rock lodged in tip (4) Well Installed

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB15 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/17/1999 Date End: 11/17/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 20.5'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/17/1999		6.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description / Unified Classification System	Remarks
	0	SS	S-1	9-19-46-45	65	0.1	SP	Gravelly FILL, poorly sorted, angular to subround, 30-35% gravel upto 1.5 in. max., mostly	(1)
				(17"/24")				coarse to medium subangular to subrounded sand, 5-10% fines,v. dense, moist, brown	
		SS	S-2	34-65-63-69	128	0.1	SW	Silty SAND, angular to subround, 5-10% gravel upto 1.0 in. max., mostly subround,	
				(20"/24")				poorly sorted, coarse to fine sand, 15-20% fines, v. dense, moist, brown to light brown	(2)
	5	SS	S-3	25-27-29-32	56	0.1	SP	Same as S-2,	
				(17"/24")					
		SS	S-4	55-49-51-51	100	0.1	SW	Gravelly, Silty, SAND,poorly sorted, subangular to subround, 10-15 % gravel,,subround to round	
				(22"/24")				medium to fine sand, 10-15% fines, wet, v.dense, tan to gray	
	10	SS	S-5	24-24-54-27	78	0.1	SW	Same as S-4, but very wet	
				(18"/24")					
	15	SS	S-6	19-33-42-39	38	0.1	SP	Silty SAND, moderately sorted, subround, 5-7% gravel up to 0.25 in. max, mainly medium	
				(15"/24")				to fine sand, 10-15% fines, wet, dense to very dense, and tanish gray	
	20	SS	S-7	100/5"		0.1	SP	Same as S-6	(3)
	25								
	30								

Remarks:
(1) Top 3" inches consisted of ASPHALT
(2) 2 1/2" Spoon for MS/MSD sampling
(3) Well Installed

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC = Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB16 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/17/1999 Date End: 11/17/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 12.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/17/1999		6.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	13-24-29-34	53	0	SP	Gravelly FILL, poorly sorted, angular to subround, 20-25% gravel upto 1.75 in. max., mostly	(1)
				(15"/24")				coarse to medium subangular to subrounded sand, 5-10% fines, v.dense, moist, brown	
		SS	S-2	25-61-75-100/2"	136	0.1	SP	Gravelly SAND, angular to subround, moderately sorted 10-15% gravel upto 1.0 in. max.,	
				(14"/20")				subround, coarse to fine sand, 5-10% fines, v. dense, moist, brown to light brown	
	5	SS	S-3	31-65-78-71	143	1.1	SP	Same as S-2, except gravel is angular to subangular upto 1.5 in. max	
				(18"/24")					
		SS	S-4	35-37-39-30	76	0	SP	Same as S-2 except very wet	
				(16"/24")					
	10	SS	S-5	19-28-38-32	33	0	SP	Same as S-2 with slight gradation in sand matrix	
				(18"/24")					
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of ASPHALT

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB17 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/17/1999 Date End: 11/17/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 10.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/17/1999		6.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0	SS	S-1	15-22-42-45	64	0	SP	Gravelly FILL, poorly sorted, angular to subround, 20-25% gravel upto 1.0 in. max., mostly	(1)
				(16"/24")				coarse to medium subangular to subrounded sand, 5-10% fines, v.dense, moist, brown	
		SS	S-2	40-46-81-52	127	0.1	SP	Gravelly SAND, angular to subround, poorly sorted 10-15% gravel upto 1.75 in. max., subround	
				(15"/20")				coarse to fine sand, 5-10% fines, v. dense, moist, brown to light brown	
	5	SS	S-3	24-26-42-46	68	0.4	SP	Same as S-2, except increase in fines upto 15%, moist, v.dense, grayish tan	
				(20"/24")					
		SS	S-4	41-38-37-19	75	0.1	SW	Same as S-3 except wet, abrupt change to a well sorted subround to round, coarse to medium	
				(23"/24")				sand, 0-5 % fines, wet, v.dense, brown	
		SS	S-5	8-13-15-19	28	0	SW	Same as the bottom 5" of S-4 with a gradational change to a medium to fine sand	
	10			(24"/24")					
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of ASPHALT

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

N:\Hazwaste\BROCKTON\Field\Boring Logs\[Boring Log BR-17.xls]Sheet1

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB18 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/18/1999 **Date End:** 11/18/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 8.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/18/1999		6.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery / RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description / Unified Classification System	Remarks
	0								
		SS	S-1	10-15-30-17	45	0.5	SP	Gravelly FILL, poorly sorted, angular to subround, 20-25% gravel upto 1.0 in. max., mostly coarse to medium subangular to subrounded sand, 5-10% fines, dense, moist, brown	(1)
				(20"/24")					
		SS	S-2	10-9-9-7	18	0.7	SP	Same as S-1 except max diameter of gravel is .25 in., loose to m.dense, tan ro brown	
				(18"/20")					
	5	SS	S-3	10-5-4-3	9	0.5	SP	Same as S-2, except Gravelly SAND increase in fines upto 15%, moist, loose, grayish tan	
				(20"/24")					
		SS	S-4	29-10-9-18	19	1.1	SM	Same as S-3 except wet, gradational change with an increase in fines upto 25% m.dense, brown	
				(13"/24")					
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches consisted of grass and organic roots and debris

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB19 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/19/1999 Date End: 11/19/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: Depth to Bedrock:
Total Depth Drilled: 8.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/19/1999		6.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery / RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description / Unified Classification System	Remarks
	0	SS	S-1	11-10-11-15	21	0.5	SP	Sandy FILL, poorly sorted, angular to subround, 5-10% gravel upto 0.25 in. max., mostly	(1)
				(16"/24")				coarse to medium subangular to subrounded sand, 5-10% fines, m. dense, moist, brown	
		SS	S-2	15-15-15-13	30	0.7	SP	Same as S-1 except tan to brown	
				(12"/20")					
	5	SS	S-3	14-24-29-25	54	0.5	SM	Silty SAND, subround to round moderately sorted, gravel 5-10% upto 0.25 in. max, mostly mediu	
				(20"/24")				to fine sand, 15-20% fines, damp, v.dense, grayish tan	
		SS	S-4	22-15-13-10	28	1.1	SM	Same as S-3 except wet, gradational change, dense, with an increase in fines upto 25%	
				(13"/24")					
	10								
	15								
	20								
	25								
	30								

Remarks:
(1) Top 3" inches ASPHALT

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

Stone & Webster Engineering Corporation	BORING LOG	Boring: BRSWSB20 Job Number: 05000.33 Sheet: 1 of 1

Site: Brockton Army Reserve
Client: USACE
Coordinates:
Contractor: N.H. Boring
Foreman: Ken Smith

Date Start: 11/19/1999 **Date End:** 11/19/1999
S&W Geologist/Eng.: T. Davdison
Ground Elevation: **Depth to Bedrock:**
Total Depth Drilled: 17.0'
Drill Rig Type: Mobile B-59

Methods:
Soil Drilling: 4.5" I.D. H.S.A.
Soil Sampling: Split Spoon
Rock Coring:
Casing Size:
Other:

Groundwater Readings

Date	Time	Water at:	Stabilization Time:
11/19/1999		5.0 ft	

Comments:

Elev. (feet)	Depth (feet)	Sample Type	Sample No.	Blows or Recovery RQD	SPT N Value	PID (ppm)	USC Symbol	Sample Description Unified Classification System	Remarks
	0								
	5								
	10	SS	S-1	21-32-21-24 (20"/24")	53	46.1	SP	Gravelly SAND, poorly sorted, subangular to subround, gravel 20-25% upto 1.5 in. max, mainly coarse to fine sand, 0-5% fines, wet, v.dense, greenish gray with petrolleum sheen present	
		SS	S-2	30-36-100/3" (13"/15")	36	19.2	SM	Silty SAND, moderately sorted, subround to round, 0-5% gravel upto 0.25 in. max, mainly M-F sand, 15-20% fines, wet, m.dense, light tan to gray, petrolleum odor present	(1)
	15	SS	S-3	24-48-52-48 (21"/24")	50	0.7	SM	Same as S-2 but,v.dense, and no petrolleum odor or sheen present	
	20								
	25								
	30								

Remarks:
(1) Spoon encountered rock, rock fragment lodged in tip

Legend/Notes: Datum:
Indicates location of samples
Blows = number of blows required to drive 2" O.D. sampling spoon 6" or distance shown using 140 pound hammer falling 30".
* indicates use of 300 pound hammer
( ) = inches of sample recovery
Recovery = % rock core recovery
RQD = Rock Quality Density
SPT N = Standard Penetration Test resistance to driving, blows/ft.
USC= Unified Soil Classification system

Sample Type:
SS = Split Spoon Sample
HQ=HQ Wireline Rock Core
PP= Pocket Penetrometer
Reading (tsf)

Approved	Date

APPENDIX G

MONITORING WELL COMPLETION LOGS

NOTES:

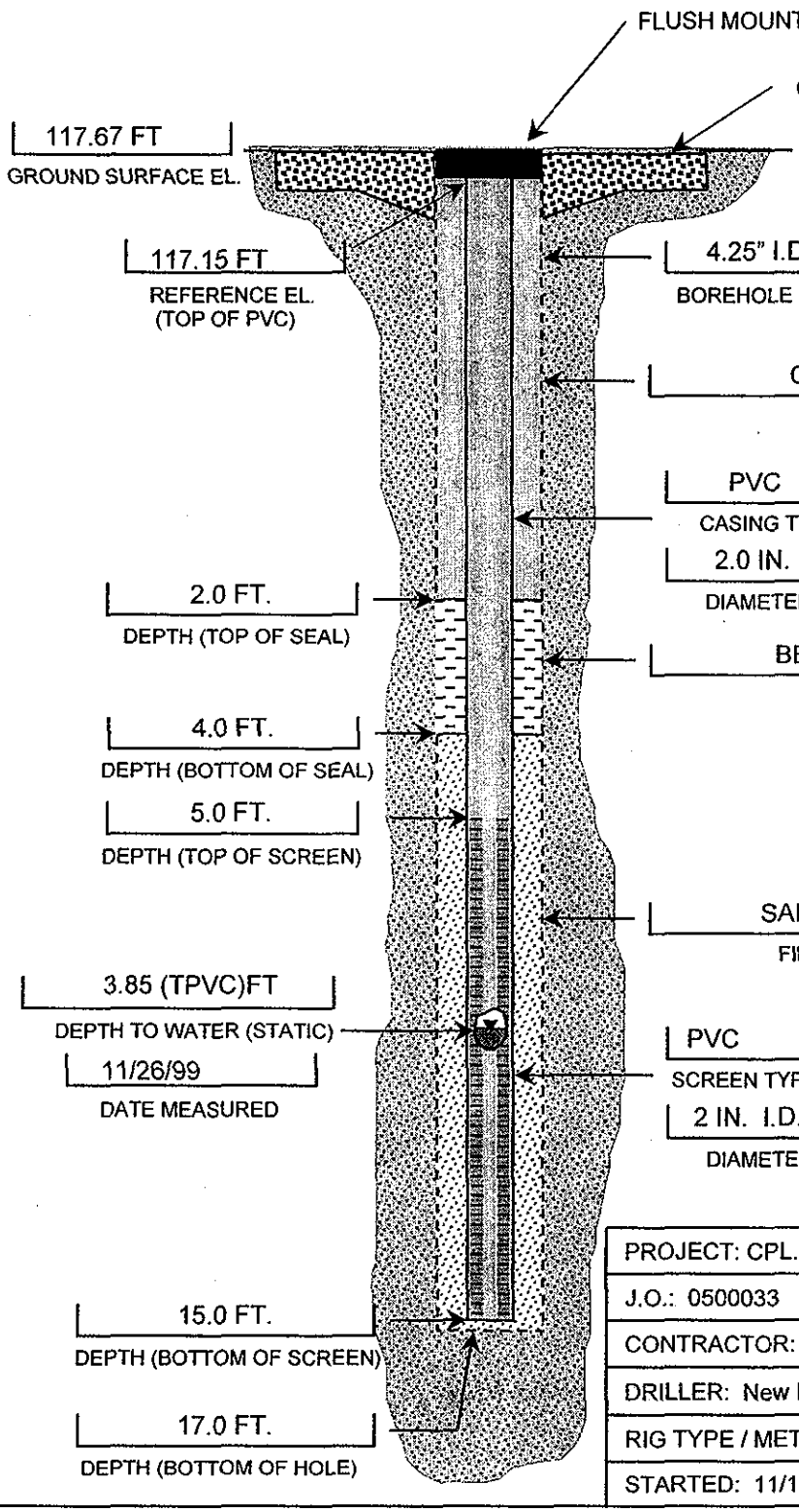
1. ALL DEPTHS MEASURED AS BGS. UNLESS OTHERWISE NOTED.
2. DRAWING NOT TO SCALE.

MONITORING WELL LOG
BRSWMW13 (BRSWSB02)

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGIES AND SERVICES

Northing: 2919639.7759

Easting: 812171.1512



PROJECT: CPL. Gordon Craig Army Reserve Center	
J.O.: 0500033	CLIENT: USACE
CONTRACTOR: Stone & Webster	
DRILLER: New Hampshire Boring	
RIG TYPE / METHOD: Hollow Stemmed Auger	
STARTED: 11/17/99	COMPLETED: 11/17/99

NOTES:

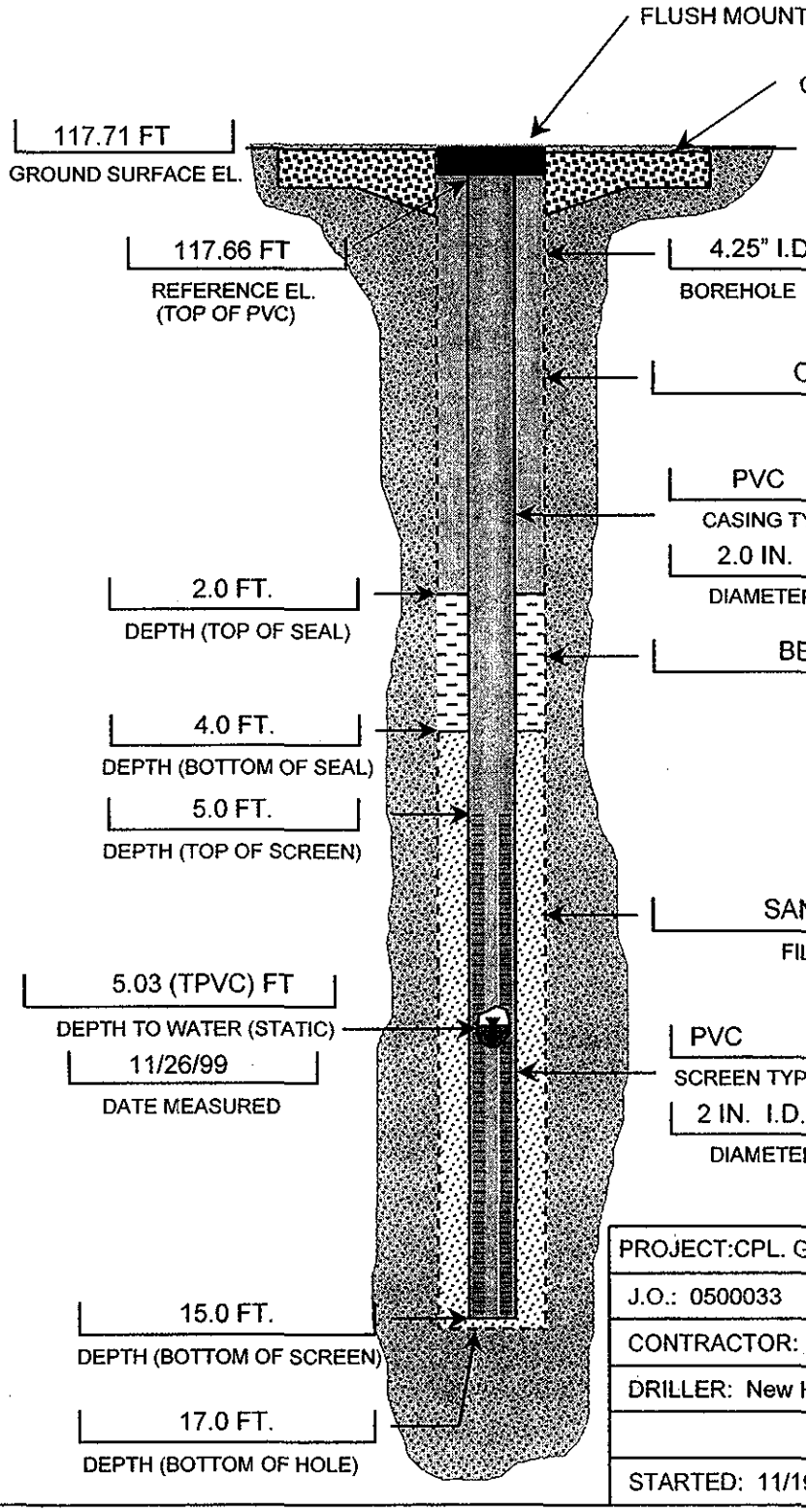
1. ALL DEPTHS MEASURED AS BGS. UNLESS OTHERWISE NOTED.
2. DRAWING NOT TO SCALE.

MONITORING WELL LOG
BRSWMW14 (BRSWSB14)

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGIES AND SERVICES

Northing: 2919639.7759

Easting: 812171.1512



PROJECT:CPL. Gordon Craig Army Reserve Center	
J.O.: 0500033	CLIENT: USACE
CONTRACTOR: Stone & Webster	
DRILLER: New Hampshire Boring	
STARTED: 11/19/99	COMPLETED: 11/19/99

NOTES:

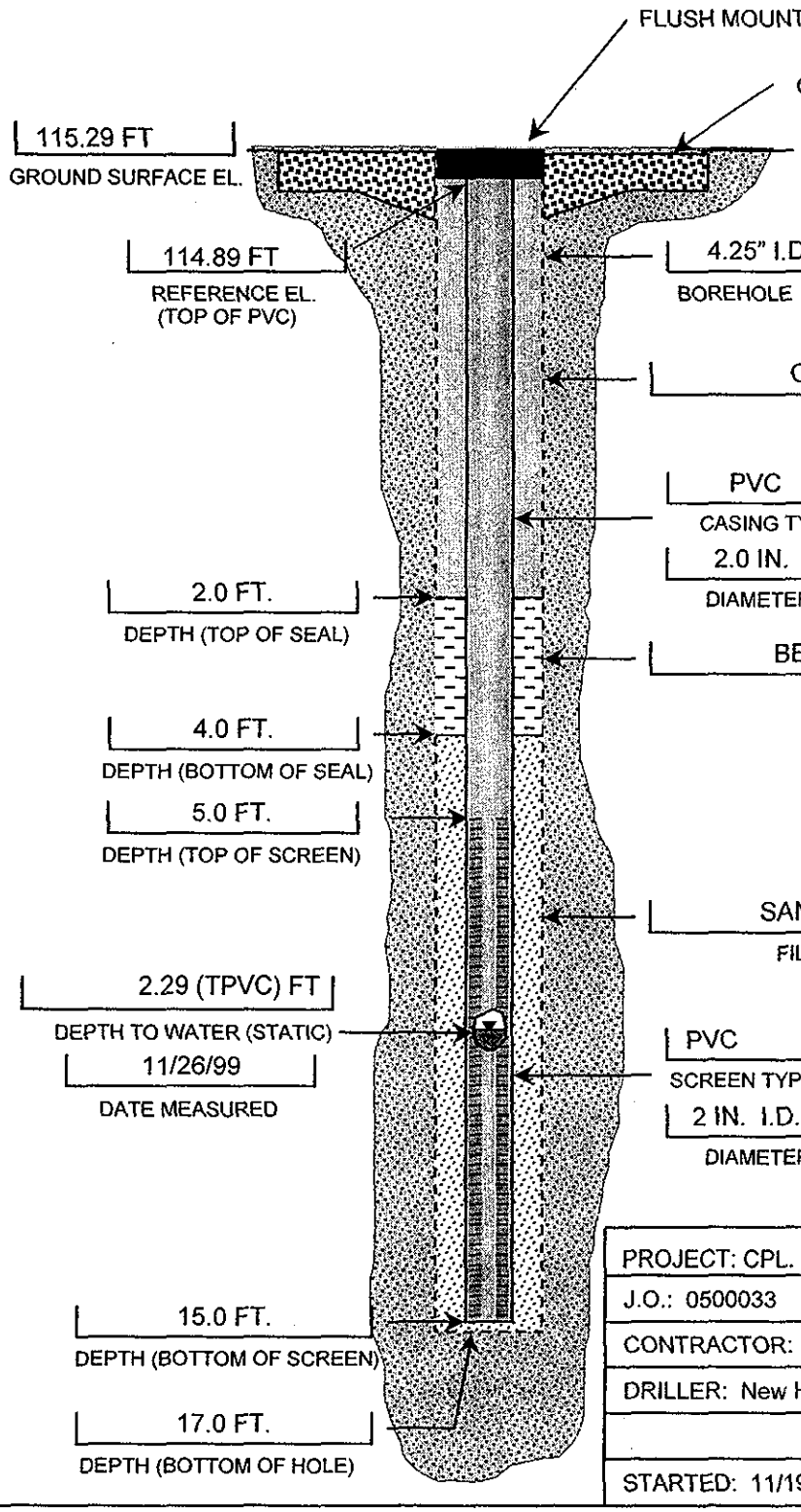
1. ALL DEPTHS MEASURED AS BGS. UNLESS OTHERWISE NOTED.
2. DRAWING NOT TO SCALE.

MONITORING WELL LOG
BRSWMW15 (BRSWSB15A)

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGIES AND SERVICES

Northing:

Easting:



PROJECT: CPL. Gordon Craig Army Reserve Center	
J.O.: 0500033	CLIENT: USACE
CONTRACTOR: Stone & Webster	
DRILLER: New Hampshire Boring	
STARTED: 11/19/99	COMPLETED: 11/19/99

APPENDIX H

GROUNDWATER FIELD ANALYSIS FORMS

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B1 Date: 11/29/99
Sample ID: BRSWGW01
Company: Stone & Webster
Sampler: K. Syrigos/ J.Coyne

Depth to screen = 7 ft (top)/ 17 ft (bottom) (bgs)
Pump intake set at 12 feet (topvc)
Purging Device (pump type): Whale Pump
Initial depth to water = 4.55 feet (topvc)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
1130	6.55	NC	1.000	12.68	994.000	2.59	6.38	167.0	25.10	-----
1135	6.70	NC	1.300	12.94	1000.000	2.00	6.34	168.0	16.50	-----
1140	6.75	NC	1.500	12.83	1001.000	1.63	6.32	167.3	14.50	-----
1145	6.75	NC	2.00	12.49	1002.000	1.48	6.32	166.7	9.80	-----
1150	7.10	0.250	2.500	12.72	1009.000	1.17	6.31	159.1	8.60	-----
1155	6.89	0.250	2.80	12.38	1004.000	1.12	6.30	157.9	7.10	-----
1200	6.92	0.250	3.500	12.63	992.000	0.92	6.30	152.0	4.98	-----

Notes: Final depth to water=6.92 ft (topvc)
PID: 0.0 ppm

------ = Information was not collected.

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet
min = minute
C = Celcius
mS = millisiemens
cm = centimeters
ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units
NC= not collected

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B2 Date: 11/29/99
Sample ID: BRSWGW02
Company: Stone & Webster
Sampler: K. Syrigos/ J. Coyne

Depth to screen = 7.3 ft (top)/ 12.3 ft (bottom) (bgs)
Pump intake set at 10 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 4.57 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
1310	5.30	0.250	0.5	12.44	638.000	6.26	6.52	192.4	127.00	-----
1315	5.25	0.300	1.0	11.56	641.000	6.12	6.46	200.3	85.00	-----
1320	5.65	0.250	1.5	12.50	651.000	5.75	6.39	208.1	82.2	-----
1325	5.65	0.250	2.0	12.15	668.000	5.58	6.33	207.4	34.50	-----
1330	5.85	0.250	2.3	12.57	639.000	5.38	6.30	208.1	29.00	-----
1335	5.85	0.250	2.5	12.71	635.000	5.31	6.25	209.7	36.20	-----
1340	6.10	0.250	3.0	13.07	651.000	5.29	6.19	208.0	36.20	
1345	6.35	0.250	4.0	13.37	644.000	5.26	6.15	207.6	31.50	
1350	6.25	NC	4.5	13.21	656.000	5.61	6.11	204.5	NC	

Notes:
PID = 0.0 ppm.
------ = *Information was not collected.*

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet

min = minute
C = Celcius
mS = millisiemens
cm = centimeters

ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units
NC= not collected

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B3 Date 12/01/99
Sample ID: BRSWGW03
Company: Stone & Webster
Sampler: K. Syrigos/ J. Coyne

Depth to screen = 4.3 ft (top)/ 14.3 ft (bottom) (bgs)
Pump intake set at 9 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 5.17 feet (to pvc)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
830	7.35	0.500	0.50	11.66	258.000	8.64	5.87	164.5	174.00	-----
840	7.29	0.500	1.00	11.83	291.000	4.06	5.50	42.6	230.00	-----
845	7.65	0.400	1.50	11.79	308.000	8.50	5.90	5.0	300.00	-----
850	7.15	0.500	2.00	11.47	303.000	6.28	5.90	3.2	290.00	-----
855	7.30	0.500	2.50	12.01	303.000	1.10	5.94	-0.3	290.00	-----
900	7.22	0.200	2.80	11.97	303.000	0.74	5.93	-1.3	230.00	
905	6.60	0.200	3.00	10.17	302.000	1.25	5.95	-1.3	200.00	
908	7.05	NC	4.00	11.25	307.000	0.86	5.94	-2.0	205.00	-----

Notes: PID= 0.0 ppm.

------ = Information was not collected.

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet

min = minute
C = Celcius
mS = millisiemens
cm = centimeters

ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units
NC= not collected

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B7D Date 12/01/99
Sample ID: BRSWGW07D
Company: Stone & Webster
Sampler: K. Syrigos/J. Coyne

Depth to screen = 12 ft (top)/ 32 ft (bottom) (bgs)
Pump intake set at 30 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 9.98 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
1005	9.98	0.400	0.3	12.33	61.000	6.75	5.82	102.4	22	-----
1008	10.80	0.400	0.5	10.79	61.000	5.78	5.52	127.2	17.00	-----
1011	11.15	NC	1.0	11.24	61.000	5.45	5.35	143.9	NC	-----

Note: Due to the amount of water being purged, this well was pumped dry on 12/01/99 and sampled later that day.
------ = Information was not collected.

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet
min = minute
C = Celcius
mS = millisiemens
cm = centimeters
ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units
NC= not collected

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B6 Date 12/01/99
Sampe ID: BRSWGW06
Company: Stone & Webster
Sampler:K. Syrigos/ J. Coyne

Depth to screen = 8.3 ft (top)/ 18.3 ft (bottom) (bgs)
Pump intake set at 13 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 6.42 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
1230	7.17	0.200	0.3	10.58	2412.000	7.55	6.73	167.6	450.00	-----
1233	7.41	0.400	0.4	10.49	2104.000	5.76	6.78	162.1	286.00	-----
1236	8.05	NC	NC	NC	NC	NC	NC	NC	NC	-----

Note: Due to the amount of water being purged, this well was pumped dry on 12/01/99 and sampled later that day.
PID=0.0 ppm
------ = Information was not collected.

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet

min = minute
C = Celcius
mS = millisiemens
cm = centimeters

ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units
NC= not collected

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B8 Date: 12/01/99
Sample ID: BRSWGW08
Company: Stone & Webster
Sampler: K. Syrigos/ J. Coyne

Depth to screen = 3.5 ft (top)/ 13.5 ft (bottom) (bgs)
Pump intake set at 3.5 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 3.2 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
1402	3.51	0.150	<0.25	11.54	131.000	2.42	6.34	192.8	160.00	-----
1405	3.28	0.300	<0.25	10.31	132.000	2.09	6.17	194.6	95.00	-----
1408	3.49	0.300	0.3	11.22	130.000	1.60	6.06	196.6	72.00	-----
1409	3.59	0.300	NC	NC	NC	NC	NC	NC	NC	-----

Notes: Due to falling water levels, purged 4 gallons from the well dry on 12/01/99 and sampled later that day.
PID=0.07 ppm.
------ = Information was not collected.

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet
min = minute
C = Celcius
mS = millisiemens
cm = centimeters
ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: BRSWMW14 Date 12/02/99
Sample ID: BRSWGW14
Company: Stone & Webster
Sampler: K. Syrigos/ J. Coyne

Depth to screen = 5 ft (top)/ 15 ft (bottom) (bgs)
Pump intake set at 10 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 5.25 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
845	5.75	0.300	0.5	12.68	252.000	2.94	8.42	164.8	40.00	
850	5.66	0.300	1.0	11.57	246.000	2.61	7.98	167.4	28.00	
900	5.62	0.600	1.3	11.61	246.000	2.48	7.64	168.7	25.00	
905	5.66	0.600	1.5	12.33	240.000	2.37	7.53	163.7	20.00	
908	5.60	0.300	2.0	11.91	236.000	2.49	7.37	162.3	18.00	
911	5.74	0.300	2.5	11.93	232.000	2.49	7.25	160.1	15.00	
915	5.55	0.300	3.0	11.28	226.000	2.54	7.14	155.3	15.70	
920	5.50	0.300	3.5	11.44	229.000	2.52	7.10	152.3	13.00	

Notes: PID=0.0 ppm

------ = Information was not collected.

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet

min = minute
C = Celcius
mS = millisiemens
cm = centimeters

ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units
NC=not collected

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B12 Date 12/02/99
Sample ID: BRSWGW12
Company: Stone & Webster
Sampler: K.Syrigos/ J. Coyne

Depth to screen = 3 ft (top)/ 18 ft (bottom) (bgs)
Pump intake set at 10 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 5.90 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
1015	6.45	0.300	0.3	13.34	196.00	4.43	6.90	182.7	146.00	-----
1020	6.51	0.400	0.5	13.55	200.00	3.63	6.81	185.9	108.00	-----
1030	6.45	0.300	0.8	13.12	198.00	3.73	6.73	186.8	105.00	-----
1032	6.43	0.300	1.0	13.37	197.00	3.63	6.73	187.4	75.00	-----
1035	6.48	0.300	1.3	13.33	194.00	3.30	6.69	190.4	75.00	-----
1038	6.51	0.300	1.8	13.43	194.00	3.00	6.69	192.5	74.00	-----

Notes: PID= 0.2 ppm.

NC = *Not Collected*
topvc = top of pvc
hrs = hours
bgs = below ground surface

ft = *feet*
min = minute
C = Celcius
mS = millisiemens

cm = centimeters
ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: BRSWMW15 Date 12/02/99
Samplel ID: BRSWGW15
Company: Stone & Webster
Sampler: K.Syrigos/J.Coyne

Depth to screen = 5 ft (top)/ 15 ft (bottom) (bgs)
Pump intake set at 10 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 2.8 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
1209	3.60	0.300	<0.25	11.95	153.000	5.81	6.93	123.1	86.00	-----
1212	3.70	0.200	<0.25	12.04	153.000	4.11	6.90	131.5	100.00	-----
1215	3.60	0.200	0.25	12.21	152.000	3.56	6.83	132.8	111.00	-----
1218	3.80	0.200	0.25	12.25	153.000	3.30	6.77	120.9	117.00	-----
1221	4.00	NC	NC	NC	NC	NC	NC	NC	NC	-----

Notes: Due to falling water levels, well was pumped dry on 12/02/99 and sampled later that day at 1330.

------ = Information was not collected.

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet

min = minute
C = Celcius
mS = millisiemens
cm = centimeters

ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: BRSWMW13 Date: 12/03/99
Well ID: BRSWGW13
Company: Stone & Webster
Sampler: J. Coyne / K. Syrigos

Depth to screen = 5 ft (top)/ 15 ft (bottom) (bgs)
Pump intake set at 10 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 4.39 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
906	4.90	0.20	0.30	13.91	498.00	1.41	7.59	-84.4	215	-----
910	5.00	0.20	0.80	13.29	487.00	1.29	6.94	-75.4	122	-----
915	5.11	NC	1.0	13.48	488.00	1.01	6.84	-78.7	NC	-----

Notes: Due to constant drawdown even at the lowest pumping rates, the well was pumped dry on 12/03/99 and sampled later that day.
PID = 0.0 ppm.
------ = Information was not collected.

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet

min = minute
C = Celcius
mS = millisiemens
cm = centimeters

ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units
NC= not collected

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B5A Date 12/03/99
Sample ID: BRSWGW05A
Company: Stone & Webster
Sampler: K. Syrigos/J. Coyne

Depth to screen = 4.3 ft (top)/ 14.3 ft (bottom) (bgs)
Pump intake set at 9.3 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 7.45 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh (mv)	Turbidity (NTU)	Comments
945	7.55	0.400	0.3	13.97	154.000	1.09	6.71	64.0	89.0	-----
950	7.51	0.200	0.5	13.64	124.000	1.00	6.51	68.2	65.0	-----
953	7.49	0.200	0.9	13.05	204.000	1.32	6.47	66.5	55.0	-----
955	7.51	0.300	1.0	13.11	235.000	1.23	6.46	64.0	38.0	
1000	7.56	NC	NC	NC	NC	NC	NC	NC	NC	-----

Notes: Due to falling water levels, the well was pumped dry on 12/03/99 and sampled later that day. PID=6.0 ppm.
------ = Information was not collected.

GROUND WATER FIELD ANALYSIS FORMS

Location: Brockton
Well ID: B5A Date 12/03/99
Sample ID: BRSWGW05A
Company: Stone & Webster
Sampler: K. Syrigos/J. Coyne

Depth to screen = 4.3 ft (top)/ 14.3 ft (bottom) (bgs)
Pump intake set at 9.3 feet (bgs)
Purging Device (pump type): Whale Pump
Initial depth to water = 7.45 feet (bgs)

Time (24 hrs)	Water Depth (topvc) (ft)	Flow Rate (liters/min)	Cumulative Volume Purged (gallons)	Temp (C)	Specific Cond (mS/cm)	Dissolved Oxygen (mg/l)	pH	ORP/Eh. (mv)	Turbidity (NTU)	Comments
945	7.55	0.400	0.3	13.97	154.000	1.09	6.71	64.0	89.0	-----
950	7.51	0.200	0.5	13.64	124.000	1.00	6.51	68.2	65.0	-----
953	7.49	0.200	0.9	13.05	204.000	1.32	6.47	66.5	55.0	-----
955	7.51	0.300	1.0	13.11	235.000	1.23	6.46	64.0	38.0	
1000	7.56	NC	NC	NC	NC	NC	NC	NC	NC	-----

Notes: Due to falling water levels, the well was pumped dry on 12/03/99 and sampled later that day. PID=6.0 ppm.
----- = *Information was not collected.*

topvc = top of pvc
hrs = hours
bgs = below ground surface
ft = feet

min = minute
C = Celcius
mS = millisiemens
cm = centimeters

ORP = Oxidation-Reduction Potential
mv = millivolts
NTU = Nephelometric Turbidity Units
NC= not collected

APPENDIX I

HAZARDOUS WASTE MANIFEST

(66) 16-18
19-21

66-19-18
19-21

GCC FILE # 43514

[redacted]

NON-HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No.	Manifest Document No. 12375	2. Page 1 of 1

3. Generator's Name and Mailing Address
CRAIG RESERVE CENTERS
NATIONAL GUARD (BROCKTON)
WEST CHESTNUT STREET BROCKTON MA. 02402

4. Generator's Phone ( ) 508-583-8569 ,MA

5. Transporter 1 Company Name	6. US EPA ID Number	A. Transporter's Phone
GENERAL CHEMICAL CORPORATION	MAD019371079	
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone
		508-872-50
9. Designated Facility Name and Site Address	10. US EPA ID Number	C. Facility's Phone
GENERAL CHEMICAL CORPORATION 133 LELAND STREET FRAMINGHAM MA 01702	MAD019371079	508-872-50

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. NON RCRA NON DOT REGULATED MATERIAL (NON HAZARDOUS SOIL)	03	DM	2100	MA99 P
b. NON RCRA NON DOT REGULATED MATERIAL (PURGE WATER)	03	DM	105	MA99 G
c.				
d.				

GENERATOR

D. Additional Descriptions for Materials Listed Above	E. Handling Codes for Wastes Listed Above
Auth. # 947-09 (0001)	S 0 1
Auth. # 947-10 (0002)	S 0 1

15. Special Handling Instructions and Additional Information

GENERAL CHEMICAL (508)827-5000

16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year
PETER W. THOMSON	Peter W. Thomson	03	06	00

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Carl Hyland	Carl Hyland	03	06	00

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
SANDY FOSTER	Sandy Foster	03	09	00

[redacted]

ORIGINAL - RETURN TO GENERATOR

APPENDIX J

HYDRAULIC CONDUCTIVITY TEST METHOD AND CALCULATIONS

METHOD OF SLUG TEST ANALYSES

Aquifer testing in accordance with the Bouwer and Rice slug test method (1976) was performed on newly installed wells MW-13, MW14, and MW-15. This method is based on the geometry of the well and the rate of recovery of the groundwater level with in the well after a known volume is quickly removed from the equilibrated well. By quickly changing the water level from equilibrium and measuring its subsequent rate of recovery, the slug test allows for the measurement of saturated hydraulic conductivity (K) of the surrounding aquifer substrate using the well and transducer geometry in accordance with the following equation.

$$K = \frac{r_c \ln(R_e/r_w)}{2L_e} \frac{1}{t} \ln \frac{y_o}{y_t}$$

where,

- r_c = the diameter of the well (ft)
- R_e = the effective radial distance over which y is dissipated
- r_w = radial distance of the undisturbed portion of the aquifer from the centerline (ft)
- L_e = the length of screened or otherwise open section of well that is in the groundwater (ft)
- y_o = vertical difference between groundwater level inside the well at equilibrium and the static water level outside the well (ft)
- y_t = vertical difference between water level inside the well at time t and static water level outside the well (ft)
- t = time (sec)

Of these parameters, all are determined from measured values except for Re, which is discussed in further detail below.

For this project, only rising head slug tests were performed. Having measured the static groundwater levels, and lowering a known slug volume into the well and allowing for it to equilibrate to the original static level. The slug was removed and groundwater levels were monitored with time until re-equilibration occured at all slug test locations. The rate of groundwater recovery was recorded utilizing a Troll® 2000 data logger and pressure transducer.

In order to assess the data, other geometric values for the well were also measured, assumed, or calculated. These include the following:

- L_w = distance from static water level to bottom of the well (ft)
- D_o = depth of static water level (ft)
- D_t = depth of water level at time t (ft)
- r_c = diameter of well (ft)
- r_{cable} = diameter of pressure transducer cable (ft)

H = height of the water to bedrock or confining layer (ft)
n = porosity of the soil surrounding the screen

All the wells for this project we installed with 2 inch inside diameter (ID) PVC riser and screened pipes; thus r_c equals 0.0833 (ft). However, R_e, the effective radial distance over which y is dissipated, must take into account the cross-sectional area of the Troll® 2000 cable, which has a 0.25 inch-diameter. The effective radius is then calculated as:

$$R_e = \{[PI*(r_c)^2 - PI*(r_{cable})^2]/PI\}^{0.5}$$

Therefore, R_e equals 0.8268 feet. As the hollow stem augers used to drill the wells were 8 inches outside diameter (OD), the distance from the center of the well to the normal K of the aquifer is estimated to be 4 inches, i.e. $r_w = 0.33$ feet. The length of the screen for each well is 10 feet. To determine the value of Le at each well, the depth of water must be taken into account. For those wells where the screen is below the water table, L_e equals the entire length of the screen. Otherwise, (as is the case for all the wells at this site) L_e equals the depth of the water minus the depth to the bottom of the screen. Similarly, L_w equals the depth of water minus the depth to the bottom of the well. The value of y_t is calculated as the difference between the water level measurement after it has been displaced at time t and the static measurement. The value of H is calculated as the depth of the bedrock or confining layer minus the depth of the water table. The value of n is taken as the porosity of the sand packing as is assumed to be 0.25.

Using these geometric dimensions, the effective radial distance over which y is dissipated (R_e) is determined in terms of the dimensionless ratio $\ln(R_e/r_w)$. R_e has been determined for various systems using an electrical resistance network analog. The resulting data has been fitted to into two equations, one for $L_w < H$ and one for $L_w = H$. Constants A and B act in the equation of the former, while constant C is for the latter. Using these empirical curves of the dimensionless parameters A, B, and C as a function of L_e/r_w, $\ln(R_e/r_w)$ can be calculated.

The value of K is calculated on the basis of several y and t values. Values of y_t and t are plotted and a best-fit line transects the data points. Data points are extracted and utilized in the aforementioned equation to calculate K. Only the best fit straight line should be utilized to evaluate the slope for the equation K, because as t increases and y decreases it deviates from the straight line.

Often there are two straight-line portions of the response curve; this is known as the double straight-line effect. The first line is a result of the high permeability of the wells surrounding gravel or sand pack. The water in this permeable zone quickly migrates into the well. Once this water has drained water from the surrounding stratum migrates in at a slower rate yielding a second linear feature. This line is more indicative of the ground water flow rates in the undisturbed aquifer. When calculating K for a well with the double straight-line effect one should use the slope of the second line that characterizes the native materials.

IN_SITU INC. Troll

Report generated: 02/02/2000 17:44:50
Report from file: C:\WINSITU\DATA\MW-2OUT.BIN
DataMgr Version 2.19.0.0

Serial number: 11909
Firmware Version 7.08
Unit name:

Test name: MW-2 (slugout)

Test defined on: 11/23/1999 10:54:45
Test started on: 11/23/1999 10:55:02
Test stopped on: 11/23/1999 11:44:44
Test extracted on: 11/23/1999 14:51:20

Data gathered using Linear testing
Time between data point Minutes.
Number of data samples: 995

TOTAL DATA SAMPLES 995

Channel number [1]
Measurement type: Temperature
Channel name: Temperature

Channel number [2]
Measurement type: Pressure/Level
Channel name: Pressure Head
Sensor Range: 30 PSI.
Specific gravity: 1

Date	Time	ET (min)	Chan[1] Celsius	Chan[2] Meters H2O	Feet H2O
11/23/1999	10:55:02	0	17.14	3.191	10.46648
11/23/1999	10:55:05	0.05	17.15	3.191	10.46648
11/23/1999	10:55:08	0.1	17.15	3.191	10.46648
11/23/1999	10:55:11	0.15	17.15	3.191	10.46648
11/23/1999	10:55:14	0.2	17.15	3.191	10.46648
11/23/1999	10:55:17	0.25	17.15	3.191	10.46648
11/23/1999	10:55:20	0.3	17.15	3.167	10.38776
11/23/1999	10:55:23	0.35	17.15	2.993	9.81704
11/23/1999	10:55:26	0.4	17.15	3.079	10.09912
11/23/1999	10:55:29	0.45	17.15	3.101	10.17128
11/23/1999	10:55:32	0.5	17.15	3.113	10.21064

11/23/1999	10:55:35	0.55	17.15	3.123	10.24344
11/23/1999	10:55:38	0.6	17.14	3.126	10.25328
11/23/1999	10:55:41	0.65	17.14	3.129	10.26312
11/23/1999	10:55:44	0.7	17.15	3.131	10.26968
11/23/1999	10:55:47	0.75	17.15	3.134	10.27952
11/23/1999	10:55:50	0.8	17.14	3.135	10.2828
11/23/1999	10:55:53	0.85	17.15	3.138	10.29264
11/23/1999	10:55:56	0.9	17.15	3.138	10.29264
11/23/1999	10:55:59	0.95	17.14	3.141	10.30248
11/23/1999	10:56:02	1	17.15	3.142	10.30576
11/23/1999	10:56:05	1.05	17.15	3.142	10.30576
11/23/1999	10:56:08	1.1	17.15	3.143	10.30904
11/23/1999	10:56:11	1.15	17.15	3.143	10.30904
11/23/1999	10:56:14	1.2	17.15	3.145	10.3156
11/23/1999	10:56:17	1.25	17.15	3.145	10.3156
11/23/1999	10:56:20	1.3	17.15	3.145	10.3156
11/23/1999	10:56:23	1.35	17.15	3.145	10.3156
11/23/1999	10:56:26	1.4	17.15	3.146	10.31888
11/23/1999	10:56:29	1.45	17.15	3.146	10.31888
11/23/1999	10:56:32	1.5	17.15	3.146	10.31888
11/23/1999	10:56:35	1.55	17.15	3.146	10.31888
11/23/1999	10:56:38	1.6	17.15	3.146	10.31888
11/23/1999	10:56:41	1.65	17.15	3.148	10.32544
11/23/1999	10:56:44	1.7	17.15	3.148	10.32544
11/23/1999	10:56:47	1.75	17.15	3.148	10.32544
11/23/1999	10:56:50	1.8	17.15	3.148	10.32544
11/23/1999	10:56:53	1.85	17.15	3.148	10.32544
11/23/1999	10:56:56	1.9	17.15	3.149	10.32872
11/23/1999	10:56:59	1.95	17.15	3.149	10.32872
11/23/1999	10:57:02	2	17.15	3.149	10.32872
11/23/1999	10:57:05	2.05	17.15	3.149	10.32872
11/23/1999	10:57:08	2.1	17.15	3.149	10.32872
11/23/1999	10:57:11	2.15	17.15	3.149	10.32872
11/23/1999	10:57:14	2.2	17.15	3.149	10.32872
11/23/1999	10:57:17	2.25	17.15	3.149	10.32872
11/23/1999	10:57:20	2.3	17.15	3.149	10.32872
11/23/1999	10:57:23	2.35	17.15	3.15	10.332
11/23/1999	10:57:26	2.4	17.15	3.15	10.332
11/23/1999	10:57:29	2.45	17.15	3.15	10.332
11/23/1999	10:57:32	2.5	17.15	3.15	10.332
11/23/1999	10:57:35	2.55	17.15	3.152	10.33856
11/23/1999	10:57:38	2.6	17.15	3.152	10.33856
11/23/1999	10:57:41	2.65	17.15	3.15	10.332
11/23/1999	10:57:44	2.7	17.15	3.15	10.332
11/23/1999	10:57:47	2.75	17.15	3.15	10.332
11/23/1999	10:57:50	2.8	17.15	3.152	10.33856
11/23/1999	10:57:53	2.85	17.15	3.152	10.33856
11/23/1999	10:57:56	2.9	17.15	3.152	10.33856
11/23/1999	10:57:59	2.95	17.15	3.152	10.33856

11/23/1999	10:58:02	3	17.15	3.152	10.33856
11/23/1999	10:58:05	3.05	17.15	3.152	10.33856
11/23/1999	10:58:08	3.1	17.15	3.152	10.33856
11/23/1999	10:58:11	3.15	17.15	3.152	10.33856
11/23/1999	10:58:14	3.2	17.15	3.152	10.33856
11/23/1999	10:58:17	3.25	17.15	3.152	10.33856
11/23/1999	10:58:20	3.3	17.15	3.152	10.33856
11/23/1999	10:58:23	3.35	17.15	3.152	10.33856
11/23/1999	10:58:26	3.4	17.15	3.152	10.33856
11/23/1999	10:58:29	3.45	17.15	3.153	10.34184
11/23/1999	10:58:32	3.5	17.16	3.152	10.33856
11/23/1999	10:58:35	3.55	17.15	3.152	10.33856
11/23/1999	10:58:38	3.6	17.15	3.153	10.34184
11/23/1999	10:58:41	3.65	17.15	3.153	10.34184
11/23/1999	10:58:44	3.7	17.15	3.152	10.33856
11/23/1999	10:58:47	3.75	17.15	3.153	10.34184
11/23/1999	10:58:50	3.8	17.15	3.153	10.34184
11/23/1999	10:58:53	3.85	17.15	3.153	10.34184
11/23/1999	10:58:56	3.9	17.15	3.153	10.34184
11/23/1999	10:58:59	3.95	17.15	3.153	10.34184
11/23/1999	10:59:02	4	17.15	3.153	10.34184
11/23/1999	10:59:05	4.05	17.16	3.153	10.34184
11/23/1999	10:59:08	4.1	17.15	3.153	10.34184
11/23/1999	10:59:11	4.15	17.16	3.153	10.34184
11/23/1999	10:59:14	4.2	17.15	3.153	10.34184
11/23/1999	10:59:17	4.25	17.15	3.153	10.34184
11/23/1999	10:59:20	4.3	17.15	3.153	10.34184
11/23/1999	10:59:23	4.35	17.15	3.153	10.34184
11/23/1999	10:59:26	4.4	17.15	3.153	10.34184
11/23/1999	10:59:29	4.45	17.15	3.153	10.34184
11/23/1999	10:59:32	4.5	17.15	3.153	10.34184
11/23/1999	10:59:35	4.55	17.15	3.153	10.34184
11/23/1999	10:59:38	4.6	17.16	3.153	10.34184
11/23/1999	10:59:41	4.65	17.15	3.153	10.34184
11/23/1999	10:59:44	4.7	17.15	3.153	10.34184
11/23/1999	10:59:47	4.75	17.15	3.153	10.34184
11/23/1999	10:59:50	4.8	17.16	3.153	10.34184
11/23/1999	10:59:53	4.85	17.15	3.153	10.34184
11/23/1999	10:59:56	4.9	17.15	3.153	10.34184
11/23/1999	10:59:59	4.95	17.15	3.153	10.34184
11/23/1999	11:00:02	5	17.16	3.153	10.34184
11/23/1999	11:00:05	5.05	17.15	3.153	10.34184
11/23/1999	11:00:08	5.1	17.15	3.153	10.34184
11/23/1999	11:00:11	5.15	17.15	3.153	10.34184
11/23/1999	11:00:14	5.2	17.15	3.155	10.3484
11/23/1999	11:00:17	5.25	17.15	3.153	10.34184
11/23/1999	11:00:20	5.3	17.15	3.153	10.34184
11/23/1999	11:00:23	5.35	17.15	3.155	10.3484
11/23/1999	11:00:26	5.4	17.15	3.153	10.34184

11/23/1999	11:00:29	5.45	17.15	3.155	10.3484
11/23/1999	11:00:32	5.5	17.15	3.155	10.3484
11/23/1999	11:00:35	5.55	17.15	3.155	10.3484
11/23/1999	11:00:38	5.6	17.15	3.155	10.3484
11/23/1999	11:00:41	5.65	17.15	3.155	10.3484
11/23/1999	11:00:44	5.7	17.15	3.155	10.3484
11/23/1999	11:00:47	5.75	17.15	3.155	10.3484
11/23/1999	11:00:50	5.8	17.15	3.155	10.3484
11/23/1999	11:00:53	5.85	17.15	3.155	10.3484
11/23/1999	11:00:56	5.9	17.15	3.155	10.3484
11/23/1999	11:00:59	5.95	17.15	3.155	10.3484
11/23/1999	11:01:02	6	17.15	3.155	10.3484
11/23/1999	11:01:05	6.05	17.15	3.155	10.3484
11/23/1999	11:01:08	6.1	17.15	3.155	10.3484
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11/23/1999	11:01:17	6.25	17.15	3.155	10.3484
11/23/1999	11:01:20	6.3	17.15	3.155	10.3484
11/23/1999	11:01:23	6.35	17.15	3.155	10.3484
11/23/1999	11:01:26	6.4	17.15	3.155	10.3484
11/23/1999	11:01:29	6.45	17.15	3.156	10.35168
11/23/1999	11:01:32	6.5	17.15	3.155	10.3484
11/23/1999	11:01:35	6.55	17.15	3.156	10.35168
11/23/1999	11:01:38	6.6	17.15	3.155	10.3484
11/23/1999	11:01:41	6.65	17.15	3.156	10.35168
11/23/1999	11:01:44	6.7	17.15	3.156	10.35168
11/23/1999	11:01:47	6.75	17.15	3.156	10.35168
11/23/1999	11:01:50	6.8	17.15	3.156	10.35168
11/23/1999	11:01:53	6.85	17.15	3.155	10.3484
11/23/1999	11:01:56	6.9	17.15	3.156	10.35168
11/23/1999	11:01:59	6.95	17.15	3.156	10.35168
11/23/1999	11:02:02	7	17.15	3.156	10.35168
11/23/1999	11:02:05	7.05	17.15	3.156	10.35168
11/23/1999	11:02:08	7.1	17.15	3.156	10.35168
11/23/1999	11:02:11	7.15	17.15	3.156	10.35168
11/23/1999	11:02:14	7.2	17.15	3.156	10.35168
11/23/1999	11:02:17	7.25	17.15	3.156	10.35168
11/23/1999	11:02:20	7.3	17.15	3.157	10.35496
11/23/1999	11:02:23	7.35	17.15	3.156	10.35168
11/23/1999	11:02:26	7.4	17.15	3.157	10.35496
11/23/1999	11:02:29	7.45	17.15	3.157	10.35496
11/23/1999	11:02:32	7.5	17.15	3.156	10.35168
11/23/1999	11:02:35	7.55	17.15	3.156	10.35168
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11/23/1999	11:02:47	7.75	17.15	3.156	10.35168
11/23/1999	11:02:50	7.8	17.15	3.156	10.35168
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11/23/1999	11:02:56	7.9	17.15	3.156	10.35168
11/23/1999	11:02:59	7.95	17.15	3.156	10.35168
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11/23/1999	11:03:05	8.05	17.15	3.157	10.35496
11/23/1999	11:03:08	8.1	17.15	3.156	10.35168
11/23/1999	11:03:11	8.15	17.15	3.156	10.35168
11/23/1999	11:03:14	8.2	17.14	3.157	10.35496
11/23/1999	11:03:17	8.25	17.14	3.156	10.35168
11/23/1999	11:03:20	8.3	17.15	3.156	10.35168
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11/23/1999	11:03:29	8.45	17.14	3.156	10.35168
11/23/1999	11:03:32	8.5	17.14	3.157	10.35496
11/23/1999	11:03:35	8.55	17.14	3.156	10.35168
11/23/1999	11:03:38	8.6	17.14	3.157	10.35496
11/23/1999	11:03:41	8.65	17.14	3.157	10.35496
11/23/1999	11:03:44	8.7	17.15	3.157	10.35496
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11/23/1999	11:03:50	8.8	17.14	3.157	10.35496
11/23/1999	11:03:53	8.85	17.14	3.157	10.35496
11/23/1999	11:03:56	8.9	17.14	3.157	10.35496
11/23/1999	11:03:59	8.95	17.14	3.157	10.35496
11/23/1999	11:04:02	9	17.14	3.157	10.35496
11/23/1999	11:04:05	9.05	17.14	3.157	10.35496
11/23/1999	11:04:08	9.1	17.14	3.157	10.35496
11/23/1999	11:04:11	9.15	17.14	3.157	10.35496
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11/23/1999	11:04:17	9.25	17.14	3.157	10.35496
11/23/1999	11:04:20	9.3	17.14	3.157	10.35496
11/23/1999	11:04:23	9.35	17.14	3.157	10.35496
11/23/1999	11:04:26	9.4	17.14	3.157	10.35496
11/23/1999	11:04:29	9.45	17.14	3.157	10.35496
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11/23/1999	11:04:41	9.65	17.14	3.157	10.35496
11/23/1999	11:04:44	9.7	17.14	3.157	10.35496
11/23/1999	11:04:47	9.75	17.14	3.157	10.35496
11/23/1999	11:04:50	9.8	17.14	3.157	10.35496
11/23/1999	11:04:53	9.85	17.14	3.157	10.35496
11/23/1999	11:04:56	9.9	17.14	3.157	10.35496
11/23/1999	11:04:59	9.95	17.14	3.157	10.35496
11/23/1999	11:05:02	10	17.14	3.157	10.35496
11/23/1999	11:05:05	10.05	17.14	3.157	10.35496
11/23/1999	11:05:08	10.1	17.14	3.157	10.35496
11/23/1999	11:05:11	10.15	17.14	3.157	10.35496
11/23/1999	11:05:14	10.2	17.14	3.157	10.35496
11/23/1999	11:05:17	10.25	17.14	3.157	10.35496
11/23/1999	11:05:20	10.3	17.14	3.159	10.36152

11/23/1999	11:05:23	10.35	17.14	3.157	10.35496
11/23/1999	11:05:26	10.4	17.14	3.159	10.36152
11/23/1999	11:05:29	10.45	17.14	3.157	10.35496
11/23/1999	11:05:32	10.5	17.14	3.157	10.35496
11/23/1999	11:05:35	10.55	17.14	3.157	10.35496
11/23/1999	11:05:38	10.6	17.14	3.157	10.35496
11/23/1999	11:05:41	10.65	17.14	3.157	10.35496
11/23/1999	11:05:44	10.7	17.14	3.157	10.35496
11/23/1999	11:05:47	10.75	17.14	3.157	10.35496
11/23/1999	11:05:50	10.8	17.14	3.157	10.35496
11/23/1999	11:05:53	10.85	17.14	3.157	10.35496
11/23/1999	11:05:56	10.9	17.14	3.157	10.35496
11/23/1999	11:05:59	10.95	17.14	3.159	10.36152
11/23/1999	11:06:02	11	17.14	3.159	10.36152
11/23/1999	11:06:05	11.05	17.14	3.159	10.36152
11/23/1999	11:06:08	11.1	17.14	3.159	10.36152
11/23/1999	11:06:11	11.15	17.14	3.157	10.35496
11/23/1999	11:06:14	11.2	17.14	3.159	10.36152
11/23/1999	11:06:17	11.25	17.14	3.159	10.36152
11/23/1999	11:06:20	11.3	17.14	3.159	10.36152
11/23/1999	11:06:23	11.35	17.14	3.157	10.35496
11/23/1999	11:06:26	11.4	17.14	3.159	10.36152
11/23/1999	11:06:29	11.45	17.14	3.159	10.36152
11/23/1999	11:06:32	11.5	17.14	3.157	10.35496
11/23/1999	11:06:35	11.55	17.14	3.157	10.35496
11/23/1999	11:06:38	11.6	17.14	3.157	10.35496
11/23/1999	11:06:41	11.65	17.14	3.157	10.35496
11/23/1999	11:06:44	11.7	17.14	3.157	10.35496
11/23/1999	11:06:47	11.75	17.14	3.157	10.35496
11/23/1999	11:06:50	11.8	17.14	3.159	10.36152
11/23/1999	11:06:53	11.85	17.14	3.159	10.36152
11/23/1999	11:06:56	11.9	17.14	3.159	10.36152
11/23/1999	11:06:59	11.95	17.14	3.157	10.35496
11/23/1999	11:07:02	12	17.14	3.159	10.36152
11/23/1999	11:07:05	12.05	17.14	3.157	10.35496
11/23/1999	11:07:08	12.1	17.14	3.157	10.35496
11/23/1999	11:07:11	12.15	17.14	3.157	10.35496
11/23/1999	11:07:14	12.2	17.14	3.159	10.36152
11/23/1999	11:07:17	12.25	17.14	3.159	10.36152
11/23/1999	11:07:20	12.3	17.14	3.159	10.36152
11/23/1999	11:07:23	12.35	17.13	3.159	10.36152
11/23/1999	11:07:26	12.4	17.13	3.157	10.35496
11/23/1999	11:07:29	12.45	17.14	3.159	10.36152
11/23/1999	11:07:32	12.5	17.13	3.159	10.36152
11/23/1999	11:07:35	12.55	17.13	3.159	10.36152
11/23/1999	11:07:38	12.6	17.13	3.159	10.36152
11/23/1999	11:07:41	12.65	17.13	3.159	10.36152
11/23/1999	11:07:44	12.7	17.13	3.159	10.36152
11/23/1999	11:07:47	12.75	17.13	3.159	10.36152

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11/23/1999	11:07:53	12.85	17.14	3.159	10.36152
11/23/1999	11:07:56	12.9	17.13	3.159	10.36152
11/23/1999	11:07:59	12.95	17.13	3.159	10.36152
11/23/1999	11:08:02	13	17.14	3.159	10.36152
11/23/1999	11:08:05	13.05	17.13	3.159	10.36152
11/23/1999	11:08:08	13.1	17.13	3.159	10.36152
11/23/1999	11:08:11	13.15	17.13	3.159	10.36152
11/23/1999	11:08:14	13.2	17.13	3.159	10.36152
11/23/1999	11:08:17	13.25	17.13	3.159	10.36152
11/23/1999	11:08:20	13.3	17.13	3.159	10.36152
11/23/1999	11:08:23	13.35	17.13	3.159	10.36152
11/23/1999	11:08:26	13.4	17.13	3.159	10.36152
11/23/1999	11:08:29	13.45	17.13	3.159	10.36152
11/23/1999	11:08:32	13.5	17.13	3.159	10.36152
11/23/1999	11:08:35	13.55	17.13	3.159	10.36152
11/23/1999	11:08:38	13.6	17.13	3.159	10.36152
11/23/1999	11:08:41	13.65	17.13	3.159	10.36152
11/23/1999	11:08:44	13.7	17.12	3.157	10.35496
11/23/1999	11:08:47	13.75	17.13	3.157	10.35496
11/23/1999	11:08:50	13.8	17.13	3.159	10.36152
11/23/1999	11:08:53	13.85	17.13	3.159	10.36152
11/23/1999	11:08:56	13.9	17.13	3.159	10.36152
11/23/1999	11:08:59	13.95	17.13	3.159	10.36152
11/23/1999	11:09:02	14	17.13	3.159	10.36152
11/23/1999	11:09:05	14.05	17.12	3.159	10.36152
11/23/1999	11:09:08	14.1	17.13	3.159	10.36152
11/23/1999	11:09:11	14.15	17.13	3.159	10.36152
11/23/1999	11:09:14	14.2	17.12	3.159	10.36152
11/23/1999	11:09:17	14.25	17.12	3.159	10.36152
11/23/1999	11:09:20	14.3	17.12	3.159	10.36152
11/23/1999	11:09:23	14.35	17.12	3.159	10.36152
11/23/1999	11:09:26	14.4	17.12	3.159	10.36152
11/23/1999	11:09:29	14.45	17.12	3.159	10.36152
11/23/1999	11:09:32	14.5	17.12	3.159	10.36152
11/23/1999	11:09:35	14.55	17.12	3.159	10.36152
11/23/1999	11:09:38	14.6	17.13	3.159	10.36152
11/23/1999	11:09:41	14.65	17.12	3.16	10.3648
11/23/1999	11:09:44	14.7	17.12	3.159	10.36152
11/23/1999	11:09:47	14.75	17.12	3.159	10.36152
11/23/1999	11:09:50	14.8	17.12	3.159	10.36152
11/23/1999	11:09:53	14.85	17.12	3.16	10.3648
11/23/1999	11:09:56	14.9	17.12	3.159	10.36152
11/23/1999	11:09:59	14.95	17.12	3.159	10.36152
11/23/1999	11:10:02	15	17.12	3.16	10.3648
11/23/1999	11:10:05	15.05	17.13	3.159	10.36152
11/23/1999	11:10:08	15.1	17.12	3.159	10.36152
11/23/1999	11:10:11	15.15	17.12	3.16	10.3648
11/23/1999	11:10:14	15.2	17.12	3.159	10.36152

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11/23/1999	11:10:20	15.3	17.12	3.159	10.36152
11/23/1999	11:10:23	15.35	17.12	3.159	10.36152
11/23/1999	11:10:26	15.4	17.12	3.159	10.36152
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11/23/1999	11:10:38	15.6	17.12	3.16	10.3648
11/23/1999	11:10:41	15.65	17.12	3.16	10.3648
11/23/1999	11:10:44	15.7	17.12	3.159	10.36152
11/23/1999	11:10:47	15.75	17.12	3.16	10.3648
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11/23/1999	11:10:56	15.9	17.12	3.16	10.3648
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11/23/1999	11:11:02	16	17.12	3.16	10.3648
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11/23/1999	11:11:08	16.1	17.12	3.16	10.3648
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11/23/1999	11:11:20	16.3	17.12	3.16	10.3648
11/23/1999	11:11:23	16.35	17.12	3.16	10.3648
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11/23/1999	11:11:29	16.45	17.12	3.16	10.3648
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11/23/1999	11:11:44	16.7	17.12	3.16	10.3648
11/23/1999	11:11:47	16.75	17.12	3.16	10.3648
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11/23/1999	11:11:53	16.85	17.12	3.16	10.3648
11/23/1999	11:11:56	16.9	17.12	3.16	10.3648
11/23/1999	11:11:59	16.95	17.12	3.16	10.3648
11/23/1999	11:12:02	17	17.12	3.16	10.3648
11/23/1999	11:12:05	17.05	17.12	3.16	10.3648
11/23/1999	11:12:08	17.1	17.12	3.159	10.36152
11/23/1999	11:12:11	17.15	17.12	3.16	10.3648
11/23/1999	11:12:14	17.2	17.12	3.159	10.36152
11/23/1999	11:12:17	17.25	17.12	3.159	10.36152
11/23/1999	11:12:20	17.3	17.12	3.16	10.3648
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11/23/1999	11:12:26	17.4	17.12	3.16	10.3648
11/23/1999	11:12:29	17.45	17.12	3.159	10.36152
11/23/1999	11:12:32	17.5	17.11	3.159	10.36152
11/23/1999	11:12:35	17.55	17.11	3.16	10.3648
11/23/1999	11:12:38	17.6	17.12	3.159	10.36152
11/23/1999	11:12:41	17.65	17.11	3.159	10.36152

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11/23/1999	11:12:50	17.8	17.12	3.159	10.36152
11/23/1999	11:12:53	17.85	17.11	3.16	10.3648
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11/23/1999	11:12:59	17.95	17.11	3.159	10.36152
11/23/1999	11:13:02	18	17.11	3.16	10.3648
11/23/1999	11:13:05	18.05	17.11	3.159	10.36152
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11/23/1999	11:13:11	18.15	17.11	3.16	10.3648
11/23/1999	11:13:14	18.2	17.1	3.159	10.36152
11/23/1999	11:13:17	18.25	17.11	3.16	10.3648
11/23/1999	11:13:20	18.3	17.11	3.16	10.3648
11/23/1999	11:13:23	18.35	17.11	3.159	10.36152
11/23/1999	11:13:26	18.4	17.1	3.16	10.3648
11/23/1999	11:13:29	18.45	17.11	3.16	10.3648
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11/23/1999	11:13:38	18.6	17.11	3.16	10.3648
11/23/1999	11:13:41	18.65	17.1	3.16	10.3648
11/23/1999	11:13:44	18.7	17.11	3.16	10.3648
11/23/1999	11:13:47	18.75	17.1	3.16	10.3648
11/23/1999	11:13:50	18.8	17.1	3.16	10.3648
11/23/1999	11:13:53	18.85	17.1	3.16	10.3648
11/23/1999	11:13:56	18.9	17.11	3.16	10.3648
11/23/1999	11:13:59	18.95	17.1	3.162	10.37136
11/23/1999	11:14:02	19	17.1	3.16	10.3648
11/23/1999	11:14:05	19.05	17.11	3.159	10.36152
11/23/1999	11:14:08	19.1	17.1	3.16	10.3648
11/23/1999	11:14:11	19.15	17.1	3.16	10.3648
11/23/1999	11:14:14	19.2	17.1	3.16	10.3648
11/23/1999	11:14:17	19.25	17.1	3.16	10.3648
11/23/1999	11:14:20	19.3	17.1	3.16	10.3648
11/23/1999	11:14:23	19.35	17.1	3.16	10.3648
11/23/1999	11:14:26	19.4	17.1	3.16	10.3648
11/23/1999	11:14:29	19.45	17.1	3.16	10.3648
11/23/1999	11:14:32	19.5	17.1	3.16	10.3648
11/23/1999	11:14:35	19.55	17.1	3.16	10.3648
11/23/1999	11:14:38	19.6	17.1	3.16	10.3648
11/23/1999	11:14:41	19.65	17.1	3.16	10.3648
11/23/1999	11:14:44	19.7	17.1	3.16	10.3648
11/23/1999	11:14:47	19.75	17.1	3.16	10.3648
11/23/1999	11:14:50	19.8	17.1	3.16	10.3648
11/23/1999	11:14:53	19.85	17.1	3.16	10.3648
11/23/1999	11:14:56	19.9	17.1	3.16	10.3648
11/23/1999	11:14:59	19.95	17.1	3.16	10.3648
11/23/1999	11:15:02	20	17.1	3.16	10.3648
11/23/1999	11:15:05	20.05	17.1	3.16	10.3648
11/23/1999	11:15:08	20.1	17.1	3.16	10.3648

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11/23/1999	11:15:17	20.25	17.1	3.16	10.3648
11/23/1999	11:15:20	20.3	17.09	3.16	10.3648
11/23/1999	11:15:23	20.35	17.09	3.16	10.3648
11/23/1999	11:15:26	20.4	17.09	3.16	10.3648
11/23/1999	11:15:29	20.45	17.09	3.16	10.3648
11/23/1999	11:15:32	20.5	17.09	3.16	10.3648
11/23/1999	11:15:35	20.55	17.09	3.162	10.37136
11/23/1999	11:15:38	20.6	17.09	3.16	10.3648
11/23/1999	11:15:41	20.65	17.09	3.16	10.3648
11/23/1999	11:15:44	20.7	17.09	3.162	10.37136
11/23/1999	11:15:47	20.75	17.09	3.16	10.3648
11/23/1999	11:15:50	20.8	17.1	3.16	10.3648
11/23/1999	11:15:53	20.85	17.09	3.162	10.37136
11/23/1999	11:15:56	20.9	17.09	3.16	10.3648
11/23/1999	11:15:59	20.95	17.09	3.16	10.3648
11/23/1999	11:16:02	21	17.09	3.16	10.3648
11/23/1999	11:16:05	21.05	17.09	3.16	10.3648
11/23/1999	11:16:08	21.1	17.09	3.162	10.37136
11/23/1999	11:16:11	21.15	17.09	3.162	10.37136
11/23/1999	11:16:14	21.2	17.09	3.16	10.3648
11/23/1999	11:16:17	21.25	17.09	3.16	10.3648
11/23/1999	11:16:20	21.3	17.09	3.16	10.3648
11/23/1999	11:16:23	21.35	17.09	3.16	10.3648
11/23/1999	11:16:26	21.4	17.09	3.16	10.3648
11/23/1999	11:16:29	21.45	17.09	3.16	10.3648
11/23/1999	11:16:32	21.5	17.09	3.16	10.3648
11/23/1999	11:16:35	21.55	17.09	3.162	10.37136
11/23/1999	11:16:38	21.6	17.09	3.16	10.3648
11/23/1999	11:16:41	21.65	17.09	3.16	10.3648
11/23/1999	11:16:44	21.7	17.09	3.16	10.3648
11/23/1999	11:16:47	21.75	17.09	3.16	10.3648
11/23/1999	11:16:50	21.8	17.09	3.16	10.3648
11/23/1999	11:16:53	21.85	17.09	3.16	10.3648
11/23/1999	11:16:56	21.9	17.09	3.162	10.37136
11/23/1999	11:16:59	21.95	17.09	3.16	10.3648
11/23/1999	11:17:02	22	17.08	3.16	10.3648
11/23/1999	11:17:05	22.05	17.09	3.162	10.37136
11/23/1999	11:17:08	22.1	17.08	3.162	10.37136
11/23/1999	11:17:11	22.15	17.08	3.162	10.37136
11/23/1999	11:17:14	22.2	17.08	3.162	10.37136
11/23/1999	11:17:17	22.25	17.08	3.162	10.37136
11/23/1999	11:17:20	22.3	17.08	3.162	10.37136
11/23/1999	11:17:23	22.35	17.08	3.162	10.37136
11/23/1999	11:17:26	22.4	17.08	3.162	10.37136
11/23/1999	11:17:29	22.45	17.08	3.162	10.37136
11/23/1999	11:17:32	22.5	17.08	3.162	10.37136
11/23/1999	11:17:35	22.55	17.08	3.162	10.37136

11/23/1999	11:17:38	22.6	17.08	3.162	10.37136
11/23/1999	11:17:41	22.65	17.08	3.162	10.37136
11/23/1999	11:17:44	22.7	17.08	3.162	10.37136
11/23/1999	11:17:47	22.75	17.08	3.162	10.37136
11/23/1999	11:17:50	22.8	17.08	3.162	10.37136
11/23/1999	11:17:53	22.85	17.08	3.162	10.37136
11/23/1999	11:17:56	22.9	17.08	3.162	10.37136
11/23/1999	11:17:59	22.95	17.08	3.162	10.37136
11/23/1999	11:18:02	23	17.07	3.162	10.37136
11/23/1999	11:18:05	23.05	17.08	3.162	10.37136
11/23/1999	11:18:08	23.1	17.07	3.16	10.3648
11/23/1999	11:18:11	23.15	17.07	3.162	10.37136
11/23/1999	11:18:14	23.2	17.07	3.162	10.37136
11/23/1999	11:18:17	23.25	17.07	3.162	10.37136
11/23/1999	11:18:20	23.3	17.07	3.162	10.37136
11/23/1999	11:18:23	23.35	17.07	3.163	10.37464
11/23/1999	11:18:26	23.4	17.07	3.162	10.37136
11/23/1999	11:18:29	23.45	17.07	3.162	10.37136
11/23/1999	11:18:32	23.5	17.07	3.162	10.37136
11/23/1999	11:18:35	23.55	17.07	3.162	10.37136
11/23/1999	11:18:38	23.6	17.06	3.162	10.37136
11/23/1999	11:18:41	23.65	17.06	3.162	10.37136
11/23/1999	11:18:44	23.7	17.06	3.163	10.37464
11/23/1999	11:18:47	23.75	17.06	3.162	10.37136
11/23/1999	11:18:50	23.8	17.06	3.162	10.37136
11/23/1999	11:18:53	23.85	17.06	3.162	10.37136
11/23/1999	11:18:56	23.9	17.06	3.162	10.37136
11/23/1999	11:18:59	23.95	17.06	3.162	10.37136
11/23/1999	11:19:02	24	17.06	3.162	10.37136
11/23/1999	11:19:05	24.05	17.06	3.162	10.37136
11/23/1999	11:19:08	24.1	17.06	3.162	10.37136
11/23/1999	11:19:11	24.15	17.06	3.162	10.37136
11/23/1999	11:19:14	24.2	17.06	3.162	10.37136
11/23/1999	11:19:17	24.25	17.06	3.162	10.37136
11/23/1999	11:19:20	24.3	17.06	3.162	10.37136
11/23/1999	11:19:23	24.35	17.06	3.162	10.37136
11/23/1999	11:19:26	24.4	17.06	3.162	10.37136
11/23/1999	11:19:29	24.45	17.06	3.162	10.37136
11/23/1999	11:19:32	24.5	17.06	3.162	10.37136
11/23/1999	11:19:35	24.55	17.05	3.162	10.37136
11/23/1999	11:19:38	24.6	17.05	3.162	10.37136
11/23/1999	11:19:41	24.65	17.05	3.162	10.37136
11/23/1999	11:19:44	24.7	17.05	3.163	10.37464
11/23/1999	11:19:47	24.75	17.05	3.162	10.37136
11/23/1999	11:19:50	24.8	17.05	3.163	10.37464
11/23/1999	11:19:53	24.85	17.05	3.163	10.37464
11/23/1999	11:19:56	24.9	17.05	3.163	10.37464
11/23/1999	11:19:59	24.95	17.05	3.163	10.37464
11/23/1999	11:20:02	25	17.05	3.163	10.37464

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11/23/1999	11:20:08	25.1	17.04	3.162	10.37136
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11/23/1999	11:22:50	27.8	16.98	3.166	10.38448
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11/23/1999	11:23:02	28	16.98	3.166	10.38448
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11/23/1999	11:23:29	28.45	16.97	3.167	10.38776
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11/23/1999	11:23:47	28.75	16.96	3.167	10.38776
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11/23/1999	11:24:02	29	16.96	3.167	10.38776
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11/23/1999	11:24:23	29.35	16.95	3.167	10.38776
11/23/1999	11:24:26	29.4	16.95	3.167	10.38776
11/23/1999	11:24:29	29.45	16.94	3.167	10.38776
11/23/1999	11:24:32	29.5	16.95	3.167	10.38776
11/23/1999	11:24:35	29.55	16.95	3.167	10.38776
11/23/1999	11:24:38	29.6	16.95	3.167	10.38776
11/23/1999	11:24:41	29.65	16.94	3.167	10.38776
11/23/1999	11:24:44	29.7	16.94	3.167	10.38776
11/23/1999	11:24:47	29.75	16.94	3.169	10.39432
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11/23/1999	11:24:53	29.85	16.94	3.169	10.39432
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11/23/1999	11:25:29	30.45	16.92	3.169	10.39432
11/23/1999	11:25:32	30.5	16.92	3.167	10.38776
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11/23/1999	11:25:53	30.85	16.91	3.169	10.39432
11/23/1999	11:25:56	30.9	16.91	3.169	10.39432
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11/23/1999	11:26:02	31	16.91	3.169	10.39432
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11/23/1999	11:26:32	31.5	16.9	3.169	10.39432
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11/23/1999	11:27:59	32.95	16.87	3.173	10.40744
11/23/1999	11:28:02	33	16.88	3.173	10.40744
11/23/1999	11:28:05	33.05	16.87	3.173	10.40744
11/23/1999	11:28:08	33.1	16.87	3.173	10.40744
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11/23/1999	11:28:20	33.3	16.87	3.172	10.40416
11/23/1999	11:28:23	33.35	16.87	3.173	10.40744
11/23/1999	11:28:26	33.4	16.89	3.172	10.40416
11/23/1999	11:28:29	33.45	16.91	3.17	10.3976
11/23/1999	11:28:32	33.5	16.93	3.172	10.40416
11/23/1999	11:28:35	33.55	16.95	3.17	10.3976
11/23/1999	11:28:38	33.6	16.96	3.172	10.40416
11/23/1999	11:28:41	33.65	16.95	3.17	10.3976
11/23/1999	11:28:44	33.7	16.94	3.172	10.40416
11/23/1999	11:28:47	33.75	16.94	3.17	10.3976
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11/23/1999	11:29:47	34.75	16.95	3.17	10.3976
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11/23/1999	11:30:32	35.5	16.93	3.172	10.40416
11/23/1999	11:30:35	35.55	16.92	3.17	10.3976
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11/23/1999	11:30:50	35.8	16.92	3.17	10.3976
11/23/1999	11:30:53	35.85	16.92	3.17	10.3976
11/23/1999	11:30:56	35.9	16.92	3.17	10.3976
11/23/1999	11:30:59	35.95	16.92	3.172	10.40416
11/23/1999	11:31:02	36	16.92	3.17	10.3976
11/23/1999	11:31:05	36.05	16.92	3.17	10.3976
11/23/1999	11:31:08	36.1	16.92	3.17	10.3976
11/23/1999	11:31:11	36.15	16.91	3.17	10.3976
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11/23/1999	11:31:17	36.25	16.91	3.17	10.3976
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11/23/1999	11:31:29	36.45	16.91	3.17	10.3976
11/23/1999	11:31:32	36.5	16.91	3.17	10.3976
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11/23/1999	11:31:47	36.75	16.91	3.17	10.3976
11/23/1999	11:31:50	36.8	16.9	3.17	10.3976
11/23/1999	11:31:53	36.85	16.91	3.17	10.3976
11/23/1999	11:31:56	36.9	16.9	3.17	10.3976
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11/23/1999	11:32:08	37.1	16.9	3.17	10.3976
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11/23/1999	11:32:26	37.4	16.9	3.17	10.3976
11/23/1999	11:32:29	37.45	16.89	3.17	10.3976
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11/23/1999	11:32:38	37.6	16.89	3.172	10.40416
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11/23/1999	11:32:47	37.75	16.89	3.17	10.3976
11/23/1999	11:32:50	37.8	16.89	3.172	10.40416
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11/23/1999	11:33:02	38	16.89	3.172	10.40416
11/23/1999	11:33:05	38.05	16.89	3.172	10.40416
11/23/1999	11:33:08	38.1	16.89	3.172	10.40416
11/23/1999	11:33:11	38.15	16.89	3.172	10.40416
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11/23/1999	11:33:17	38.25	16.89	3.172	10.40416
11/23/1999	11:33:20	38.3	16.88	3.172	10.40416
11/23/1999	11:33:23	38.35	16.88	3.172	10.40416
11/23/1999	11:33:26	38.4	16.88	3.172	10.40416
11/23/1999	11:33:29	38.45	16.88	3.172	10.40416
11/23/1999	11:33:32	38.5	16.88	3.172	10.40416
11/23/1999	11:33:35	38.55	16.88	3.172	10.40416
11/23/1999	11:33:38	38.6	16.88	3.172	10.40416
11/23/1999	11:33:41	38.65	16.88	3.17	10.3976
11/23/1999	11:33:44	38.7	16.88	3.172	10.40416
11/23/1999	11:33:47	38.75	16.88	3.172	10.40416
11/23/1999	11:33:50	38.8	16.88	3.172	10.40416
11/23/1999	11:33:53	38.85	16.88	3.172	10.40416
11/23/1999	11:33:56	38.9	16.87	3.171	10.40088
11/23/1999	11:33:59	38.95	16.88	3.172	10.40416
11/23/1999	11:34:02	39	16.88	3.17	10.3976
11/23/1999	11:34:05	39.05	16.88	3.172	10.40416
11/23/1999	11:34:08	39.1	16.87	3.171	10.40088
11/23/1999	11:34:11	39.15	16.87	3.172	10.40416
11/23/1999	11:34:14	39.2	16.87	3.172	10.40416
11/23/1999	11:34:17	39.25	16.87	3.171	10.40088
11/23/1999	11:34:20	39.3	16.87	3.172	10.40416
11/23/1999	11:34:23	39.35	16.87	3.172	10.40416
11/23/1999	11:34:26	39.4	16.86	3.171	10.40088
11/23/1999	11:34:29	39.45	16.86	3.172	10.40416
11/23/1999	11:34:32	39.5	16.86	3.172	10.40416
11/23/1999	11:34:35	39.55	16.86	3.171	10.40088
11/23/1999	11:34:38	39.6	16.86	3.171	10.40088
11/23/1999	11:34:41	39.65	16.86	3.172	10.40416
11/23/1999	11:34:44	39.7	16.86	3.171	10.40088

11/23/1999	11:34:47	39.75	16.86	3.172	10.40416
11/23/1999	11:34:50	39.8	16.86	3.172	10.40416
11/23/1999	11:34:53	39.85	16.86	3.172	10.40416
11/23/1999	11:34:56	39.9	16.86	3.172	10.40416
11/23/1999	11:34:59	39.95	16.86	3.172	10.40416
11/23/1999	11:35:02	40	16.86	3.171	10.40088
11/23/1999	11:35:05	40.05	16.86	3.171	10.40088
11/23/1999	11:35:08	40.1	16.86	3.172	10.40416
11/23/1999	11:35:11	40.15	16.86	3.172	10.40416
11/23/1999	11:35:14	40.2	16.86	3.172	10.40416
11/23/1999	11:35:17	40.25	16.86	3.172	10.40416
11/23/1999	11:35:20	40.3	16.85	3.172	10.40416
11/23/1999	11:35:23	40.35	16.86	3.172	10.40416
11/23/1999	11:35:26	40.4	16.85	3.172	10.40416
11/23/1999	11:35:29	40.45	16.85	3.172	10.40416
11/23/1999	11:35:32	40.5	16.85	3.172	10.40416
11/23/1999	11:35:35	40.55	16.85	3.172	10.40416
11/23/1999	11:35:38	40.6	16.85	3.172	10.40416
11/23/1999	11:35:41	40.65	16.85	3.172	10.40416
11/23/1999	11:35:44	40.7	16.85	3.172	10.40416
11/23/1999	11:35:47	40.75	16.85	3.172	10.40416
11/23/1999	11:35:50	40.8	16.85	3.172	10.40416
11/23/1999	11:35:53	40.85	16.85	3.172	10.40416
11/23/1999	11:35:56	40.9	16.85	3.172	10.40416
11/23/1999	11:35:59	40.95	16.85	3.172	10.40416
11/23/1999	11:36:02	41	16.85	3.172	10.40416
11/23/1999	11:36:05	41.05	16.85	3.172	10.40416
11/23/1999	11:36:08	41.1	16.85	3.172	10.40416
11/23/1999	11:36:11	41.15	16.85	3.172	10.40416
11/23/1999	11:36:14	41.2	16.85	3.172	10.40416
11/23/1999	11:36:17	41.25	16.85	3.172	10.40416
11/23/1999	11:36:20	41.3	16.85	3.172	10.40416
11/23/1999	11:36:23	41.35	16.85	3.172	10.40416
11/23/1999	11:36:26	41.4	16.85	3.172	10.40416
11/23/1999	11:36:29	41.45	16.85	3.172	10.40416
11/23/1999	11:36:32	41.5	16.85	3.172	10.40416
11/23/1999	11:36:35	41.55	16.84	3.172	10.40416
11/23/1999	11:36:38	41.6	16.85	3.174	10.41072
11/23/1999	11:36:41	41.65	16.85	3.172	10.40416
11/23/1999	11:36:44	41.7	16.85	3.172	10.40416
11/23/1999	11:36:47	41.75	16.85	3.172	10.40416
11/23/1999	11:36:50	41.8	16.84	3.172	10.40416
11/23/1999	11:36:53	41.85	16.84	3.174	10.41072
11/23/1999	11:36:56	41.9	16.84	3.172	10.40416
11/23/1999	11:36:59	41.95	16.84	3.174	10.41072
11/23/1999	11:37:02	42	16.84	3.172	10.40416
11/23/1999	11:37:05	42.05	16.84	3.172	10.40416
11/23/1999	11:37:08	42.1	16.84	3.172	10.40416
11/23/1999	11:37:11	42.15	16.84	3.172	10.40416

11/23/1999	11:37:14	42.2	16.84	3.174	10.41072
11/23/1999	11:37:17	42.25	16.83	3.172	10.40416
11/23/1999	11:37:20	42.3	16.84	3.172	10.40416
11/23/1999	11:37:23	42.35	16.84	3.172	10.40416
11/23/1999	11:37:26	42.4	16.83	3.172	10.40416
11/23/1999	11:37:29	42.45	16.84	3.172	10.40416
11/23/1999	11:37:32	42.5	16.83	3.172	10.40416
11/23/1999	11:37:35	42.55	16.84	3.172	10.40416
11/23/1999	11:37:38	42.6	16.84	3.172	10.40416
11/23/1999	11:37:41	42.65	16.83	3.174	10.41072
11/23/1999	11:37:44	42.7	16.83	3.172	10.40416
11/23/1999	11:37:47	42.75	16.83	3.172	10.40416
11/23/1999	11:37:50	42.8	16.83	3.174	10.41072
11/23/1999	11:37:53	42.85	16.83	3.172	10.40416
11/23/1999	11:37:56	42.9	16.83	3.172	10.40416
11/23/1999	11:37:59	42.95	16.83	3.174	10.41072
11/23/1999	11:38:02	43	16.83	3.174	10.41072
11/23/1999	11:38:05	43.05	16.84	3.174	10.41072
11/23/1999	11:38:08	43.1	16.83	3.172	10.40416
11/23/1999	11:38:11	43.15	16.83	3.174	10.41072
11/23/1999	11:38:14	43.2	16.83	3.174	10.41072
11/23/1999	11:38:17	43.25	16.83	3.172	10.40416
11/23/1999	11:38:20	43.3	16.83	3.174	10.41072
11/23/1999	11:38:23	43.35	16.83	3.174	10.41072
11/23/1999	11:38:26	43.4	16.83	3.174	10.41072
11/23/1999	11:38:29	43.45	16.83	3.174	10.41072
11/23/1999	11:38:32	43.5	16.83	3.174	10.41072
11/23/1999	11:38:35	43.55	16.83	3.174	10.41072
11/23/1999	11:38:38	43.6	16.83	3.172	10.40416
11/23/1999	11:38:41	43.65	16.83	3.174	10.41072
11/23/1999	11:38:44	43.7	16.83	3.172	10.40416
11/23/1999	11:38:47	43.75	16.83	3.174	10.41072
11/23/1999	11:38:50	43.8	16.83	3.174	10.41072
11/23/1999	11:38:53	43.85	16.83	3.174	10.41072
11/23/1999	11:38:56	43.9	16.83	3.174	10.41072
11/23/1999	11:38:59	43.95	16.83	3.174	10.41072
11/23/1999	11:39:02	44	16.83	3.172	10.40416
11/23/1999	11:39:05	44.05	16.83	3.174	10.41072
11/23/1999	11:39:08	44.1	16.83	3.172	10.40416
11/23/1999	11:39:11	44.15	16.83	3.172	10.40416
11/23/1999	11:39:14	44.2	16.83	3.174	10.41072
11/23/1999	11:39:17	44.25	16.83	3.174	10.41072
11/23/1999	11:39:20	44.3	16.83	3.172	10.40416
11/23/1999	11:39:23	44.35	16.83	3.172	10.40416
11/23/1999	11:39:26	44.4	16.83	3.172	10.40416
11/23/1999	11:39:29	44.45	16.83	3.174	10.41072
11/23/1999	11:39:32	44.5	16.83	3.174	10.41072
11/23/1999	11:39:35	44.55	16.83	3.174	10.41072
11/23/1999	11:39:38	44.6	16.83	3.174	10.41072

11/23/1999	11:39:41	44.65	16.83	3.174	10.41072
11/23/1999	11:39:44	44.7	16.83	3.174	10.41072
11/23/1999	11:39:47	44.75	16.83	3.174	10.41072
11/23/1999	11:39:50	44.8	16.83	3.172	10.40416
11/23/1999	11:39:53	44.85	16.83	3.174	10.41072
11/23/1999	11:39:56	44.9	16.83	3.172	10.40416
11/23/1999	11:39:59	44.95	16.83	3.174	10.41072
11/23/1999	11:40:02	45	16.83	3.174	10.41072
11/23/1999	11:40:05	45.05	16.83	3.174	10.41072
11/23/1999	11:40:08	45.1	16.83	3.174	10.41072
11/23/1999	11:40:11	45.15	16.83	3.174	10.41072
11/23/1999	11:40:14	45.2	16.83	3.174	10.41072
11/23/1999	11:40:17	45.25	16.83	3.174	10.41072
11/23/1999	11:40:20	45.3	16.83	3.174	10.41072
11/23/1999	11:40:23	45.35	16.83	3.174	10.41072
11/23/1999	11:40:26	45.4	16.83	3.174	10.41072
11/23/1999	11:40:29	45.45	16.83	3.174	10.41072
11/23/1999	11:40:32	45.5	16.83	3.174	10.41072
11/23/1999	11:40:35	45.55	16.83	3.174	10.41072
11/23/1999	11:40:38	45.6	16.83	3.174	10.41072
11/23/1999	11:40:41	45.65	16.83	3.174	10.41072
11/23/1999	11:40:44	45.7	16.83	3.174	10.41072
11/23/1999	11:40:47	45.75	16.83	3.174	10.41072
11/23/1999	11:40:50	45.8	16.83	3.174	10.41072
11/23/1999	11:40:53	45.85	16.83	3.174	10.41072
11/23/1999	11:40:56	45.9	16.83	3.174	10.41072
11/23/1999	11:40:59	45.95	16.83	3.174	10.41072
11/23/1999	11:41:02	46	16.83	3.174	10.41072
11/23/1999	11:41:05	46.05	16.83	3.174	10.41072
11/23/1999	11:41:08	46.1	16.83	3.174	10.41072
11/23/1999	11:41:11	46.15	16.83	3.174	10.41072
11/23/1999	11:41:14	46.2	16.83	3.174	10.41072
11/23/1999	11:41:17	46.25	16.83	3.174	10.41072
11/23/1999	11:41:20	46.3	16.83	3.175	10.414
11/23/1999	11:41:23	46.35	16.83	3.174	10.41072
11/23/1999	11:41:26	46.4	16.83	3.174	10.41072
11/23/1999	11:41:29	46.45	16.83	3.174	10.41072
11/23/1999	11:41:32	46.5	16.83	3.174	10.41072
11/23/1999	11:41:35	46.55	16.83	3.174	10.41072
11/23/1999	11:41:38	46.6	16.83	3.174	10.41072
11/23/1999	11:41:41	46.65	16.83	3.174	10.41072
11/23/1999	11:41:44	46.7	16.83	3.174	10.41072
11/23/1999	11:41:47	46.75	16.83	3.174	10.41072
11/23/1999	11:41:50	46.8	16.83	3.174	10.41072
11/23/1999	11:41:53	46.85	16.83	3.174	10.41072
11/23/1999	11:41:56	46.9	16.83	3.174	10.41072
11/23/1999	11:41:59	46.95	16.83	3.174	10.41072
11/23/1999	11:42:02	47	16.83	3.174	10.41072
11/23/1999	11:42:05	47.05	16.83	3.174	10.41072

11/23/1999	11:42:08	47.1	16.83	3.174	10.41072
11/23/1999	11:42:11	47.15	16.83	3.174	10.41072
11/23/1999	11:42:14	47.2	16.83	3.174	10.41072
11/23/1999	11:42:17	47.25	16.83	3.174	10.41072
11/23/1999	11:42:20	47.3	16.83	3.174	10.41072
11/23/1999	11:42:23	47.35	16.83	3.174	10.41072
11/23/1999	11:42:26	47.4	16.83	3.174	10.41072
11/23/1999	11:42:29	47.45	16.83	3.174	10.41072
11/23/1999	11:42:32	47.5	16.83	3.174	10.41072
11/23/1999	11:42:35	47.55	16.83	3.174	10.41072
11/23/1999	11:42:38	47.6	16.83	3.174	10.41072
11/23/1999	11:42:41	47.65	16.82	3.174	10.41072
11/23/1999	11:42:44	47.7	16.83	3.174	10.41072
11/23/1999	11:42:47	47.75	16.83	3.174	10.41072
11/23/1999	11:42:50	47.8	16.83	3.174	10.41072
11/23/1999	11:42:53	47.85	16.83	3.174	10.41072
11/23/1999	11:42:56	47.9	16.83	3.174	10.41072
11/23/1999	11:42:59	47.95	16.83	3.174	10.41072
11/23/1999	11:43:02	48	16.82	3.174	10.41072
11/23/1999	11:43:05	48.05	16.83	3.174	10.41072
11/23/1999	11:43:08	48.1	16.82	3.175	10.414
11/23/1999	11:43:11	48.15	16.85	3.172	10.40416
11/23/1999	11:43:14	48.2	16.87	3.173	10.40744
11/23/1999	11:43:17	48.25	16.89	3.173	10.40744
11/23/1999	11:43:20	48.3	16.91	3.173	10.40744
11/23/1999	11:43:23	48.35	16.92	3.173	10.40744
11/23/1999	11:43:26	48.4	16.95	3.173	10.40744
11/23/1999	11:43:29	48.45	16.93	3.173	10.40744
11/23/1999	11:43:32	48.5	16.92	3.174	10.41072
11/23/1999	11:43:35	48.55	16.94	3.173	10.40744
11/23/1999	11:43:38	48.6	16.96	3.173	10.40744
11/23/1999	11:43:41	48.65	16.98	3.172	10.40416
11/23/1999	11:43:44	48.7	17	3.173	10.40744
11/23/1999	11:43:47	48.75	17.01	3.173	10.40744
11/23/1999	11:43:50	48.8	17.03	3.173	10.40744
11/23/1999	11:43:53	48.85	17.02	3.174	10.41072
11/23/1999	11:43:56	48.9	17	3.174	10.41072
11/23/1999	11:43:59	48.95	16.99	3.174	10.41072
11/23/1999	11:44:02	49	16.98	3.174	10.41072
11/23/1999	11:44:05	49.05	16.98	3.173	10.40744
11/23/1999	11:44:08	49.1	16.98	3.173	10.40744
11/23/1999	11:44:11	49.15	16.97	3.174	10.41072
11/23/1999	11:44:14	49.2	16.97	3.174	10.41072
11/23/1999	11:44:17	49.25	16.97	3.174	10.41072
11/23/1999	11:44:20	49.3	16.96	3.174	10.41072
11/23/1999	11:44:23	49.35	16.96	3.174	10.41072
11/23/1999	11:44:26	49.4	16.95	3.174	10.41072
11/23/1999	11:44:29	49.45	16.95	3.174	10.41072
11/23/1999	11:44:32	49.5	16.95	3.174	10.41072

11/23/1999	11:44:35	49.55	16.95	3.176	10.41728
11/23/1999	11:44:38	49.6	16.95	3.174	10.41072
11/23/1999	11:44:41	49.65	16.94	3.176	10.41728
11/23/1999	11:44:44	49.7	16.94	3.174	10.41072

IN_SITU INC. Troll

Report generated: 02/02/2000 17:41:52
Report from file: C:\WINSITU\DATA\MW-14OUT.BIN
DataMgr Version 2.19.0.0

Serial number: 11909
Firmware Version 7.08
Unit name:

Test name: MW-14(slugout)

Test defined on: 11/23/1999 17:41:05
Test started on: 11/24/1999 10:19:39
Test stopped on: 11/24/1999 10:37:55
Test extracted on: 11/24/1999 10:38:07

Data gathered using Linear testing
Time between data poin Minutes.
Number of data sample 366

TOTAL DATA SAMPLES 366

Channel number [1]
Measurement type: Temperature
Channel name: Temperature

Channel number [2]
Measurement type: Pressure/Level
Channel name: Pressure Head
Sensor Range: 30 PSI.
Specific gravity: 1

Date	Time	ET (min)	Chan[1] Celsius	Chan[2] Meters H2O	Feet H2O
11/24/1999	10:19:39	0	16.35	2.785	9.1348
11/24/1999	10:19:42	0.05	16.36	2.785	9.1348
11/24/1999	10:19:45	0.1	16.36	2.785	9.1348
11/24/1999	10:19:48	0.15	16.36	2.785	9.1348
11/24/1999	10:19:51	0.2	16.36	2.785	9.1348
11/24/1999	10:19:54	0.25	16.36	2.785	9.1348
11/24/1999	10:19:57	0.3	16.36	2.785	9.1348
11/24/1999	10:20:00	0.35	16.36	2.785	9.1348
11/24/1999	10:20:03	0.4	16.35	2.785	9.1348
11/24/1999	10:20:06	0.45	16.35	2.785	9.1348
11/24/1999	10:20:09	0.5	16.35	2.786	9.13808

11/24/1999	10:20:12	0.55	16.35	2.785	9.1348
11/24/1999	10:20:15	0.6	16.35	2.785	9.1348
11/24/1999	10:20:18	0.65	16.35	2.785	9.1348
11/24/1999	10:20:21	0.7	16.35	2.785	9.1348
11/24/1999	10:20:24	0.75	16.35	2.785	9.1348
11/24/1999	10:20:27	0.8	16.35	2.785	9.1348
11/24/1999	10:20:30	0.85	16.35	2.785	9.1348
11/24/1999	10:20:33	0.9	16.35	2.785	9.1348
11/24/1999	10:20:36	0.95	16.35	2.785	9.1348
11/24/1999	10:20:39	1	16.35	2.786	9.13808
11/24/1999	10:20:42	1.05	16.35	2.785	9.1348
11/24/1999	10:20:45	1.1	16.35	2.785	9.1348
11/24/1999	10:20:48	1.15	16.35	2.785	9.1348
11/24/1999	10:20:51	1.2	16.34	2.66	8.7248
11/24/1999	10:20:54	1.25	16.35	2.612	8.56736
11/24/1999	10:20:57	1.3	16.35	2.7	8.856
11/24/1999	10:21:00	1.35	16.35	2.717	8.91176
11/24/1999	10:21:03	1.4	16.34	2.724	8.93472
11/24/1999	10:21:06	1.45	16.34	2.728	8.94784
11/24/1999	10:21:09	1.5	16.34	2.731	8.95768
11/24/1999	10:21:12	1.55	16.34	2.735	8.9708
11/24/1999	10:21:15	1.6	16.35	2.736	8.97408
11/24/1999	10:21:18	1.65	16.34	2.739	8.98392
11/24/1999	10:21:21	1.7	16.34	2.739	8.98392
11/24/1999	10:21:24	1.75	16.35	2.741	8.99048
11/24/1999	10:21:27	1.8	16.35	2.742	8.99376
11/24/1999	10:21:30	1.85	16.34	2.743	8.99704
11/24/1999	10:21:33	1.9	16.34	2.743	8.99704
11/24/1999	10:21:36	1.95	16.34	2.745	9.0036
11/24/1999	10:21:39	2	16.34	2.746	9.00688
11/24/1999	10:21:42	2.05	16.34	2.748	9.01344
11/24/1999	10:21:45	2.1	16.34	2.748	9.01344
11/24/1999	10:21:48	2.15	16.34	2.749	9.01672
11/24/1999	10:21:51	2.2	16.34	2.749	9.01672
11/24/1999	10:21:54	2.25	16.34	2.75	9.02
11/24/1999	10:21:57	2.3	16.34	2.752	9.02656
11/24/1999	10:22:00	2.35	16.34	2.752	9.02656
11/24/1999	10:22:03	2.4	16.34	2.752	9.02656
11/24/1999	10:22:06	2.45	16.33	2.753	9.02984
11/24/1999	10:22:09	2.5	16.34	2.753	9.02984
11/24/1999	10:22:12	2.55	16.33	2.755	9.0364
11/24/1999	10:22:15	2.6	16.34	2.755	9.0364
11/24/1999	10:22:18	2.65	16.33	2.756	9.03968
11/24/1999	10:22:21	2.7	16.34	2.756	9.03968
11/24/1999	10:22:24	2.75	16.33	2.757	9.04296
11/24/1999	10:22:27	2.8	16.33	2.757	9.04296
11/24/1999	10:22:30	2.85	16.33	2.759	9.04952
11/24/1999	10:22:33	2.9	16.34	2.757	9.04296
11/24/1999	10:22:36	2.95	16.33	2.759	9.04952

11/24/1999	10:22:39	3	16.33	2.759	9.04952
11/24/1999	10:22:42	3.05	16.33	2.76	9.0528
11/24/1999	10:22:45	3.1	16.33	2.762	9.05936
11/24/1999	10:22:48	3.15	16.33	2.762	9.05936
11/24/1999	10:22:51	3.2	16.33	2.762	9.05936
11/24/1999	10:22:54	3.25	16.33	2.763	9.06264
11/24/1999	10:22:57	3.3	16.33	2.763	9.06264
11/24/1999	10:23:00	3.35	16.33	2.763	9.06264
11/24/1999	10:23:03	3.4	16.33	2.763	9.06264
11/24/1999	10:23:06	3.45	16.33	2.764	9.06592
11/24/1999	10:23:09	3.5	16.33	2.764	9.06592
11/24/1999	10:23:12	3.55	16.33	2.766	9.07248
11/24/1999	10:23:15	3.6	16.33	2.766	9.07248
11/24/1999	10:23:18	3.65	16.33	2.766	9.07248
11/24/1999	10:23:21	3.7	16.33	2.766	9.07248
11/24/1999	10:23:24	3.75	16.33	2.768	9.07904
11/24/1999	10:23:27	3.8	16.33	2.767	9.07576
11/24/1999	10:23:30	3.85	16.33	2.767	9.07576
11/24/1999	10:23:33	3.9	16.33	2.768	9.07904
11/24/1999	10:23:36	3.95	16.33	2.768	9.07904
11/24/1999	10:23:39	4	16.33	2.768	9.07904
11/24/1999	10:23:42	4.05	16.33	2.768	9.07904
11/24/1999	10:23:45	4.1	16.33	2.769	9.08232
11/24/1999	10:23:48	4.15	16.33	2.768	9.07904
11/24/1999	10:23:51	4.2	16.33	2.769	9.08232
11/24/1999	10:23:54	4.25	16.33	2.769	9.08232
11/24/1999	10:23:57	4.3	16.33	2.769	9.08232
11/24/1999	10:24:00	4.35	16.33	2.771	9.08888
11/24/1999	10:24:03	4.4	16.33	2.771	9.08888
11/24/1999	10:24:06	4.45	16.33	2.771	9.08888
11/24/1999	10:24:09	4.5	16.32	2.772	9.09216
11/24/1999	10:24:12	4.55	16.33	2.772	9.09216
11/24/1999	10:24:15	4.6	16.33	2.772	9.09216
11/24/1999	10:24:18	4.65	16.32	2.772	9.09216
11/24/1999	10:24:21	4.7	16.32	2.774	9.09872
11/24/1999	10:24:24	4.75	16.32	2.774	9.09872
11/24/1999	10:24:27	4.8	16.32	2.774	9.09872
11/24/1999	10:24:30	4.85	16.32	2.774	9.09872
11/24/1999	10:24:33	4.9	16.32	2.774	9.09872
11/24/1999	10:24:36	4.95	16.32	2.774	9.09872
11/24/1999	10:24:39	5	16.32	2.775	9.102
11/24/1999	10:24:42	5.05	16.32	2.775	9.102
11/24/1999	10:24:45	5.1	16.32	2.775	9.102
11/24/1999	10:24:48	5.15	16.32	2.775	9.102
11/24/1999	10:24:51	5.2	16.32	2.775	9.102
11/24/1999	10:24:54	5.25	16.32	2.776	9.10528
11/24/1999	10:24:57	5.3	16.32	2.775	9.102
11/24/1999	10:25:00	5.35	16.32	2.776	9.10528
11/24/1999	10:25:03	5.4	16.32	2.775	9.102

11/24/1999	10:25:06	5.45	16.32	2.776	9.10528
11/24/1999	10:25:09	5.5	16.34	2.775	9.102
11/24/1999	10:25:12	5.55	16.36	2.775	9.102
11/24/1999	10:25:15	5.6	16.39	2.776	9.10528
11/24/1999	10:25:18	5.65	16.37	2.776	9.10528
11/24/1999	10:25:21	5.7	16.36	2.776	9.10528
11/24/1999	10:25:24	5.75	16.36	2.778	9.11184
11/24/1999	10:25:27	5.8	16.36	2.778	9.11184
11/24/1999	10:25:30	5.85	16.36	2.778	9.11184
11/24/1999	10:25:33	5.9	16.36	2.778	9.11184
11/24/1999	10:25:36	5.95	16.36	2.778	9.11184
11/24/1999	10:25:39	6	16.35	2.779	9.11512
11/24/1999	10:25:42	6.05	16.35	2.778	9.11184
11/24/1999	10:25:45	6.1	16.35	2.779	9.11512
11/24/1999	10:25:48	6.15	16.35	2.778	9.11184
11/24/1999	10:25:51	6.2	16.35	2.779	9.11512
11/24/1999	10:25:54	6.25	16.35	2.778	9.11184
11/24/1999	10:25:57	6.3	16.35	2.778	9.11184
11/24/1999	10:26:00	6.35	16.35	2.778	9.11184
11/24/1999	10:26:03	6.4	16.35	2.779	9.11512
11/24/1999	10:26:06	6.45	16.35	2.779	9.11512
11/24/1999	10:26:09	6.5	16.35	2.779	9.11512
11/24/1999	10:26:12	6.55	16.35	2.779	9.11512
11/24/1999	10:26:15	6.6	16.35	2.779	9.11512
11/24/1999	10:26:18	6.65	16.35	2.779	9.11512
11/24/1999	10:26:21	6.7	16.35	2.779	9.11512
11/24/1999	10:26:24	6.75	16.34	2.779	9.11512
11/24/1999	10:26:27	6.8	16.35	2.779	9.11512
11/24/1999	10:26:30	6.85	16.34	2.781	9.12168
11/24/1999	10:26:33	6.9	16.34	2.779	9.11512
11/24/1999	10:26:36	6.95	16.34	2.781	9.12168
11/24/1999	10:26:39	7	16.34	2.779	9.11512
11/24/1999	10:26:42	7.05	16.34	2.779	9.11512
11/24/1999	10:26:45	7.1	16.34	2.781	9.12168
11/24/1999	10:26:48	7.15	16.34	2.781	9.12168
11/24/1999	10:26:51	7.2	16.33	2.779	9.11512
11/24/1999	10:26:54	7.25	16.34	2.781	9.12168
11/24/1999	10:26:57	7.3	16.34	2.781	9.12168
11/24/1999	10:27:00	7.35	16.33	2.781	9.12168
11/24/1999	10:27:03	7.4	16.34	2.781	9.12168
11/24/1999	10:27:06	7.45	16.33	2.779	9.11512
11/24/1999	10:27:09	7.5	16.34	2.781	9.12168
11/24/1999	10:27:12	7.55	16.33	2.781	9.12168
11/24/1999	10:27:15	7.6	16.33	2.781	9.12168
11/24/1999	10:27:18	7.65	16.34	2.781	9.12168
11/24/1999	10:27:21	7.7	16.33	2.782	9.12496
11/24/1999	10:27:24	7.75	16.33	2.781	9.12168
11/24/1999	10:27:27	7.8	16.33	2.782	9.12496
11/24/1999	10:27:30	7.85	16.33	2.782	9.12496

11/24/1999	10:27:33	7.9	16.33	2.782	9.12496
11/24/1999	10:27:36	7.95	16.33	2.781	9.12168
11/24/1999	10:27:39	8	16.33	2.782	9.12496
11/24/1999	10:27:42	8.05	16.33	2.782	9.12496
11/24/1999	10:27:45	8.1	16.33	2.782	9.12496
11/24/1999	10:27:48	8.15	16.35	2.782	9.12496
11/24/1999	10:27:51	8.2	16.37	2.781	9.12168
11/24/1999	10:27:54	8.25	16.39	2.781	9.12168
11/24/1999	10:27:57	8.3	16.4	2.782	9.12496
11/24/1999	10:28:00	8.35	16.39	2.782	9.12496
11/24/1999	10:28:03	8.4	16.38	2.782	9.12496
11/24/1999	10:28:06	8.45	16.38	2.782	9.12496
11/24/1999	10:28:09	8.5	16.38	2.782	9.12496
11/24/1999	10:28:12	8.55	16.38	2.782	9.12496
11/24/1999	10:28:15	8.6	16.38	2.782	9.12496
11/24/1999	10:28:18	8.65	16.38	2.782	9.12496
11/24/1999	10:28:21	8.7	16.37	2.782	9.12496
11/24/1999	10:28:24	8.75	16.37	2.782	9.12496
11/24/1999	10:28:27	8.8	16.37	2.782	9.12496
11/24/1999	10:28:30	8.85	16.37	2.783	9.12824
11/24/1999	10:28:33	8.9	16.37	2.783	9.12824
11/24/1999	10:28:36	8.95	16.37	2.783	9.12824
11/24/1999	10:28:39	9	16.37	2.783	9.12824
11/24/1999	10:28:42	9.05	16.36	2.783	9.12824
11/24/1999	10:28:45	9.1	16.36	2.783	9.12824
11/24/1999	10:28:48	9.15	16.36	2.783	9.12824
11/24/1999	10:28:51	9.2	16.36	2.783	9.12824
11/24/1999	10:28:54	9.25	16.36	2.783	9.12824
11/24/1999	10:28:57	9.3	16.36	2.782	9.12496
11/24/1999	10:29:00	9.35	16.36	2.783	9.12824
11/24/1999	10:29:03	9.4	16.36	2.782	9.12496
11/24/1999	10:29:06	9.45	16.36	2.783	9.12824
11/24/1999	10:29:09	9.5	16.36	2.782	9.12496
11/24/1999	10:29:12	9.55	16.36	2.783	9.12824
11/24/1999	10:29:15	9.6	16.36	2.783	9.12824
11/24/1999	10:29:18	9.65	16.36	2.783	9.12824
11/24/1999	10:29:21	9.7	16.36	2.783	9.12824
11/24/1999	10:29:24	9.75	16.35	2.783	9.12824
11/24/1999	10:29:27	9.8	16.36	2.783	9.12824
11/24/1999	10:29:30	9.85	16.36	2.783	9.12824
11/24/1999	10:29:33	9.9	16.36	2.783	9.12824
11/24/1999	10:29:36	9.95	16.36	2.782	9.12496
11/24/1999	10:29:39	10	16.36	2.783	9.12824
11/24/1999	10:29:42	10.05	16.36	2.783	9.12824
11/24/1999	10:29:45	10.1	16.35	2.783	9.12824
11/24/1999	10:29:48	10.15	16.35	2.785	9.1348
11/24/1999	10:29:51	10.2	16.36	2.783	9.12824
11/24/1999	10:29:54	10.25	16.35	2.783	9.12824
11/24/1999	10:29:57	10.3	16.36	2.783	9.12824

11/24/1999	10:30:00	10.35	16.35	2.785	9.1348
11/24/1999	10:30:03	10.4	16.36	2.783	9.12824
11/24/1999	10:30:06	10.45	16.36	2.783	9.12824
11/24/1999	10:30:09	10.5	16.35	2.783	9.12824
11/24/1999	10:30:12	10.55	16.35	2.783	9.12824
11/24/1999	10:30:15	10.6	16.35	2.783	9.12824
11/24/1999	10:30:18	10.65	16.36	2.785	9.1348
11/24/1999	10:30:21	10.7	16.36	2.783	9.12824
11/24/1999	10:30:24	10.75	16.35	2.783	9.12824
11/24/1999	10:30:27	10.8	16.35	2.783	9.12824
11/24/1999	10:30:30	10.85	16.35	2.785	9.1348
11/24/1999	10:30:33	10.9	16.35	2.785	9.1348
11/24/1999	10:30:36	10.95	16.35	2.785	9.1348
11/24/1999	10:30:39	11	16.35	2.783	9.12824
11/24/1999	10:30:42	11.05	16.36	2.783	9.12824
11/24/1999	10:30:45	11.1	16.38	2.783	9.12824
11/24/1999	10:30:48	11.15	16.41	2.783	9.12824
11/24/1999	10:30:51	11.2	16.42	2.783	9.12824
11/24/1999	10:30:54	11.25	16.44	2.783	9.12824
11/24/1999	10:30:57	11.3	16.46	2.783	9.12824
11/24/1999	10:31:00	11.35	16.48	2.783	9.12824
11/24/1999	10:31:03	11.4	16.47	2.783	9.12824
11/24/1999	10:31:06	11.45	16.45	2.783	9.12824
11/24/1999	10:31:09	11.5	16.45	2.783	9.12824
11/24/1999	10:31:12	11.55	16.45	2.785	9.1348
11/24/1999	10:31:15	11.6	16.44	2.785	9.1348
11/24/1999	10:31:18	11.65	16.44	2.785	9.1348
11/24/1999	10:31:21	11.7	16.44	2.785	9.1348
11/24/1999	10:31:24	11.75	16.44	2.785	9.1348
11/24/1999	10:31:27	11.8	16.43	2.785	9.1348
11/24/1999	10:31:30	11.85	16.43	2.783	9.12824
11/24/1999	10:31:33	11.9	16.43	2.785	9.1348
11/24/1999	10:31:36	11.95	16.42	2.785	9.1348
11/24/1999	10:31:39	12	16.42	2.785	9.1348
11/24/1999	10:31:42	12.05	16.42	2.785	9.1348
11/24/1999	10:31:45	12.1	16.42	2.783	9.12824
11/24/1999	10:31:48	12.15	16.42	2.785	9.1348
11/24/1999	10:31:51	12.2	16.42	2.783	9.12824
11/24/1999	10:31:54	12.25	16.42	2.785	9.1348
11/24/1999	10:31:57	12.3	16.41	2.783	9.12824
11/24/1999	10:32:00	12.35	16.41	2.785	9.1348
11/24/1999	10:32:03	12.4	16.41	2.785	9.1348
11/24/1999	10:32:06	12.45	16.41	2.785	9.1348
11/24/1999	10:32:09	12.5	16.41	2.783	9.12824
11/24/1999	10:32:12	12.55	16.41	2.785	9.1348
11/24/1999	10:32:15	12.6	16.41	2.785	9.1348
11/24/1999	10:32:18	12.65	16.41	2.785	9.1348
11/24/1999	10:32:21	12.7	16.41	2.783	9.12824
11/24/1999	10:32:24	12.75	16.41	2.785	9.1348

11/24/1999	10:32:27	12.8	16.41	2.785	9.1348
11/24/1999	10:32:30	12.85	16.41	2.785	9.1348
11/24/1999	10:32:33	12.9	16.41	2.783	9.12824
11/24/1999	10:32:36	12.95	16.41	2.785	9.1348
11/24/1999	10:32:39	13	16.41	2.785	9.1348
11/24/1999	10:32:42	13.05	16.41	2.783	9.12824
11/24/1999	10:32:45	13.1	16.41	2.785	9.1348
11/24/1999	10:32:48	13.15	16.4	2.785	9.1348
11/24/1999	10:32:51	13.2	16.41	2.785	9.1348
11/24/1999	10:32:54	13.25	16.4	2.783	9.12824
11/24/1999	10:32:57	13.3	16.4	2.785	9.1348
11/24/1999	10:33:00	13.35	16.4	2.783	9.12824
11/24/1999	10:33:03	13.4	16.4	2.785	9.1348
11/24/1999	10:33:06	13.45	16.4	2.785	9.1348
11/24/1999	10:33:09	13.5	16.4	2.785	9.1348
11/24/1999	10:33:12	13.55	16.4	2.785	9.1348
11/24/1999	10:33:15	13.6	16.4	2.785	9.1348
11/24/1999	10:33:18	13.65	16.4	2.785	9.1348
11/24/1999	10:33:21	13.7	16.41	2.785	9.1348
11/24/1999	10:33:24	13.75	16.41	2.785	9.1348
11/24/1999	10:33:27	13.8	16.41	2.785	9.1348
11/24/1999	10:33:30	13.85	16.41	2.785	9.1348
11/24/1999	10:33:33	13.9	16.41	2.783	9.12824
11/24/1999	10:33:36	13.95	16.41	2.785	9.1348
11/24/1999	10:33:39	14	16.41	2.785	9.1348
11/24/1999	10:33:42	14.05	16.4	2.785	9.1348
11/24/1999	10:33:45	14.1	16.39	2.783	9.12824
11/24/1999	10:33:48	14.15	16.42	2.785	9.1348
11/24/1999	10:33:51	14.2	16.42	2.785	9.1348
11/24/1999	10:33:54	14.25	16.42	2.785	9.1348
11/24/1999	10:33:57	14.3	16.44	2.783	9.12824
11/24/1999	10:34:00	14.35	16.45	2.783	9.12824
11/24/1999	10:34:03	14.4	16.48	2.783	9.12824
11/24/1999	10:34:06	14.45	16.5	2.783	9.12824
11/24/1999	10:34:09	14.5	16.52	2.783	9.12824
11/24/1999	10:34:12	14.55	16.53	2.783	9.12824
11/24/1999	10:34:15	14.6	16.52	2.783	9.12824
11/24/1999	10:34:18	14.65	16.54	2.783	9.12824
11/24/1999	10:34:21	14.7	16.56	2.783	9.12824
11/24/1999	10:34:24	14.75	16.57	2.783	9.12824
11/24/1999	10:34:27	14.8	16.58	2.783	9.12824
11/24/1999	10:34:30	14.85	16.6	2.783	9.12824
11/24/1999	10:34:33	14.9	16.61	2.783	9.12824
11/24/1999	10:34:36	14.95	16.62	2.783	9.12824
11/24/1999	10:34:39	15	16.61	2.784	9.13152
11/24/1999	10:34:42	15.05	16.6	2.784	9.13152
11/24/1999	10:34:45	15.1	16.59	2.784	9.13152
11/24/1999	10:34:48	15.15	16.58	2.784	9.13152
11/24/1999	10:34:51	15.2	16.58	2.783	9.12824

11/24/1999	10:34:54	15.25	16.58	2.784	9.13152
11/24/1999	10:34:57	15.3	16.56	2.784	9.13152
11/24/1999	10:35:00	15.35	16.56	2.784	9.13152
11/24/1999	10:35:03	15.4	16.56	2.784	9.13152
11/24/1999	10:35:06	15.45	16.55	2.784	9.13152
11/24/1999	10:35:09	15.5	16.55	2.783	9.12824
11/24/1999	10:35:12	15.55	16.58	2.783	9.12824
11/24/1999	10:35:15	15.6	16.6	2.783	9.12824
11/24/1999	10:35:18	15.65	16.61	2.783	9.12824
11/24/1999	10:35:21	15.7	16.63	2.783	9.12824
11/24/1999	10:35:24	15.75	16.64	2.783	9.12824
11/24/1999	10:35:27	15.8	16.65	2.783	9.12824
11/24/1999	10:35:30	15.85	16.64	2.784	9.13152
11/24/1999	10:35:33	15.9	16.63	2.784	9.13152
11/24/1999	10:35:36	15.95	16.62	2.784	9.13152
11/24/1999	10:35:39	16	16.61	2.784	9.13152
11/24/1999	10:35:42	16.05	16.61	2.784	9.13152
11/24/1999	10:35:45	16.1	16.6	2.783	9.12824
11/24/1999	10:35:48	16.15	16.6	2.784	9.13152
11/24/1999	10:35:51	16.2	16.59	2.784	9.13152
11/24/1999	10:35:54	16.25	16.59	2.784	9.13152
11/24/1999	10:35:57	16.3	16.59	2.784	9.13152
11/24/1999	10:36:00	16.35	16.58	2.783	9.12824
11/24/1999	10:36:03	16.4	16.58	2.784	9.13152
11/24/1999	10:36:06	16.45	16.57	2.784	9.13152
11/24/1999	10:36:09	16.5	16.59	2.783	9.12824
11/24/1999	10:36:12	16.55	16.62	2.783	9.12824
11/24/1999	10:36:15	16.6	16.64	2.783	9.12824
11/24/1999	10:36:18	16.65	16.65	2.783	9.12824
11/24/1999	10:36:21	16.7	16.65	2.783	9.12824
11/24/1999	10:36:24	16.75	16.64	2.784	9.13152
11/24/1999	10:36:27	16.8	16.63	2.784	9.13152
11/24/1999	10:36:30	16.85	16.62	2.784	9.13152
11/24/1999	10:36:33	16.9	16.61	2.784	9.13152
11/24/1999	10:36:36	16.95	16.61	2.784	9.13152
11/24/1999	10:36:39	17	16.61	2.784	9.13152
11/24/1999	10:36:42	17.05	16.6	2.784	9.13152
11/24/1999	10:36:45	17.1	16.6	2.784	9.13152
11/24/1999	10:36:48	17.15	16.61	2.784	9.13152
11/24/1999	10:36:51	17.2	16.63	2.783	9.12824
11/24/1999	10:36:54	17.25	16.65	2.783	9.12824
11/24/1999	10:36:57	17.3	16.67	2.783	9.12824
11/24/1999	10:37:00	17.35	16.65	2.783	9.12824
11/24/1999	10:37:03	17.4	16.65	2.784	9.13152
11/24/1999	10:37:06	17.45	16.64	2.784	9.13152
11/24/1999	10:37:09	17.5	16.64	2.784	9.13152
11/24/1999	10:37:12	17.55	16.63	2.784	9.13152
11/24/1999	10:37:15	17.6	16.62	2.784	9.13152
11/24/1999	10:37:18	17.65	16.62	2.784	9.13152

11/24/1999	10:37:21	17.7	16.62	2.784	9.13152
11/24/1999	10:37:24	17.75	16.61	2.783	9.12824
11/24/1999	10:37:27	17.8	16.61	2.784	9.13152
11/24/1999	10:37:30	17.85	16.61	2.784	9.13152
11/24/1999	10:37:33	17.9	16.6	2.784	9.13152
11/24/1999	10:37:36	17.95	16.6	2.784	9.13152
11/24/1999	10:37:39	18	16.6	2.784	9.13152
11/24/1999	10:37:42	18.05	16.6	2.784	9.13152
11/24/1999	10:37:45	18.1	16.59	2.784	9.13152
11/24/1999	10:37:48	18.15	16.59	2.784	9.13152
11/24/1999	10:37:51	18.2	16.58	2.784	9.13152
11/24/1999	10:37:54	18.25	16.6	2.784	9.13152

IN_SITU INC. Troll

Report generated: 02/02/2000 17:32:47
Report from file: C:\WINSITU\DATA\MW-15AOT.BIN
DataMgr Version 2.19.0.0

Serial number: 11909
Firmware Version 7.08
Unit name:

Test name: MW-15A (slugout)

Test defined on: 11/24/1999 8:49:06
Test started on: 11/24/1999 8:49:18
Test stopped on: 11/24/1999 9:34:16
Test extracted on: 11/24/1999 10:35:09

Data gathered using Linear testing
Time between data points: 0.0500 Minutes.
Number of data samples: 900

TOTAL DATA SAMPLES 900

Channel number [1]
Measurement type: Temperature
Channel name: Temperature

Channel number [2]
Measurement type: Pressure/Level
Channel name: Pressure Head
Sensor Range: 30 PSI.
Specific gravity: 1

Date	Time	ET (min)	Chan[1] Celsius	Chan[2] Meters H2O	Feet H20
11/24/1999	8:49:18	0	17.58	3.584	11.75552
11/24/1999	8:49:21	0.05	17.58	3.584	11.75552
11/24/1999	8:49:24	0.1	17.58	3.584	11.75552
11/24/1999	8:49:27	0.15	17.58	3.584	11.75552
11/24/1999	8:49:30	0.2	17.58	3.584	11.75552
11/24/1999	8:49:33	0.25	17.57	3.581	11.74568
11/24/1999	8:49:36	0.3	17.57	3.309	10.85352
11/24/1999	8:49:39	0.35	17.56	3.342	10.96176
11/24/1999	8:49:42	0.4	17.56	3.342	10.96176
11/24/1999	8:49:45	0.45	17.56	3.346	10.97488
11/24/1999	8:49:48	0.5	17.56	3.349	10.98472

11/24/1999	8:49:51	0.55	17.56	3.352	10.99456
11/24/1999	8:49:54	0.6	17.56	3.353	10.99784
11/24/1999	8:49:57	0.65	17.56	3.354	11.00112
11/24/1999	8:50:00	0.7	17.56	3.358	11.01424
11/24/1999	8:50:03	0.75	17.56	3.361	11.02408
11/24/1999	8:50:06	0.8	17.56	3.362	11.02736
11/24/1999	8:50:09	0.85	17.55	3.365	11.0372
11/24/1999	8:50:12	0.9	17.55	3.368	11.04704
11/24/1999	8:50:15	0.95	17.55	3.372	11.06016
11/24/1999	8:50:18	1	17.55	3.373	11.06344
11/24/1999	8:50:21	1.05	17.55	3.375	11.07
11/24/1999	8:50:24	1.1	17.55	3.378	11.07984
11/24/1999	8:50:27	1.15	17.55	3.379	11.08312
11/24/1999	8:50:30	1.2	17.55	3.379	11.08312
11/24/1999	8:50:33	1.25	17.54	3.382	11.09296
11/24/1999	8:50:36	1.3	17.54	3.385	11.1028
11/24/1999	8:50:39	1.35	17.54	3.386	11.10608
11/24/1999	8:50:42	1.4	17.54	3.387	11.10936
11/24/1999	8:50:45	1.45	17.53	3.39	11.1192
11/24/1999	8:50:48	1.5	17.53	3.392	11.12576
11/24/1999	8:50:51	1.55	17.53	3.393	11.12904
11/24/1999	8:50:54	1.6	17.53	3.396	11.13888
11/24/1999	8:50:57	1.65	17.53	3.396	11.13888
11/24/1999	8:51:00	1.7	17.53	3.399	11.14872
11/24/1999	8:51:03	1.75	17.53	3.4	11.152
11/24/1999	8:51:06	1.8	17.52	3.401	11.15528
11/24/1999	8:51:09	1.85	17.52	3.402	11.15856
11/24/1999	8:51:12	1.9	17.52	3.404	11.16512
11/24/1999	8:51:15	1.95	17.52	3.406	11.17168
11/24/1999	8:51:18	2	17.51	3.406	11.17168
11/24/1999	8:51:21	2.05	17.51	3.408	11.17824
11/24/1999	8:51:24	2.1	17.51	3.409	11.18152
11/24/1999	8:51:27	2.15	17.51	3.411	11.18808
11/24/1999	8:51:30	2.2	17.51	3.412	11.19136
11/24/1999	8:51:33	2.25	17.51	3.413	11.19464
11/24/1999	8:51:36	2.3	17.5	3.415	11.2012
11/24/1999	8:51:39	2.35	17.5	3.416	11.20448
11/24/1999	8:51:42	2.4	17.5	3.418	11.21104
11/24/1999	8:51:45	2.45	17.5	3.418	11.21104
11/24/1999	8:51:48	2.5	17.5	3.419	11.21432
11/24/1999	8:51:51	2.55	17.5	3.42	11.2176
11/24/1999	8:51:54	2.6	17.5	3.422	11.22416
11/24/1999	8:51:57	2.65	17.49	3.423	11.22744
11/24/1999	8:52:00	2.7	17.49	3.425	11.234
11/24/1999	8:52:03	2.75	17.48	3.425	11.234
11/24/1999	8:52:06	2.8	17.48	3.426	11.23728
11/24/1999	8:52:09	2.85	17.48	3.429	11.24712
11/24/1999	8:52:12	2.9	17.48	3.429	11.24712
11/24/1999	8:52:15	2.95	17.48	3.43	11.2504

11/24/1999	8:52:18	3	17.48	3.432	11.25696
11/24/1999	8:52:21	3.05	17.48	3.433	11.26024
11/24/1999	8:52:24	3.1	17.48	3.434	11.26352
11/24/1999	8:52:27	3.15	17.48	3.434	11.26352
11/24/1999	8:52:30	3.2	17.47	3.436	11.27008
11/24/1999	8:52:33	3.25	17.47	3.437	11.27336
11/24/1999	8:52:36	3.3	17.47	3.437	11.27336
11/24/1999	8:52:39	3.35	17.47	3.44	11.2832
11/24/1999	8:52:42	3.4	17.47	3.44	11.2832
11/24/1999	8:52:45	3.45	17.47	3.442	11.28976
11/24/1999	8:52:48	3.5	17.47	3.442	11.28976
11/24/1999	8:52:51	3.55	17.47	3.443	11.29304
11/24/1999	8:52:54	3.6	17.47	3.444	11.29632
11/24/1999	8:52:57	3.65	17.47	3.446	11.30288
11/24/1999	8:53:00	3.7	17.46	3.446	11.30288
11/24/1999	8:53:03	3.75	17.46	3.447	11.30616
11/24/1999	8:53:06	3.8	17.46	3.447	11.30616
11/24/1999	8:53:09	3.85	17.46	3.45	11.316
11/24/1999	8:53:12	3.9	17.46	3.45	11.316
11/24/1999	8:53:15	3.95	17.45	3.451	11.31928
11/24/1999	8:53:18	4	17.45	3.451	11.31928
11/24/1999	8:53:21	4.05	17.45	3.453	11.32584
11/24/1999	8:53:24	4.1	17.45	3.453	11.32584
11/24/1999	8:53:27	4.15	17.45	3.453	11.32584
11/24/1999	8:53:30	4.2	17.45	3.455	11.3324
11/24/1999	8:53:33	4.25	17.45	3.456	11.33568
11/24/1999	8:53:36	4.3	17.45	3.456	11.33568
11/24/1999	8:53:39	4.35	17.45	3.458	11.34224
11/24/1999	8:53:42	4.4	17.45	3.459	11.34552
11/24/1999	8:53:45	4.45	17.45	3.459	11.34552
11/24/1999	8:53:48	4.5	17.45	3.461	11.35208
11/24/1999	8:53:51	4.55	17.44	3.461	11.35208
11/24/1999	8:53:54	4.6	17.44	3.462	11.35536
11/24/1999	8:53:57	4.65	17.44	3.462	11.35536
11/24/1999	8:54:00	4.7	17.44	3.463	11.35864
11/24/1999	8:54:03	4.75	17.44	3.463	11.35864
11/24/1999	8:54:06	4.8	17.44	3.465	11.3652
11/24/1999	8:54:09	4.85	17.44	3.466	11.36848
11/24/1999	8:54:12	4.9	17.44	3.466	11.36848
11/24/1999	8:54:15	4.95	17.44	3.468	11.37504
11/24/1999	8:54:18	5	17.44	3.468	11.37504
11/24/1999	8:54:21	5.05	17.43	3.468	11.37504
11/24/1999	8:54:24	5.1	17.43	3.469	11.37832
11/24/1999	8:54:27	5.15	17.43	3.469	11.37832
11/24/1999	8:54:30	5.2	17.43	3.47	11.3816
11/24/1999	8:54:33	5.25	17.43	3.473	11.39144
11/24/1999	8:54:36	5.3	17.43	3.473	11.39144
11/24/1999	8:54:39	5.35	17.43	3.473	11.39144
11/24/1999	8:54:42	5.4	17.43	3.473	11.39144

11/24/1999	8:54:45	5.45	17.43	3.475	11.398
11/24/1999	8:54:48	5.5	17.43	3.476	11.40128
11/24/1999	8:54:51	5.55	17.42	3.476	11.40128
11/24/1999	8:54:54	5.6	17.43	3.476	11.40128
11/24/1999	8:54:57	5.65	17.42	3.477	11.40456
11/24/1999	8:55:00	5.7	17.42	3.479	11.41112
11/24/1999	8:55:03	5.75	17.42	3.479	11.41112
11/24/1999	8:55:06	5.8	17.42	3.479	11.41112
11/24/1999	8:55:09	5.85	17.42	3.48	11.4144
11/24/1999	8:55:12	5.9	17.42	3.48	11.4144
11/24/1999	8:55:15	5.95	17.42	3.482	11.42096
11/24/1999	8:55:18	6	17.42	3.482	11.42096
11/24/1999	8:55:21	6.05	17.42	3.483	11.42424
11/24/1999	8:55:24	6.1	17.42	3.483	11.42424
11/24/1999	8:55:27	6.15	17.42	3.484	11.42752
11/24/1999	8:55:30	6.2	17.42	3.484	11.42752
11/24/1999	8:55:33	6.25	17.41	3.484	11.42752
11/24/1999	8:55:36	6.3	17.42	3.486	11.43408
11/24/1999	8:55:39	6.35	17.41	3.486	11.43408
11/24/1999	8:55:42	6.4	17.42	3.487	11.43736
11/24/1999	8:55:45	6.45	17.42	3.489	11.44392
11/24/1999	8:55:48	6.5	17.41	3.489	11.44392
11/24/1999	8:55:51	6.55	17.41	3.489	11.44392
11/24/1999	8:55:54	6.6	17.41	3.489	11.44392
11/24/1999	8:55:57	6.65	17.41	3.49	11.4472
11/24/1999	8:56:00	6.7	17.41	3.491	11.45048
11/24/1999	8:56:03	6.75	17.41	3.491	11.45048
11/24/1999	8:56:06	6.8	17.41	3.491	11.45048
11/24/1999	8:56:09	6.85	17.41	3.493	11.45704
11/24/1999	8:56:12	6.9	17.41	3.493	11.45704
11/24/1999	8:56:15	6.95	17.41	3.493	11.45704
11/24/1999	8:56:18	7	17.41	3.494	11.46032
11/24/1999	8:56:21	7.05	17.41	3.496	11.46688
11/24/1999	8:56:24	7.1	17.41	3.496	11.46688
11/24/1999	8:56:27	7.15	17.41	3.496	11.46688
11/24/1999	8:56:30	7.2	17.41	3.496	11.46688
11/24/1999	8:56:33	7.25	17.41	3.497	11.47016
11/24/1999	8:56:36	7.3	17.41	3.497	11.47016
11/24/1999	8:56:39	7.35	17.41	3.498	11.47344
11/24/1999	8:56:42	7.4	17.41	3.498	11.47344
11/24/1999	8:56:45	7.45	17.41	3.498	11.47344
11/24/1999	8:56:48	7.5	17.41	3.5	11.48
11/24/1999	8:56:51	7.55	17.41	3.5	11.48
11/24/1999	8:56:54	7.6	17.41	3.5	11.48
11/24/1999	8:56:57	7.65	17.41	3.501	11.48328
11/24/1999	8:57:00	7.7	17.41	3.501	11.48328
11/24/1999	8:57:03	7.75	17.41	3.501	11.48328
11/24/1999	8:57:06	7.8	17.41	3.503	11.48984
11/24/1999	8:57:09	7.85	17.41	3.503	11.48984

11/24/1999	8:57:12	7.9	17.41	3.502	11.48656
11/24/1999	8:57:15	7.95	17.41	3.503	11.48984
11/24/1999	8:57:18	8	17.41	3.503	11.48984
11/24/1999	8:57:21	8.05	17.41	3.503	11.48984
11/24/1999	8:57:24	8.1	17.41	3.505	11.4964
11/24/1999	8:57:27	8.15	17.41	3.506	11.49968
11/24/1999	8:57:30	8.2	17.41	3.505	11.4964
11/24/1999	8:57:33	8.25	17.41	3.506	11.49968
11/24/1999	8:57:36	8.3	17.41	3.506	11.49968
11/24/1999	8:57:39	8.35	17.41	3.506	11.49968
11/24/1999	8:57:42	8.4	17.41	3.508	11.50624
11/24/1999	8:57:45	8.45	17.41	3.508	11.50624
11/24/1999	8:57:48	8.5	17.41	3.508	11.50624
11/24/1999	8:57:51	8.55	17.41	3.508	11.50624
11/24/1999	8:57:54	8.6	17.41	3.508	11.50624
11/24/1999	8:57:57	8.65	17.41	3.51	11.5128
11/24/1999	8:58:00	8.7	17.41	3.51	11.5128
11/24/1999	8:58:03	8.75	17.41	3.51	11.5128
11/24/1999	8:58:06	8.8	17.41	3.51	11.5128
11/24/1999	8:58:09	8.85	17.41	3.51	11.5128
11/24/1999	8:58:12	8.9	17.41	3.51	11.5128
11/24/1999	8:58:15	8.95	17.41	3.512	11.51936
11/24/1999	8:58:18	9	17.41	3.512	11.51936
11/24/1999	8:58:21	9.05	17.41	3.512	11.51936
11/24/1999	8:58:24	9.1	17.41	3.513	11.52264
11/24/1999	8:58:27	9.15	17.41	3.513	11.52264
11/24/1999	8:58:30	9.2	17.41	3.513	11.52264
11/24/1999	8:58:33	9.25	17.41	3.513	11.52264
11/24/1999	8:58:36	9.3	17.41	3.513	11.52264
11/24/1999	8:58:39	9.35	17.41	3.515	11.5292
11/24/1999	8:58:42	9.4	17.41	3.516	11.53248
11/24/1999	8:58:45	9.45	17.41	3.515	11.5292
11/24/1999	8:58:48	9.5	17.41	3.516	11.53248
11/24/1999	8:58:51	9.55	17.41	3.516	11.53248
11/24/1999	8:58:54	9.6	17.41	3.516	11.53248
11/24/1999	8:58:57	9.65	17.41	3.517	11.53576
11/24/1999	8:59:00	9.7	17.41	3.517	11.53576
11/24/1999	8:59:03	9.75	17.41	3.517	11.53576
11/24/1999	8:59:06	9.8	17.41	3.517	11.53576
11/24/1999	8:59:09	9.85	17.41	3.519	11.54232
11/24/1999	8:59:12	9.9	17.41	3.519	11.54232
11/24/1999	8:59:15	9.95	17.41	3.519	11.54232
11/24/1999	8:59:18	10	17.41	3.519	11.54232
11/24/1999	8:59:21	10.05	17.41	3.52	11.5456
11/24/1999	8:59:24	10.1	17.41	3.52	11.5456
11/24/1999	8:59:27	10.15	17.41	3.52	11.5456
11/24/1999	8:59:30	10.2	17.41	3.52	11.5456
11/24/1999	8:59:33	10.25	17.41	3.522	11.55216
11/24/1999	8:59:36	10.3	17.41	3.522	11.55216

11/24/1999	8:59:39	10.35	17.41	3.522	11.55216
11/24/1999	8:59:42	10.4	17.41	3.522	11.55216
11/24/1999	8:59:45	10.45	17.41	3.523	11.55544
11/24/1999	8:59:48	10.5	17.41	3.523	11.55544
11/24/1999	8:59:51	10.55	17.41	3.523	11.55544
11/24/1999	8:59:54	10.6	17.41	3.523	11.55544
11/24/1999	8:59:57	10.65	17.41	3.524	11.55872
11/24/1999	9:00:00	10.7	17.41	3.524	11.55872
11/24/1999	9:00:03	10.75	17.41	3.524	11.55872
11/24/1999	9:00:06	10.8	17.41	3.526	11.56528
11/24/1999	9:00:09	10.85	17.41	3.526	11.56528
11/24/1999	9:00:12	10.9	17.41	3.526	11.56528
11/24/1999	9:00:15	10.95	17.41	3.526	11.56528
11/24/1999	9:00:18	11	17.41	3.526	11.56528
11/24/1999	9:00:21	11.05	17.41	3.526	11.56528
11/24/1999	9:00:24	11.1	17.41	3.527	11.56856
11/24/1999	9:00:27	11.15	17.41	3.527	11.56856
11/24/1999	9:00:30	11.2	17.41	3.527	11.56856
11/24/1999	9:00:33	11.25	17.41	3.527	11.56856
11/24/1999	9:00:36	11.3	17.41	3.529	11.57512
11/24/1999	9:00:39	11.35	17.41	3.529	11.57512
11/24/1999	9:00:42	11.4	17.41	3.529	11.57512
11/24/1999	9:00:45	11.45	17.41	3.529	11.57512
11/24/1999	9:00:48	11.5	17.41	3.53	11.5784
11/24/1999	9:00:51	11.55	17.41	3.53	11.5784
11/24/1999	9:00:54	11.6	17.41	3.53	11.5784
11/24/1999	9:00:57	11.65	17.41	3.53	11.5784
11/24/1999	9:01:00	11.7	17.41	3.53	11.5784
11/24/1999	9:01:03	11.75	17.41	3.53	11.5784
11/24/1999	9:01:06	11.8	17.41	3.532	11.58496
11/24/1999	9:01:09	11.85	17.41	3.53	11.5784
11/24/1999	9:01:12	11.9	17.41	3.532	11.58496
11/24/1999	9:01:15	11.95	17.42	3.532	11.58496
11/24/1999	9:01:18	12	17.41	3.532	11.58496
11/24/1999	9:01:21	12.05	17.42	3.533	11.58824
11/24/1999	9:01:24	12.1	17.41	3.533	11.58824
11/24/1999	9:01:27	12.15	17.42	3.533	11.58824
11/24/1999	9:01:30	12.2	17.41	3.533	11.58824
11/24/1999	9:01:33	12.25	17.42	3.533	11.58824
11/24/1999	9:01:36	12.3	17.41	3.534	11.59152
11/24/1999	9:01:39	12.35	17.42	3.534	11.59152
11/24/1999	9:01:42	12.4	17.42	3.534	11.59152
11/24/1999	9:01:45	12.45	17.42	3.534	11.59152
11/24/1999	9:01:48	12.5	17.41	3.534	11.59152
11/24/1999	9:01:51	12.55	17.42	3.534	11.59152
11/24/1999	9:01:54	12.6	17.42	3.536	11.59808
11/24/1999	9:01:57	12.65	17.42	3.536	11.59808
11/24/1999	9:02:00	12.7	17.42	3.536	11.59808
11/24/1999	9:02:03	12.75	17.42	3.536	11.59808

11/24/1999	9:02:06	12.8	17.42	3.536	11.59808
11/24/1999	9:02:09	12.85	17.42	3.536	11.59808
11/24/1999	9:02:12	12.9	17.42	3.536	11.59808
11/24/1999	9:02:15	12.95	17.42	3.536	11.59808
11/24/1999	9:02:18	13	17.42	3.537	11.60136
11/24/1999	9:02:21	13.05	17.42	3.537	11.60136
11/24/1999	9:02:24	13.1	17.42	3.537	11.60136
11/24/1999	9:02:27	13.15	17.42	3.537	11.60136
11/24/1999	9:02:30	13.2	17.42	3.539	11.60792
11/24/1999	9:02:33	13.25	17.42	3.539	11.60792
11/24/1999	9:02:36	13.3	17.42	3.539	11.60792
11/24/1999	9:02:39	13.35	17.42	3.539	11.60792
11/24/1999	9:02:42	13.4	17.42	3.539	11.60792
11/24/1999	9:02:45	13.45	17.42	3.539	11.60792
11/24/1999	9:02:48	13.5	17.42	3.54	11.6112
11/24/1999	9:02:51	13.55	17.42	3.54	11.6112
11/24/1999	9:02:54	13.6	17.42	3.54	11.6112
11/24/1999	9:02:57	13.65	17.42	3.54	11.6112
11/24/1999	9:03:00	13.7	17.42	3.54	11.6112
11/24/1999	9:03:03	13.75	17.42	3.54	11.6112
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11/24/1999	9:03:09	13.85	17.42	3.54	11.6112
11/24/1999	9:03:12	13.9	17.42	3.54	11.6112
11/24/1999	9:03:15	13.95	17.42	3.541	11.61448
11/24/1999	9:03:18	14	17.42	3.541	11.61448
11/24/1999	9:03:21	14.05	17.43	3.542	11.61776
11/24/1999	9:03:24	14.1	17.43	3.541	11.61448
11/24/1999	9:03:27	14.15	17.43	3.541	11.61448
11/24/1999	9:03:30	14.2	17.42	3.542	11.61776
11/24/1999	9:03:33	14.25	17.43	3.542	11.61776
11/24/1999	9:03:36	14.3	17.43	3.542	11.61776
11/24/1999	9:03:39	14.35	17.43	3.542	11.61776
11/24/1999	9:03:42	14.4	17.42	3.542	11.61776
11/24/1999	9:03:45	14.45	17.42	3.542	11.61776
11/24/1999	9:03:48	14.5	17.42	3.542	11.61776
11/24/1999	9:03:51	14.55	17.43	3.543	11.62104
11/24/1999	9:03:54	14.6	17.42	3.542	11.61776
11/24/1999	9:03:57	14.65	17.43	3.543	11.62104
11/24/1999	9:04:00	14.7	17.43	3.543	11.62104
11/24/1999	9:04:03	14.75	17.43	3.543	11.62104
11/24/1999	9:04:06	14.8	17.42	3.543	11.62104
11/24/1999	9:04:09	14.85	17.43	3.543	11.62104
11/24/1999	9:04:12	14.9	17.43	3.543	11.62104
11/24/1999	9:04:15	14.95	17.43	3.543	11.62104
11/24/1999	9:04:18	15	17.42	3.545	11.6276
11/24/1999	9:04:21	15.05	17.43	3.543	11.62104
11/24/1999	9:04:24	15.1	17.43	3.545	11.6276
11/24/1999	9:04:27	15.15	17.43	3.545	11.6276
11/24/1999	9:04:30	15.2	17.43	3.545	11.6276

11/24/1999	9:04:33	15.25	17.43	3.545	11.6276
11/24/1999	9:04:36	15.3	17.43	3.545	11.6276
11/24/1999	9:04:39	15.35	17.43	3.545	11.6276
11/24/1999	9:04:42	15.4	17.43	3.546	11.63088
11/24/1999	9:04:45	15.45	17.43	3.545	11.6276
11/24/1999	9:04:48	15.5	17.43	3.545	11.6276
11/24/1999	9:04:51	15.55	17.43	3.546	11.63088
11/24/1999	9:04:54	15.6	17.43	3.546	11.63088
11/24/1999	9:04:57	15.65	17.43	3.546	11.63088
11/24/1999	9:05:00	15.7	17.43	3.546	11.63088
11/24/1999	9:05:03	15.75	17.44	3.546	11.63088
11/24/1999	9:05:06	15.8	17.44	3.548	11.63744
11/24/1999	9:05:09	15.85	17.43	3.546	11.63088
11/24/1999	9:05:12	15.9	17.44	3.546	11.63088
11/24/1999	9:05:15	15.95	17.43	3.548	11.63744
11/24/1999	9:05:18	16	17.44	3.548	11.63744
11/24/1999	9:05:21	16.05	17.43	3.548	11.63744
11/24/1999	9:05:24	16.1	17.43	3.548	11.63744
11/24/1999	9:05:27	16.15	17.43	3.548	11.63744
11/24/1999	9:05:30	16.2	17.43	3.548	11.63744
11/24/1999	9:05:33	16.25	17.43	3.549	11.64072
11/24/1999	9:05:36	16.3	17.44	3.549	11.64072
11/24/1999	9:05:39	16.35	17.43	3.549	11.64072
11/24/1999	9:05:42	16.4	17.43	3.549	11.64072
11/24/1999	9:05:45	16.45	17.44	3.549	11.64072
11/24/1999	9:05:48	16.5	17.43	3.549	11.64072
11/24/1999	9:05:51	16.55	17.44	3.549	11.64072
11/24/1999	9:05:54	16.6	17.43	3.549	11.64072
11/24/1999	9:05:57	16.65	17.44	3.549	11.64072
11/24/1999	9:06:00	16.7	17.43	3.549	11.64072
11/24/1999	9:06:03	16.75	17.44	3.551	11.64728
11/24/1999	9:06:06	16.8	17.44	3.551	11.64728
11/24/1999	9:06:09	16.85	17.43	3.551	11.64728
11/24/1999	9:06:12	16.9	17.44	3.551	11.64728
11/24/1999	9:06:15	16.95	17.44	3.551	11.64728
11/24/1999	9:06:18	17	17.44	3.551	11.64728
11/24/1999	9:06:21	17.05	17.44	3.551	11.64728
11/24/1999	9:06:24	17.1	17.44	3.551	11.64728
11/24/1999	9:06:27	17.15	17.43	3.551	11.64728
11/24/1999	9:06:30	17.2	17.43	3.551	11.64728
11/24/1999	9:06:33	17.25	17.43	3.551	11.64728
11/24/1999	9:06:36	17.3	17.43	3.551	11.64728
11/24/1999	9:06:39	17.35	17.43	3.552	11.65056
11/24/1999	9:06:42	17.4	17.43	3.551	11.64728
11/24/1999	9:06:45	17.45	17.44	3.552	11.65056
11/24/1999	9:06:48	17.5	17.44	3.552	11.65056
11/24/1999	9:06:51	17.55	17.43	3.552	11.65056
11/24/1999	9:06:54	17.6	17.44	3.552	11.65056
11/24/1999	9:06:57	17.65	17.43	3.552	11.65056

11/24/1999	9:07:00	17.7	17.44	3.552	11.65056
11/24/1999	9:07:03	17.75	17.43	3.552	11.65056
11/24/1999	9:07:06	17.8	17.43	3.552	11.65056
11/24/1999	9:07:09	17.85	17.43	3.552	11.65056
11/24/1999	9:07:12	17.9	17.44	3.552	11.65056
11/24/1999	9:07:15	17.95	17.43	3.553	11.65384
11/24/1999	9:07:18	18	17.44	3.552	11.65056
11/24/1999	9:07:21	18.05	17.43	3.553	11.65384
11/24/1999	9:07:24	18.1	17.43	3.553	11.65384
11/24/1999	9:07:27	18.15	17.43	3.553	11.65384
11/24/1999	9:07:30	18.2	17.43	3.553	11.65384
11/24/1999	9:07:33	18.25	17.43	3.553	11.65384
11/24/1999	9:07:36	18.3	17.43	3.553	11.65384
11/24/1999	9:07:39	18.35	17.43	3.553	11.65384
11/24/1999	9:07:42	18.4	17.43	3.555	11.6604
11/24/1999	9:07:45	18.45	17.43	3.553	11.65384
11/24/1999	9:07:48	18.5	17.43	3.553	11.65384
11/24/1999	9:07:51	18.55	17.43	3.555	11.6604
11/24/1999	9:07:54	18.6	17.43	3.555	11.6604
11/24/1999	9:07:57	18.65	17.44	3.555	11.6604
11/24/1999	9:08:00	18.7	17.43	3.555	11.6604
11/24/1999	9:08:03	18.75	17.43	3.555	11.6604
11/24/1999	9:08:06	18.8	17.43	3.555	11.6604
11/24/1999	9:08:09	18.85	17.43	3.555	11.6604
11/24/1999	9:08:12	18.9	17.43	3.555	11.6604
11/24/1999	9:08:15	18.95	17.43	3.555	11.6604
11/24/1999	9:08:18	19	17.43	3.555	11.6604
11/24/1999	9:08:21	19.05	17.43	3.555	11.6604
11/24/1999	9:08:24	19.1	17.43	3.555	11.6604
11/24/1999	9:08:27	19.15	17.43	3.555	11.6604
11/24/1999	9:08:30	19.2	17.43	3.555	11.6604
11/24/1999	9:08:33	19.25	17.43	3.556	11.66368
11/24/1999	9:08:36	19.3	17.43	3.556	11.66368
11/24/1999	9:08:39	19.35	17.43	3.555	11.6604
11/24/1999	9:08:42	19.4	17.43	3.556	11.66368
11/24/1999	9:08:45	19.45	17.43	3.555	11.6604
11/24/1999	9:08:48	19.5	17.43	3.556	11.66368
11/24/1999	9:08:51	19.55	17.43	3.556	11.66368
11/24/1999	9:08:54	19.6	17.44	3.556	11.66368
11/24/1999	9:08:57	19.65	17.43	3.556	11.66368
11/24/1999	9:09:00	19.7	17.43	3.556	11.66368
11/24/1999	9:09:03	19.75	17.43	3.556	11.66368
11/24/1999	9:09:06	19.8	17.44	3.556	11.66368
11/24/1999	9:09:09	19.85	17.43	3.556	11.66368
11/24/1999	9:09:12	19.9	17.43	3.556	11.66368
11/24/1999	9:09:15	19.95	17.43	3.556	11.66368
11/24/1999	9:09:18	20	17.43	3.556	11.66368
11/24/1999	9:09:21	20.05	17.43	3.558	11.67024
11/24/1999	9:09:24	20.1	17.43	3.556	11.66368

11/24/1999	9:09:27	20.15	17.43	3.558	11.67024
11/24/1999	9:09:30	20.2	17.43	3.556	11.66368
11/24/1999	9:09:33	20.25	17.43	3.558	11.67024
11/24/1999	9:09:36	20.3	17.43	3.558	11.67024
11/24/1999	9:09:39	20.35	17.43	3.558	11.67024
11/24/1999	9:09:42	20.4	17.43	3.558	11.67024
11/24/1999	9:09:45	20.45	17.43	3.558	11.67024
11/24/1999	9:09:48	20.5	17.43	3.558	11.67024
11/24/1999	9:09:51	20.55	17.43	3.558	11.67024
11/24/1999	9:09:54	20.6	17.43	3.558	11.67024
11/24/1999	9:09:57	20.65	17.43	3.559	11.67352
11/24/1999	9:10:00	20.7	17.43	3.559	11.67352
11/24/1999	9:10:03	20.75	17.43	3.558	11.67024
11/24/1999	9:10:06	20.8	17.43	3.559	11.67352
11/24/1999	9:10:09	20.85	17.43	3.558	11.67024
11/24/1999	9:10:12	20.9	17.43	3.558	11.67024
11/24/1999	9:10:15	20.95	17.44	3.559	11.67352
11/24/1999	9:10:18	21	17.43	3.559	11.67352
11/24/1999	9:10:21	21.05	17.43	3.559	11.67352
11/24/1999	9:10:24	21.1	17.44	3.559	11.67352
11/24/1999	9:10:27	21.15	17.43	3.559	11.67352
11/24/1999	9:10:30	21.2	17.43	3.559	11.67352
11/24/1999	9:10:33	21.25	17.43	3.559	11.67352
11/24/1999	9:10:36	21.3	17.44	3.559	11.67352
11/24/1999	9:10:39	21.35	17.43	3.559	11.67352
11/24/1999	9:10:42	21.4	17.43	3.559	11.67352
11/24/1999	9:10:45	21.45	17.43	3.559	11.67352
11/24/1999	9:10:48	21.5	17.43	3.559	11.67352
11/24/1999	9:10:51	21.55	17.43	3.559	11.67352
11/24/1999	9:10:54	21.6	17.43	3.56	11.6768
11/24/1999	9:10:57	21.65	17.43	3.56	11.6768
11/24/1999	9:11:00	21.7	17.43	3.56	11.6768
11/24/1999	9:11:03	21.75	17.44	3.559	11.67352
11/24/1999	9:11:06	21.8	17.43	3.56	11.6768
11/24/1999	9:11:09	21.85	17.43	3.56	11.6768
11/24/1999	9:11:12	21.9	17.44	3.56	11.6768
11/24/1999	9:11:15	21.95	17.44	3.56	11.6768
11/24/1999	9:11:18	22	17.44	3.56	11.6768
11/24/1999	9:11:21	22.05	17.43	3.56	11.6768
11/24/1999	9:11:24	22.1	17.43	3.56	11.6768
11/24/1999	9:11:27	22.15	17.43	3.56	11.6768
11/24/1999	9:11:30	22.2	17.43	3.562	11.68336
11/24/1999	9:11:33	22.25	17.44	3.56	11.6768
11/24/1999	9:11:36	22.3	17.43	3.56	11.6768
11/24/1999	9:11:39	22.35	17.43	3.562	11.68336
11/24/1999	9:11:42	22.4	17.43	3.562	11.68336
11/24/1999	9:11:45	22.45	17.43	3.562	11.68336
11/24/1999	9:11:48	22.5	17.43	3.562	11.68336
11/24/1999	9:11:51	22.55	17.43	3.562	11.68336

11/24/1999	9:11:54	22.6	17.43	3.56	11.6768
11/24/1999	9:11:57	22.65	17.43	3.562	11.68336
11/24/1999	9:12:00	22.7	17.44	3.562	11.68336
11/24/1999	9:12:03	22.75	17.44	3.562	11.68336
11/24/1999	9:12:06	22.8	17.43	3.562	11.68336
11/24/1999	9:12:09	22.85	17.43	3.562	11.68336
11/24/1999	9:12:12	22.9	17.43	3.562	11.68336
11/24/1999	9:12:15	22.95	17.43	3.562	11.68336
11/24/1999	9:12:18	23	17.43	3.562	11.68336
11/24/1999	9:12:21	23.05	17.43	3.562	11.68336
11/24/1999	9:12:24	23.1	17.43	3.562	11.68336
11/24/1999	9:12:27	23.15	17.43	3.562	11.68336
11/24/1999	9:12:30	23.2	17.43	3.562	11.68336
11/24/1999	9:12:33	23.25	17.43	3.562	11.68336
11/24/1999	9:12:36	23.3	17.43	3.562	11.68336
11/24/1999	9:12:39	23.35	17.43	3.562	11.68336
11/24/1999	9:12:42	23.4	17.43	3.562	11.68336
11/24/1999	9:12:45	23.45	17.43	3.562	11.68336
11/24/1999	9:12:48	23.5	17.43	3.562	11.68336
11/24/1999	9:12:51	23.55	17.42	3.562	11.68336
11/24/1999	9:12:54	23.6	17.42	3.563	11.68664
11/24/1999	9:12:57	23.65	17.43	3.563	11.68664
11/24/1999	9:13:00	23.7	17.43	3.563	11.68664
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11/24/1999	9:13:15	23.95	17.42	3.562	11.68336
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11/24/1999	9:13:42	24.4	17.42	3.563	11.68664
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11/24/1999	9:13:48	24.5	17.42	3.563	11.68664
11/24/1999	9:13:51	24.55	17.42	3.563	11.68664
11/24/1999	9:13:54	24.6	17.42	3.563	11.68664
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11/24/1999	9:14:09	24.85	17.42	3.565	11.6932
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11/24/1999	9:14:15	24.95	17.42	3.563	11.68664
11/24/1999	9:14:18	25	17.42	3.565	11.6932

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11/24/1999	9:14:27	25.15	17.42	3.565	11.6932
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11/24/1999	9:14:36	25.3	17.41	3.565	11.6932
11/24/1999	9:14:39	25.35	17.41	3.565	11.6932
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11/24/1999	9:14:54	25.6	17.41	3.565	11.6932
11/24/1999	9:14:57	25.65	17.41	3.565	11.6932
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11/24/1999	9:15:03	25.75	17.41	3.566	11.69648
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11/24/1999	9:15:09	25.85	17.41	3.565	11.6932
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11/24/1999	9:15:21	26.05	17.41	3.565	11.6932
11/24/1999	9:15:24	26.1	17.41	3.566	11.69648
11/24/1999	9:15:27	26.15	17.41	3.565	11.6932
11/24/1999	9:15:30	26.2	17.41	3.566	11.69648
11/24/1999	9:15:33	26.25	17.41	3.565	11.6932
11/24/1999	9:15:36	26.3	17.41	3.565	11.6932
11/24/1999	9:15:39	26.35	17.41	3.566	11.69648
11/24/1999	9:15:42	26.4	17.41	3.566	11.69648
11/24/1999	9:15:45	26.45	17.41	3.566	11.69648
11/24/1999	9:15:48	26.5	17.41	3.565	11.6932
11/24/1999	9:15:51	26.55	17.41	3.566	11.69648
11/24/1999	9:15:54	26.6	17.41	3.565	11.6932
11/24/1999	9:15:57	26.65	17.41	3.566	11.69648
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11/24/1999	9:16:24	27.1	17.41	3.566	11.69648
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11/24/1999	9:16:30	27.2	17.41	3.566	11.69648
11/24/1999	9:16:33	27.25	17.41	3.566	11.69648
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11/24/1999	9:16:39	27.35	17.41	3.566	11.69648
11/24/1999	9:16:42	27.4	17.41	3.566	11.69648
11/24/1999	9:16:45	27.45	17.41	3.566	11.69648

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11/24/1999	9:16:57	27.65	17.41	3.566	11.69648
11/24/1999	9:17:00	27.7	17.4	3.566	11.69648
11/24/1999	9:17:03	27.75	17.41	3.566	11.69648
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11/24/1999	9:17:09	27.85	17.4	3.566	11.69648
11/24/1999	9:17:12	27.9	17.41	3.566	11.69648
11/24/1999	9:17:15	27.95	17.4	3.566	11.69648
11/24/1999	9:17:18	28	17.4	3.567	11.69976
11/24/1999	9:17:21	28.05	17.4	3.566	11.69648
11/24/1999	9:17:24	28.1	17.41	3.566	11.69648
11/24/1999	9:17:27	28.15	17.4	3.567	11.69976
11/24/1999	9:17:30	28.2	17.4	3.566	11.69648
11/24/1999	9:17:33	28.25	17.4	3.566	11.69648
11/24/1999	9:17:36	28.3	17.41	3.566	11.69648
11/24/1999	9:17:39	28.35	17.4	3.566	11.69648
11/24/1999	9:17:42	28.4	17.39	3.566	11.69648
11/24/1999	9:17:45	28.45	17.4	3.567	11.69976
11/24/1999	9:17:48	28.5	17.4	3.567	11.69976
11/24/1999	9:17:51	28.55	17.4	3.566	11.69648
11/24/1999	9:17:54	28.6	17.4	3.567	11.69976
11/24/1999	9:17:57	28.65	17.39	3.567	11.69976
11/24/1999	9:18:00	28.7	17.4	3.566	11.69648
11/24/1999	9:18:03	28.75	17.4	3.567	11.69976
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11/24/1999	9:18:09	28.85	17.4	3.567	11.69976
11/24/1999	9:18:12	28.9	17.39	3.566	11.69648
11/24/1999	9:18:15	28.95	17.39	3.567	11.69976
11/24/1999	9:18:18	29	17.39	3.567	11.69976
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11/24/1999	9:18:24	29.1	17.4	3.567	11.69976
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11/24/1999	9:18:39	29.35	17.39	3.567	11.69976
11/24/1999	9:18:42	29.4	17.39	3.567	11.69976
11/24/1999	9:18:45	29.45	17.39	3.567	11.69976
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11/24/1999	9:19:00	29.7	17.39	3.567	11.69976
11/24/1999	9:19:03	29.75	17.39	3.567	11.69976
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11/24/1999	9:19:09	29.85	17.39	3.567	11.69976
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11/24/1999	9:19:24	30.1	17.39	3.567	11.69976
11/24/1999	9:19:27	30.15	17.39	3.567	11.69976
11/24/1999	9:19:30	30.2	17.39	3.567	11.69976
11/24/1999	9:19:33	30.25	17.39	3.567	11.69976
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11/24/1999	9:19:39	30.35	17.39	3.567	11.69976
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11/24/1999	9:19:45	30.45	17.39	3.567	11.69976
11/24/1999	9:19:48	30.5	17.39	3.569	11.70632
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11/24/1999	9:19:57	30.65	17.39	3.569	11.70632
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11/24/1999	9:20:03	30.75	17.39	3.569	11.70632
11/24/1999	9:20:06	30.8	17.39	3.569	11.70632
11/24/1999	9:20:09	30.85	17.39	3.567	11.69976
11/24/1999	9:20:12	30.9	17.39	3.569	11.70632
11/24/1999	9:20:15	30.95	17.39	3.569	11.70632
11/24/1999	9:20:18	31	17.39	3.569	11.70632
11/24/1999	9:20:21	31.05	17.39	3.569	11.70632
11/24/1999	9:20:24	31.1	17.39	3.569	11.70632
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11/24/1999	9:21:36	32.3	17.39	3.569	11.70632
11/24/1999	9:21:39	32.35	17.39	3.569	11.70632

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11/24/1999	9:22:00	32.7	17.39	3.569	11.70632
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11/24/1999	9:22:06	32.8	17.38	3.57	11.7096
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11/24/1999	9:23:36	34.3	17.38	3.569	11.70632
11/24/1999	9:23:39	34.35	17.38	3.57	11.7096
11/24/1999	9:23:42	34.4	17.38	3.569	11.70632
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11/24/1999	9:23:48	34.5	17.39	3.57	11.7096
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11/24/1999	9:23:54	34.6	17.38	3.57	11.7096
11/24/1999	9:23:57	34.65	17.39	3.57	11.7096
11/24/1999	9:24:00	34.7	17.38	3.57	11.7096
11/24/1999	9:24:03	34.75	17.38	3.57	11.7096
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11/24/1999	9:24:18	35	17.38	3.57	11.7096
11/24/1999	9:24:21	35.05	17.38	3.57	11.7096
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11/24/1999	9:24:30	35.2	17.38	3.57	11.7096
11/24/1999	9:24:33	35.25	17.38	3.57	11.7096
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11/24/1999	9:24:42	35.4	17.38	3.57	11.7096
11/24/1999	9:24:45	35.45	17.38	3.57	11.7096
11/24/1999	9:24:48	35.5	17.38	3.57	11.7096
11/24/1999	9:24:51	35.55	17.38	3.57	11.7096
11/24/1999	9:24:54	35.6	17.38	3.57	11.7096
11/24/1999	9:24:57	35.65	17.38	3.57	11.7096
11/24/1999	9:25:00	35.7	17.38	3.57	11.7096
11/24/1999	9:25:03	35.75	17.38	3.57	11.7096
11/24/1999	9:25:06	35.8	17.38	3.57	11.7096
11/24/1999	9:25:09	35.85	17.38	3.57	11.7096
11/24/1999	9:25:12	35.9	17.38	3.57	11.7096
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11/24/1999	9:25:36	36.3	17.38	3.57	11.7096
11/24/1999	9:25:39	36.35	17.38	3.57	11.7096
11/24/1999	9:25:42	36.4	17.38	3.57	11.7096
11/24/1999	9:25:45	36.45	17.38	3.572	11.71616
11/24/1999	9:25:48	36.5	17.38	3.572	11.71616
11/24/1999	9:25:51	36.55	17.38	3.57	11.7096
11/24/1999	9:25:54	36.6	17.38	3.57	11.7096
11/24/1999	9:25:57	36.65	17.38	3.57	11.7096
11/24/1999	9:26:00	36.7	17.38	3.57	11.7096
11/24/1999	9:26:03	36.75	17.38	3.57	11.7096
11/24/1999	9:26:06	36.8	17.38	3.57	11.7096
11/24/1999	9:26:09	36.85	17.38	3.572	11.71616
11/24/1999	9:26:12	36.9	17.38	3.572	11.71616
11/24/1999	9:26:15	36.95	17.38	3.572	11.71616
11/24/1999	9:26:18	37	17.38	3.57	11.7096
11/24/1999	9:26:21	37.05	17.38	3.572	11.71616
11/24/1999	9:26:24	37.1	17.38	3.57	11.7096
11/24/1999	9:26:27	37.15	17.38	3.572	11.71616
11/24/1999	9:26:30	37.2	17.38	3.57	11.7096
11/24/1999	9:26:33	37.25	17.38	3.57	11.7096

11/24/1999	9:26:36	37.3	17.38	3.57	11.7096
11/24/1999	9:26:39	37.35	17.38	3.57	11.7096
11/24/1999	9:26:42	37.4	17.38	3.57	11.7096
11/24/1999	9:26:45	37.45	17.38	3.572	11.71616
11/24/1999	9:26:48	37.5	17.38	3.572	11.71616
11/24/1999	9:26:51	37.55	17.38	3.572	11.71616
11/24/1999	9:26:54	37.6	17.38	3.572	11.71616
11/24/1999	9:26:57	37.65	17.38	3.572	11.71616
11/24/1999	9:27:00	37.7	17.38	3.572	11.71616
11/24/1999	9:27:03	37.75	17.38	3.572	11.71616
11/24/1999	9:27:06	37.8	17.38	3.57	11.7096
11/24/1999	9:27:09	37.85	17.38	3.572	11.71616
11/24/1999	9:27:12	37.9	17.38	3.572	11.71616
11/24/1999	9:27:15	37.95	17.38	3.57	11.7096
11/24/1999	9:27:18	38	17.38	3.572	11.71616
11/24/1999	9:27:21	38.05	17.38	3.57	11.7096
11/24/1999	9:27:24	38.1	17.38	3.572	11.71616
11/24/1999	9:27:27	38.15	17.38	3.572	11.71616
11/24/1999	9:27:30	38.2	17.38	3.572	11.71616
11/24/1999	9:27:33	38.25	17.38	3.572	11.71616
11/24/1999	9:27:36	38.3	17.38	3.572	11.71616
11/24/1999	9:27:39	38.35	17.38	3.57	11.7096
11/24/1999	9:27:42	38.4	17.38	3.57	11.7096
11/24/1999	9:27:45	38.45	17.38	3.572	11.71616
11/24/1999	9:27:48	38.5	17.38	3.572	11.71616
11/24/1999	9:27:51	38.55	17.38	3.572	11.71616
11/24/1999	9:27:54	38.6	17.38	3.572	11.71616
11/24/1999	9:27:57	38.65	17.38	3.572	11.71616
11/24/1999	9:28:00	38.7	17.38	3.572	11.71616
11/24/1999	9:28:03	38.75	17.38	3.572	11.71616
11/24/1999	9:28:06	38.8	17.38	3.572	11.71616
11/24/1999	9:28:09	38.85	17.38	3.572	11.71616
11/24/1999	9:28:12	38.9	17.38	3.572	11.71616
11/24/1999	9:28:15	38.95	17.38	3.572	11.71616
11/24/1999	9:28:18	39	17.38	3.572	11.71616
11/24/1999	9:28:21	39.05	17.38	3.572	11.71616
11/24/1999	9:28:24	39.1	17.38	3.572	11.71616
11/24/1999	9:28:27	39.15	17.38	3.572	11.71616
11/24/1999	9:28:30	39.2	17.38	3.572	11.71616
11/24/1999	9:28:33	39.25	17.38	3.572	11.71616
11/24/1999	9:28:36	39.3	17.38	3.572	11.71616
11/24/1999	9:28:39	39.35	17.38	3.572	11.71616
11/24/1999	9:28:42	39.4	17.38	3.572	11.71616
11/24/1999	9:28:45	39.45	17.38	3.572	11.71616
11/24/1999	9:28:48	39.5	17.38	3.572	11.71616
11/24/1999	9:28:51	39.55	17.38	3.572	11.71616
11/24/1999	9:28:54	39.6	17.38	3.572	11.71616
11/24/1999	9:28:57	39.65	17.38	3.572	11.71616
11/24/1999	9:29:00	39.7	17.38	3.572	11.71616

11/24/1999	9:29:03	39.75	17.38	3.572	11.71616
11/24/1999	9:29:06	39.8	17.38	3.572	11.71616
11/24/1999	9:29:09	39.85	17.38	3.57	11.7096
11/24/1999	9:29:12	39.9	17.38	3.572	11.71616
11/24/1999	9:29:15	39.95	17.38	3.572	11.71616
11/24/1999	9:29:18	40	17.38	3.572	11.71616
11/24/1999	9:29:21	40.05	17.38	3.572	11.71616
11/24/1999	9:29:24	40.1	17.38	3.572	11.71616
11/24/1999	9:29:27	40.15	17.38	3.572	11.71616
11/24/1999	9:29:30	40.2	17.38	3.572	11.71616
11/24/1999	9:29:33	40.25	17.38	3.572	11.71616
11/24/1999	9:29:36	40.3	17.38	3.572	11.71616
11/24/1999	9:29:39	40.35	17.38	3.572	11.71616
11/24/1999	9:29:42	40.4	17.38	3.572	11.71616
11/24/1999	9:29:45	40.45	17.38	3.572	11.71616
11/24/1999	9:29:48	40.5	17.38	3.572	11.71616
11/24/1999	9:29:51	40.55	17.38	3.572	11.71616
11/24/1999	9:29:54	40.6	17.38	3.572	11.71616
11/24/1999	9:29:57	40.65	17.38	3.572	11.71616
11/24/1999	9:30:00	40.7	17.38	3.572	11.71616
11/24/1999	9:30:03	40.75	17.38	3.572	11.71616
11/24/1999	9:30:06	40.8	17.38	3.572	11.71616
11/24/1999	9:30:09	40.85	17.38	3.572	11.71616
11/24/1999	9:30:12	40.9	17.38	3.572	11.71616
11/24/1999	9:30:15	40.95	17.38	3.572	11.71616
11/24/1999	9:30:18	41	17.38	3.572	11.71616
11/24/1999	9:30:21	41.05	17.38	3.573	11.71944
11/24/1999	9:30:24	41.1	17.38	3.572	11.71616
11/24/1999	9:30:27	41.15	17.38	3.572	11.71616
11/24/1999	9:30:30	41.2	17.38	3.572	11.71616
11/24/1999	9:30:33	41.25	17.38	3.572	11.71616
11/24/1999	9:30:36	41.3	17.38	3.572	11.71616
11/24/1999	9:30:39	41.35	17.38	3.572	11.71616
11/24/1999	9:30:42	41.4	17.38	3.572	11.71616
11/24/1999	9:30:45	41.45	17.38	3.572	11.71616
11/24/1999	9:30:48	41.5	17.38	3.572	11.71616
11/24/1999	9:30:51	41.55	17.38	3.572	11.71616
11/24/1999	9:30:54	41.6	17.38	3.572	11.71616
11/24/1999	9:30:57	41.65	17.38	3.572	11.71616
11/24/1999	9:31:00	41.7	17.38	3.572	11.71616
11/24/1999	9:31:03	41.75	17.38	3.573	11.71944
11/24/1999	9:31:06	41.8	17.38	3.572	11.71616
11/24/1999	9:31:09	41.85	17.38	3.573	11.71944
11/24/1999	9:31:12	41.9	17.38	3.572	11.71616
11/24/1999	9:31:15	41.95	17.38	3.573	11.71944
11/24/1999	9:31:18	42	17.38	3.572	11.71616
11/24/1999	9:31:21	42.05	17.38	3.573	11.71944
11/24/1999	9:31:24	42.1	17.38	3.572	11.71616
11/24/1999	9:31:27	42.15	17.38	3.572	11.71616

11/24/1999	9:31:30	42.2	17.38	3.572	11.71616
11/24/1999	9:31:33	42.25	17.38	3.572	11.71616
11/24/1999	9:31:36	42.3	17.38	3.572	11.71616
11/24/1999	9:31:39	42.35	17.38	3.573	11.71944
11/24/1999	9:31:42	42.4	17.38	3.572	11.71616
11/24/1999	9:31:45	42.45	17.38	3.573	11.71944
11/24/1999	9:31:48	42.5	17.38	3.572	11.71616
11/24/1999	9:31:51	42.55	17.38	3.572	11.71616
11/24/1999	9:31:54	42.6	17.38	3.573	11.71944
11/24/1999	9:31:57	42.65	17.38	3.572	11.71616
11/24/1999	9:32:00	42.7	17.38	3.572	11.71616
11/24/1999	9:32:03	42.75	17.36	3.573	11.71944
11/24/1999	9:32:06	42.8	17.4	3.572	11.71616
11/24/1999	9:32:09	42.85	17.42	3.572	11.71616
11/24/1999	9:32:12	42.9	17.44	3.572	11.71616
11/24/1999	9:32:15	42.95	17.46	3.572	11.71616
11/24/1999	9:32:18	43	17.45	3.572	11.71616
11/24/1999	9:32:21	43.05	17.46	3.572	11.71616
11/24/1999	9:32:24	43.1	17.48	3.572	11.71616
11/24/1999	9:32:27	43.15	17.5	3.572	11.71616
11/24/1999	9:32:30	43.2	17.51	3.571	11.71288
11/24/1999	9:32:33	43.25	17.53	3.571	11.71288
11/24/1999	9:32:36	43.3	17.55	3.572	11.71616
11/24/1999	9:32:39	43.35	17.53	3.572	11.71616
11/24/1999	9:32:42	43.4	17.52	3.572	11.71616
11/24/1999	9:32:45	43.45	17.51	3.572	11.71616
11/24/1999	9:32:48	43.5	17.51	3.572	11.71616
11/24/1999	9:32:51	43.55	17.5	3.572	11.71616
11/24/1999	9:32:54	43.6	17.5	3.572	11.71616
11/24/1999	9:32:57	43.65	17.5	3.573	11.71944
11/24/1999	9:33:00	43.7	17.5	3.572	11.71616
11/24/1999	9:33:03	43.75	17.49	3.573	11.71944
11/24/1999	9:33:06	43.8	17.49	3.573	11.71944
11/24/1999	9:33:09	43.85	17.48	3.573	11.71944
11/24/1999	9:33:12	43.9	17.48	3.573	11.71944
11/24/1999	9:33:15	43.95	17.48	3.573	11.71944
11/24/1999	9:33:18	44	17.48	3.573	11.71944
11/24/1999	9:33:21	44.05	17.48	3.573	11.71944
11/24/1999	9:33:24	44.1	17.47	3.573	11.71944
11/24/1999	9:33:27	44.15	17.48	3.573	11.71944
11/24/1999	9:33:30	44.2	17.47	3.573	11.71944
11/24/1999	9:33:33	44.25	17.47	3.573	11.71944
11/24/1999	9:33:36	44.3	17.47	3.573	11.71944
11/24/1999	9:33:39	44.35	17.47	3.573	11.71944
11/24/1999	9:33:42	44.4	17.47	3.573	11.71944
11/24/1999	9:33:45	44.45	17.47	3.573	11.71944
11/24/1999	9:33:48	44.5	17.46	3.573	11.71944
11/24/1999	9:33:51	44.55	17.47	3.573	11.71944
11/24/1999	9:33:54	44.6	17.46	3.573	11.71944

11/24/1999	9:33:57	44.65	17.46	3.573	11.71944
11/24/1999	9:34:00	44.7	17.46	3.573	11.71944
11/24/1999	9:34:03	44.75	17.46	3.573	11.71944
11/24/1999	9:34:06	44.8	17.46	3.573	11.71944
11/24/1999	9:34:09	44.85	17.46	3.573	11.71944
11/24/1999	9:34:12	44.9	17.46	3.573	11.71944
11/24/1999	9:34:15	44.95	17.45	3.573	11.71944

APPENDIX K

COMPLETE VALIDATED 1999 DATA PACKAGE

Data validation packages for the listed groups of samples are presented in this Appendix in the following order:

- BRSWSB16(6-8), BRSWSB01(6-8), BRSWSB02(6-8)
- BRSWSB03(4-6), BRSWSB04(6-8), BRSWSB05(4-6), BRSWSB05D(4-6), BRSWSB06(4-6), BRSWSB18(4-6)
- BRSWSB15, BRSWSS09(0-3), BRSWSB09(6-8), BRSWSB07(0-3), BRSWSB07D(0-3), BRSWSB08(0-3), BRSWSS10(0-3), BRSWSB10(3-5), BRSWSS11(0-3), BRSWSB11(3-6), BRSWSS12(0-3), BRSWSB12(3-6), BRSWSB13(0-3)
- BRSWSB17, BRSWSB19, BRSWRB01
- BRSWRB02
- BRSWGW01, BRSWGW02, BRSWRB03
- BRSWGW03, BRSWGW07D, BRSWGW06, BRSWGW08
- BRSWGW13, BRSWGW05A, BRSWGW05AD
- BRSWGW14, BRSWGW12, BRSWGW12D, BRSWGW15, BRSWRB04
- BRSWSD01, BRSWSD02, BRSWSD03, BRSWSD03D, BRSWSD04, BRSWSW01, BRSWSW02, BRSWSW03, BRSWSW03D, BRSWSW04
- BRSWSD-05, BRSWSD-06, BRSWSD-07, BRSWSD-08
- BRSWSD-01, BRSWSD-02, BRSWSD-03, BRSWSD-03D, BRSWSD-04, BRSWSD-05, BRSWSD-06, BRSWSD-07, BRSWSD-08 (TOC only)

Jan. 18, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/17/99
3 Soil samples
Lab Order: 9911020

Semivolatile Organics Analysis

Samples Collected:

BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- rinsate blanks, and method blanks
* - MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

No field rinsate blank sample was submitted with the 11/17/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

Sample Log-in Documents

The sample receipt checklist was not submitted with the original package. The laboratory was requested to submit this document on 01/17/2000. The document was received 01/20/2000. The checklist does not indicate if samples were individually packaged and if custody seals were present and intact.

The cooler temperature, at time of receipt, was 4° C.

The sample receipt checklist does indicate that samples were properly preserved however the checklist does not indicate the VOA preservative. The FAXED response indicates that the VOA soil samples were $NaHSO_4$ preserved.

Field Blanks and Method Blanks

All soil extraction preparation blank results were reported as non-detected.

2,4-Dinitrophenol and bis(2-ethylhexyl)phthalate were detected in rinsate blank sample BRSWRB01 at concentrations below the method quantitation limit. These compounds were not detected in the field samples. No data were qualified based upon the rinsate blank results. Rinsate blank sample BRSWRB01 was re-extracted, outside the holding time, and reanalyzed. All results were non-detected (U). These results are reported as non-detected estimated (UJ) due to the holding time exceedance.

Matrix Spike / Matrix Spike Duplicate Results

The soil MS/MSD sample was from 9911018-13. No validation actions are required based upon the MS/MSD results.

Laboratory Control Sample

All LCS 8270C results met the laboratory specified method acceptance criteria. No results are qualified based upon the LCS results.

Field Duplicate Results

No field duplicate samples were collected on 11/17/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911020.

Surrogate Results

All sample and QC surrogate recoveries met the method acceptance criteria.

Holding Times

All sample holding times were met.

Summary

Fluorene, phenanthrene, fluoranthene, and pyrene results for samples BRSWSB02(6-8) are reported as estimated (J). These results are below the method quantitation limit.

The submitted MS/MSD results were from laboratory order 9911018-13 and these results were not used to qualify the 8270C samples from laboratory order 9911020.

No field duplicate or laboratory duplicate results were submitted with laboratory order 9911020.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil 8270C SVOC results. Validated result tables are appended to this submittal.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia SVOC soils

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB16(6-8)	A
BRSWSB01(6-8)	A
BRSWSB02(6-8)	A, J^1

A Accept all data.

J^1 Fluorene, phenanthrene, fluoranthene, and pyrene results are reported as estimated (J). The results are below the method quantitation level.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911020
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)	
Lab Sample Number:		9911020-01D	9911020-03B	9911020-04B	
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	
Sample Type:		ROUTINE	ROUTINE	ROUTINE	
Dilution Factor:		1	1	1	
Date Sampled:		11/17/1999	11/17/1999	11/17/1999	
Date Extracted:		11/22/1999	11/22/1999	11/22/1999	
Date Analyzed		11/29/1999	11/29/1999	11/29/1999	
Percent Moisture:		8.2	13.5	10	
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	
N-nitrosodimethylamine	500	550 U	560 U	540 U	
Phenol	250	280 U	280 U	270 U	
bis(2-Chloroethyl) ether	250	280 U	280 U	270 U	
2-Chlorophenol	250	280 U	280 U	270 U	
1,3-Dichlorobenzene	250	280 U	280 U	270 U	
1,4-Dichlorobenzene	250	280 U	280 U	270 U	
Benzyl Alcohol	500	550 U	560 U	540 U	
2-Methylphenol	250	280 U	280 U	270 U	
1,2-Dichlorobenzene	250	280 U	280 U	270 U	
Bis(2-chloroisopropyl)ether	250	280 U	280 U	270 U	
4-Methylphenol	250	280 U	280 U	270 U	
n-Nitroso-di-n-propylamine	250	280 U	280 U	270 U	
Hexachloroethane	250	280 U	280 U	270 U	
Nitrobenzene	250	280 U	280 U	270 U	
Isophorone	250	280 U	280 U	270 U	
2,4-Dimethylphenol	250	280 U	280 U	270 U	
Benzoic Acid	500	550 U	560 U	540 U	
2-Nitrophenol	250	280 U	280 U	270 U	
bis(2-Chloroethoxy) methane	250	280 U	280 U	270 U	
2,4-Dichlorophenol	250	280 U	280 U	270 U	
1,2,4-Trichlorobenzene	250	280 U	280 U	270 U	
Naphthalene	250	280 U	280 U	270 U	
4-Chloroaniline	250	280 U	280 U	270 U	
Hexachlorobutadiene	250	280 U	280 U	270 U	
4-Chloro-3-methylphenol	500	550 U	560 U	540 U	
2-Methylnaphthalene	250	280 U	280 U	270 U	
Hexachlorocyclopentadiene	250	280 U	280 U	270 U	
2,4,6-Trichlorophenol	250	280 U	280 U	270 U	
2,4,5-Trichlorophenol	250	280 U	280 U	270 U	
2-Chloronaphthalene	250	280 U	280 U	270 U	
2-Nitroaniline	500	550 U	560 U	540 U	

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911020
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)	
Lab Sample Number:		9911020-01D	9911020-03B	9911020-04B	
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	
Sample Type:		ROUTINE	ROUTINE	ROUTINE	
Dilution Factor:		1	1	1	
Date Sampled:		11/17/1999	11/17/1999	11/17/1999	
Date Extracted:		11/22/1999	11/22/1999	11/22/1999	
Date Analyzed		11/29/1999	11/29/1999	11/29/1999	
Percent Moisture:		8.2	13.5	10	
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	
Dimethyl phthalate	250	280 U	280 U	270 U	
2,6-Dinitrotoluene	250	280 U	280 U	270 U	
Acenaphthylene	250	280 U	280 U	270 U	
3-Nitroaniline	500	550 U	560 U	540 U	
4-Nitrophenol	500	550 U	560 U	540 U	
2,4-Dinitrophenol	500	550 U	560 U	540 U	
Acenaphthene	250	280 U	280 U	270 U	
2,4-Dinitrotoluene	250	280 U	280 U	270 U	
Dibenzofuran	250	280 U	280 U	270 U	
Diethyl phthalate	250	280 U	280 U	270 U	
4-Chlorophenyl phenyl ether	250	280 U	280 U	270 U	
Fluorene	250	280 U	280 U	61 J	
4-Nitroaniline	500	550 U	560 U	540 U	
4,6-Dinitro-2-methylphenol	500	550 U	560 U	540 U	
n-Nitrosodiphenylamine	250	280 U	280 U	270 U	
1,2-Diphenylhydrazine	250	280 U	280 U	270 U	
4-Bromophenyl phenylether	250	280 U	280 U	270 U	
Hexachlorobenzene	250	280 U	280 U	270 U	
Pentachlorophenol	500	550 U	560 U	540 U	
Phenanthrene	250	280 U	280 U	70 J	
Anthracene	250	280 U	280 U	270 U	
Carbazole	250	280 U	280 U	270 U	
Di-n-butylphthalate	250	280 U	280 U	270 U	
Fluoranthene	250	280 U	280 U	69 J	
Benzidine	250	280 U	280 U	270 U	
Pyrene	250	280 U	280 U	72 J	
Butyl benzyl phthalate	250	280 U	280 U	270 U	
bis(2-ethylhexyl)phthalate	250	280 U	280 U	270 U	
3,3'-Dichlorobenzidine	250	280 U	280 U	270 U	
Benzo(a)anthracene	250	280 U	280 U	270 U	
Chrysene	250	280 U	280 U	270 U	

Table I **Semivolatile Validated Results**
Method 8270C

Project No.: 05000.33
Lab Order: 9911020
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)	
Lab Sample Number:		9911020-01D	9911020-03B	9911020-04B	
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	
Sample Type:		ROUTINE	ROUTINE	ROUTINE	
Dilution Factor:		1	1	1	
Date Sampled:		11/17/1999	11/17/1999	11/17/1999	
Date Extracted:		11/22/1999	11/22/1999	11/22/1999	
Date Analyzed		11/29/1999	11/29/1999	11/29/1999	
Percent Moisture:		8.2	13.5	10	
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	
Di-n-octylphthalate	250	280 U	280 U	270 U	
Benzo(b)fluoranthene	250	280 U	280 U	270 U	
Benzo(k)fluoranthene	250	280 U	280 U	270 U	
Benzo(a)pyrene	250	280 U	280 U	270 U	
Dibenz(a,h)anthracene	250	280 U	280 U	270 U	
Indeno(1,2,3-cd)pyrene	250	280 U	280 U	270 U	
Benzo(g,h,i)perylene	250	280 U	280 U	270 U	

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Jan. 17, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/17/99
3 Soil samples
Lab Order: 9911020

Volatile Organics Analysis

Samples Collected:

BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)	

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

No field rinsate blank sample was submitted with the 11/17/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

The COCs indicate that a 8260B trip blank sample was submitted. The laboratory did not report 8260B trip blank results. The laboratory indicated that the trip blank was in methanol blank and not appropriate for the low level 8260B analyses. These samples were $NahSO_4$ preserved. No VOA trip blank results were reported. Potential low level contamination can not be thoroughly evaluated.

Sample Log-in Documents

The sample receipt checklist was not submitted with the original package. The laboratory was requested to submit this document on 01/17/2000. The document was received 01/20/2000. The checklist does not indicate if samples were individually packaged and if custody seals were present and intact.

The cooler temperature, at time of receipt, was 4° C.

The sample receipt checklist does indicate that samples were properly preserved however the checklist does not indicate the VOA preservative. The FAXED response indicates that the VOA soil samples were $NaHSO_4$ preserved.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the 8260B soil preparation blank.

A 8260B trip blank sample was submitted and VOC analysis was requested on the COC. The laboratory did not submit VOC trip blank results. The laboratory indicated that the trip blank was in methanol blank and not appropriate for the low level 8260B analyses. These samples were

$NaHSO_4$ preserved. No VOA trip blank results were reported. Potential low level contamination can not be thoroughly evaluated.

No target compound analytes were detected in field rinsate blank sample BRSWRB01 (11/19/99) and no validation actions were required.

Matrix Spike / Matrix Spike Duplicate Results

Sample 9911018-13C (BRSWSB15) was analyzed as the MS/MSD sample. The MS results were not reported due to poor internal standard recoveries. A list of MSD compounds not meeting the 70-130% acceptance criteria are summarized below.

Compound	% Recovery	Action
Dichlorodifluoromethane	57.9	Non-detects UJ; Detects J
2-Butanone	131	Non-detects U; Detects J
Cis-1,2-dichoroethene	62.8	Non-detects UJ; Detects J
Dibromochloromethane	68.8	Non-detects UJ; Detects J
Bromoform	63.8	Non-detects UJ; Detects J
4-Chlorotoluene	67.6	Non-detects UJ; Detects J
1.2-Dichlorobenzene	66.2	Non-detects UJ; Detects J
1,2-Dibromo-3-chloropropane	58.4	Non-detects UJ; Detects J
1,2,4-Trichlorobenzene	60	Non-detects UJ; Detects J
Naphthalene	64	Non-detects UJ; Detects J
1,2,3-Trichlorobenzene	58.1	Non-detects UJ; Detects J

All 8260 B results in laboratory order 9911020 are not qualified based upon the MS/MSD results.

Laboratory Control Sample

The laboratory soil LCS recovery acceptance criteria are 70-130%. A list of compounds not meeting this criterion is summarized below.

Compound	% Recovery	Action
Cis-1,2-Dichloroethene	62.6	Non-detects UJ; Detects J
Chloroethane	57.6	Non-detects UJ; Detects J
Bromomethane	53.6	Non-detects UJ; Detects J

Based upon the soil LCS recoveries the cis-1,2-dchloroethene, chloroethane, and bromomethane results for soil samples BRSWSB16(6-8), BRSWSB01(6-8) and BRSWSB02(6-8) are reported

as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists.

Field Duplicate Results

No field duplicate samples were collected on 11/17/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911020.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

No field duplicate or laboratory duplicate results were submitted with laboratory order 9911020.

Due to the low LCS recoveries chloroethane, bromomethane and cis-1,2-dichloroethene, results are reported as non-detected estimated (UJ). A low bias is indicated and the possibility of false negatives exists.

Methylene chloride was reported in sample BRSWSB02(6-8) at 15ug/Kg. The result is below the method quantitation limit and the result is reported as estimated (J).

The sample chain of custodies indicate that a trip blank sample was submitted for 8260B analyses. The laboratory did not report 8260B results for this trip blank.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil 8260B VOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia 8260B soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB16(6-8)	A, J^1
BRSWSB01(6-8)	A, J^1
BRSWSB02(6-8)	A, J^1, J^2

A Accept all data.

J^1 Due to low LCS recoveries the bromomethane, cis-1,2-dichloroethene, and chloroethane results are reported as non-detected estimated (UJ).

J^2 Methylene chloride is reported as estimated (J). The result is below the method quantitation limit.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911020
Site: *Gordon Craig Army Reserve*

S&W Sample Number:		BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)		
S&W Sample (cont)						
Lab Sample Number:		9911020-01A	9911020-03A	9911020-04A		
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE	ROUTINE		
Dilution Factor:		1	1	1		
Date Sampled:		11/17/99	11/17/99	11/17/99		
Date Extracted:		11/18/1999	11/18/1999	11/18/1999		
Date Analyzed:		11/29/1999	11/29/1999	11/29/1999		
Percent Moisture:		8.2	13.5	10		
Target Compounds	Report Limit	mg/Kg	mg/Kg	mg/Kg		
Dichlorodifluoromethane	4	4.6 U	5.5 U	4.7 U		
Chloromethane	4	4.6 U	5.5 U	4.7 U		
Vinyl Chloride	4	4.6 U	5.5 U	4.7 U		
Chloroethane	4	4.6 UJ	5.5 UJ	4.7 UJ		
Bromomethane	4	4.6 UJ	5.5 UJ	4.7 UJ		
Trichlorofluoromethane	4	4.6 U	5.5 U	4.7 U		
Acetone	20	23 U	45	50		
1.1-Dichloroethene	4	4.6 U	5.5 U	4.7 U		
Carbon disulfide	4	4.6 U	5.5 U	4.7 U		
Methylene Chloride	20	23 U	27 U	15 J		
Methyl tert-butyl ether	4	4.6 U	5.5 U	4.7 U		
trans-1,2-Dichloroethene	4	4.6 U	5.5 U	4.7 U		
1,1-Dichloroethane	4	4.6 U	5.5 U	4.7 U		
2-Butanone	20	23 U	27 U	24 U		
2,2-Dichloropropane	4	4.6 U	5.5 U	4.7 U		
cis-1,2-Dichloroethene	4	4.6 UJ	5.5 UJ	4.7 UJ		
Chloroform	4	4.6 U	5.5 U	4.7 U		
Bromochloromethane	4	4.6 U	5.5 U	4.7 U		
1,1,1-Trichloroethane	4	4.6 U	5.5 U	4.7 U		
1,1-Dichloropropene	4	4.6 U	5.5 U	4.7 U		
Carbon tetrachloride	4	4.6 U	5.5 U	4.7 U		
1,2-Dichloroethane	4	4.6 U	5.5 U	4.7 U		
Benzene	4	4.6 U	5.5 U	4.7 U		
Trichloroethene	4	4.6 U	5.5 U	4.7 U		
1,2-Dichloropropane	4	4.6 U	5.5 U	4.7 U		
Bromodichloromethane	4	4.6 U	5.5 U	4.7 U		
Dibromomethane	4	4.6 U	5.5 U	4.7 U		
4-Methyl-2-pentanone	20	23 U	27 U	24 U		
cis-1,3-Dichloropropene	4	4.6 U	5.5 U	4.7 U		
Toluene	4	4.6 U	5.5 U	4.7 U		
trans-1,3-Dichloropropene	4	4.6 U	5.5 U	4.7 U		
1,1,2-Trichloroethane	4	4.6 U	5.5 U	4.7 U		
1,2-Dibromoethane	4	4.6 U	5.5 U	4.7 U		
2-Hexanone	20	23 U	27 U	24 U		
1,3-Dichloropropane	4	4.6 U	5.5 U	4.7 U		
Tetrachloroethene	4	4.6 U	5.5 U	4.7 U		

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911020
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)		
S&W Sample (cont)						
Lab Sample Number:		9911020-01A	9911020-03A	9911020-04A		
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE	ROUTINE		
Dilution Factor:		1	1	1		
Date Sampled:		11/17/99	11/17/99	11/17/99		
Date Extracted:		11/18/1999	11/18/1999	11/18/1999		
Date Analyzed:		11/29/1999	11/29/1999	11/29/1999		
Percent Moisture:		8.2	13.5	10		
Dibromochloromethane	4	4.6 U	5.5 U	4.7 U		

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911020
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)		
S&W Sample (cont)						
Lab Sample Number:		9911020-01A	9911020-03A	9911020-04A		
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE	ROUTINE		
Dilution Factor:		1	1	1		
Date Sampled:		11/17/99	11/17/99	11/17/99		
Date Extracted:		11/18/1999	11/18/1999	11/18/1999		
Date Analyzed:		11/29/1999	11/29/1999	11/29/1999		
Percent Moisture:		8.2	13.5	10		
Chlorobenzene	4	4.6 U	5.5 U	4.7 U		
1,1,1,2-Tetrachloroethane	4	4.6 U	5.5 U	4.7 U		
Ethylbenzene	4	4.6 U	5.5 U	4.7 U		
m,p-Xylene	4	4.6 U	5.5 U	4.7 U		
o-Xylene	4	4.6 U	5.5 U	4.7 U		
Styrene	4	4.6 U	5.5 U	4.7 U		
Bromoform	4	4.6 U	5.5 U	4.7 U		
Isopropylbenzene	4	4.6 U	5.5 U	4.7 U		
1,1,2,2-Tetrachloroethane	4	4.6 U	5.5 U	4.7 U		
1,2,3-Trichloropropane	4	4.6 U	5.5 U	4.7 U		
Bromobenzene	4	4.6 U	5.5 U	4.7 U		
n-Propylbenzene	4	4.6 U	5.5 U	4.7 U		
2-Chlorotoluene	4	4.6 U	5.5 U	4.7 U		
4-Chlorotoluene	4	4.6 U	5.5 U	4.7 U		
1,3,5-Trimethylbenzene	4	4.6 U	5.5 U	4.7 U		
tert-Butylbenzene	4	4.6 U	5.5 U	4.7 U		
1,2,4,-Trimethylbenzene	4	4.6 U	5.5 U	4.7 U		
sec-Butylbenzene	4	4.6 U	5.5 U	4.7 U		
4-isopropyltoluene	4	4.6 U	5.5 U	4.7 U		
1,3-dichlorobenzene	4	4.6 U	5.5 U	4.7 U		
1,4-dichlorobenzene	4	4.6 U	5.5 U	4.7 U		
n-Butylbenzene	4	4.6 U	5.5 U	4.7 U		
1,2-Dichlorobenzene	4	4.6 U	5.5 U	4.7 U		
1,2-Dibromo-3-chloropropane	4	4.6 U	5.5 U	4.7 U		
1,2,4-Trichlorobenzene	4	4.6 U	5.5 U	4.7 U		
Hexachlorobutadiene	4	4.6 U	5.5 U	4.7 U		
Naphthalene	4	4.6 U	5.5 U	4.7 U		
1,2,3-Trichlorobenzene	4	4.6 U	5.5 U	4.7 U		

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Soil units mg/Kg based upon 100% total solids

Jan. 18, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/17/99
2 Soil samples
Lab Order: 9911020

Extractable Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSB16(6-8)	*BRSWSB14(0-2)*	

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack, N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

* - chain of custody documents
* - sample log-in documents
* - rinsate blanks, and method blanks
- MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

No field rinsate blank sample was submitted with the 11/17/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

The chain of custody documents indicate that only the EPH range results are to be reported for sample BRSWSB16(6-8).

Sample Log-in Documents

The sample receipt checklist was not submitted with the original package. The laboratory was requested to submit this document on 01/17/2000. The document was received 01/20/2000. The checklist does not indicate if samples were individually packaged and if custody seals were present and intact.

The sample receipt checklist does indicate that samples were properly preserved however the checklist does not indicate the VOA preservative. The FAXED response indicates that the VOA soil samples were $NaHSO_4$ preserved.

Field Blanks, and Method Blanks

The aqueous EPH rinsate blank BRSWRB01 had a positive result for the C19-C36 aliphatic range compounds. This analyte was not detected in the laboratory extraction blank or the soil samples. This result is possibly a field sampling artifact. No other blank contamination is indicated. Based upon the blank results no data validation actions were taken because the contaminant was not detected in the field samples. The narrative noted that the C19-C36 result was due to
non- petroleum hydrocarbon compounds.

Matrix Spike / Matrix Spike Duplicate Results

EPH sample BRSWSB14(0-2) was analyzed as the MS/MSD soil samples.

Compounds not meeting the method specified acceptance criteria are summarized below. The acceptance criteria are spike recoveries between 40-140% and precision criterion $\leq$50% RPD.

Compound	MS Recovery	MSD Recovery	% RPD
Acenaphthene	71.9	134	61.6
Anthracene	75.9	236	104
Pyrene	73.2	623	159
Chrysene	71.4	320	128

The MS/MSD results indicate that sample matrix homogeneity may be a problem. No target analytes were detected in EPH sample BRSWSB14(0-2). All target analyte results are reported as non-detected estimated (UJ). The aliphatic MS/MSD compound results all met the method acceptance requirements.

Laboratory Control Samples

All soil EPH LCS recoveries met the method acceptance criteria.

Field Duplicate Results

No field duplicate samples were collected on 11/17/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911020.

Surrogate Results

All soil surrogate recoveries met the method specified acceptance criteria. Specified 8270C method surrogates were reported along with specified EPH surrogates.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

Stone & Webster specified that only the range results be reported for sample BRSWSB16(6-8). All range results and target analytes were reported for sample BRSWSB14(0-2).

All target compound results for sample BRSWSB14(0-2) are reported as non-detected estimated due to poor MSD recoveries and poor MS/MSD precision. The target compound recoveries for the MSD sample were above the acceptance criteria and the MS recoveries were typically 70-80%. The aliphatic MS/MSD recoveries met the method acceptance criteria. A possible matrix homogeneity problem is indicated.

Tables 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil EPH results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table Ia EPH soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table 1a- Extractable Petroleum Hydrocarbon Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB16(6-8)	A
BRSWSB14(0-2)	A, J^1

A Accept all data.

J^1 Target compound (PAH) results are reported as non-detected estimated (UJ) due to high MSD recoveries and poor analytical precision.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911020
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB16(6-8)	BRSWSB14(0-2)		
Sample Location:						
Sample Type:			SOIL	SOIL		
Lab Sample Number:			9911020-01C	9911020-02B		
Percent Moisture:			8.8	8.2		
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/17/1999	11/17/1999		
Date Extracted			11/23/1999	11/23/1999		
Date Analyzed Aliphatics:			11/30/1999	11/30/1999		
Date Analyzed PNA			11/30/1999	11/30/1999		
Notes:						
		Report				
EPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg		
C9-C18 Aliphatic (1)	8270C	49	54 U	54 U		
C19-C36 Aliphatic (1)	8270C	49	54 U	54 U		
C11-C22 Aromatics(1,2)	8270C	49	54 U	54 U		
Targeted PAH Analytes						
Naphthalene	8270C	0.24		0.27 UJ		
2-Methylnaphthalene	8270C	0.24		0.27 UJ		
Acenaphthylene	8270C	0.24		0.27 UJ		
Acenaphthene	8270C	0.24		0.27 UJ		
Fluorene	8270C	0.24		0.27 UJ		
Phenanthrene	8270C	0.24		0.27 UJ		
Anthracene	8270C	0.24		0.27 UJ		
Fluoranthene	8270C	0.24		0.27 UJ		
Pyrene	8270C	0.24		0.27 UJ		
Benzo(a)anthracene	8270C	0.24		0.27 UJ		
Chrysene	8270C	0.24		0.27 UJ		
Benzo(b)fluoranthene	8270C	0.24		0.27 UJ		
Benzo(k)fluoranthene	8270C	0.24		0.27 UJ		
Benzo(a)pyrene	8270C	0.24		0.27 UJ		
Indeno(1,2,3-cd)pyrene	8270C	0.24		0.27 UJ		
Dibenzo(a,h)anthracene	8270C	0.24		0.27 UJ		
Benzo(g,h,i)perylene	8270C	0.24		0.27 UJ		

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
* Based upon 100% total solids
(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 17, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/17/99
3 Soil samples including the trip blank
Lab Order: 9911020

Volatile Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSB16(6-8)	BRSWSB14(0-2)	Trip Blank (soil)	

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

*- chain of custody documents
- sample log-in documents
*- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results
* - field duplicate results
* - laboratory duplicate results
- surrogate recoveries

* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Documents

All chain of custodies were properly signed and dated. The sample preservation information was not presented on the chain of custodies.

Sample Log-in Documents

The sample receipt checklist was not submitted with the original package. The laboratory was requested to submit this document on 01/17/2000. The document was received 01/20/2000. The checklist does not indicate if samples were individually packaged and if custody seals were present and intact.

The sample receipt checklist does indicate that samples were properly preserved however the checklist does not indicate the VOA preservative. The FAXED response indicates that the VOA soil samples were $NaHSO_4$ preserved.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the VPH soil preparation blank, rinsate blank BRSWRB01 (11/19/99) and the soil trip blank (9911020-05A).

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWSB15 (collected 11/16/99) was analyzed as the soil MS/MSD VPH sample. The naphthalene MS recovery (63.7%) was below the acceptance criteria and the naphthalene MS/MSD %RPD exceeded the 25% acceptance criterion. The MSD recovery was 95.4%. Naphthalene was non-detected in any samples and the LCS naphthalene recovery met the method acceptance criterion. No naphthalene results were qualified based upon the MS/MSD results.

Laboratory Control Samples

All soil laboratory control sample recoveries met the method specified recovery criteria, except for the 2,5-dibromotolouene surrogate recovery. All sample surrogate recoveries met the QC acceptance criteria and all LCS target compound recoveries met the QC acceptance criteria so no results are qualified based upon the LCS results.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Field Duplicate Results

No field duplicate samples were collected on 11/17/99.

Laboratory Duplicates

Soil sample BRSWSB12(3-6) (collected 11/16/99) was analyzed as the sample/sample duplicate. All results were non-detected and all method precision acceptance criteria were met.

Surrogate Results

Sample BRSWSB16(6-8) was reanalyzed because the surrogate recoveries for toluene-d8 and 1,2-dichloroethane –d4 were below the lower recovery limits. All surrogate recoveries for the reanalysis met the QC acceptance criteria. The reanalysis results were reported.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All VPH results are accepted without qualification.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil VPH results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table Ia VPH soils

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Volatile Petroleum Hydrocarbon Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB16(6-8)	A
BRSWSB14(0-2)	A
Trip Blank (soil)	A

A Accept all results without qualification

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911020
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB16(6-8)	BRSWSB14(0-2)	Trip Blank	
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	
Lab Sample Number:			9911020-01A	9911020-02A	9911020-05A	
Percent moisture:			8.8	8.2	N/A	
Dilution Factor:			1	1	1	
Dilution Factor:						
Date Sampled:			11/17/1999	11/17/1999	11/17/1999	
Date Analyzed:			12/03/1999	12/03/1999	12/02/1999	
Notes:						
		Report				
VPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	
C5-C8 Aliphatic (1,2)	8260	2.5	2.0 U	1.9 U	2.5 U	
C9-C12 Aliphatic(1,3)	8260	0.62	0.50 U	0.48 U	0.62 U	
C9-C10 Aromatics(1)	8260	0.62	0.50 U	0.48 U	0.62 U	
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	0.050	0.040 U	0.039 U	0.050 U	
Benzene	8260	0.050	0.040 U	0.039 U	0.050 U	
Toluene	8260	0.050	0.040 U	0.039 U	0.050 U	
Ethylbenzene	8260	0.050	0.040 U	0.039 U	0.050 U	
m,p-Xylene	8260	0.050	0.040 U	0.039 U	0.050 U	
o-Xylene	8260	0.050	0.040 U	0.039 U	0.050 U	
Napthalene	8260	0.050	0.040 U	0.039 U	0.050 U	

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution
* Reporting limit is based upon 100% total solids and a 1:1 methanol to soil ratio.

Jan. 18, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/17/99
3 Soil samples
Lab Order: 9911020

Inorganic Analysis

BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Soil samples were analyzed according to SW-846 EPA Method 6010B and mercury was analyzed by SW-846 Method 7471. Arsenic, barium, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B and silver, cadmium, lead, and antimony were analyzed in the aqueous samples according to SW-846 EPA Methods 7761, 7131, 7421, and 7041 respectively. Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
* Field blanks, and method blanks
* MS /MSD results
* LCS results
* Field duplicate results
Laboratory duplicate results

* Holding times

* All criteria were met for this parameter.

Tables 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

No field rinsate blank sample was submitted with the 11/17/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

Sample Log-in Documents

The sample receipt checklist was not submitted with the original package. The laboratory was requested to submit this document on 01/17/2000. The document was received 01/20/2000. The checklist does not indicate if samples were individually packaged and if custody seals were present and intact.

The sample receipt checklist does indicate that samples were properly preserved however the checklist does not indicate the VOA preservative. The FAXED response indicates that the VOA soil samples were $NaHSO_4$ preserved.

Field Blanks and Method Blanks

Chromium and selenium were detected in the soil preparation blanks at 0.452mg/Kg and 1.64 mg/Kg respectively. The resulting action levels were 2.25mg/Kg and 8.20mg/Kg respectively. Chromium sample results were above the action level and no chromium results were qualified based upon the method blank results.

Selenium was reported in sample BRSWSB16(6-8) at 5.5mg/Kg (J), and the blank action level was 8.20mg/Kg. The laboratory estimated the selenium result, because the positive result was below the quantitation limit (10mg/Kg). The selenium result for sample BRSWSB16(6-8) is reported as 10mg/Kg (U).

Selenium was reported in sample BRSWSB01(6-8) at 3.4mg/Kg (J), and the blank action level was 8.20mg/Kg. The laboratory estimated the selenium result, because the positive result was below the quantitation limit (11mg/Kg). The selenium result for sample BRSWSB16(6-8) is reported as 11mg/Kg (U).

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Selenium was reported in sample BRSWSB02(6-8) at 1.5mg/Kg (J), and the blank action level was 8.20mg/Kg. The laboratory estimated the selenium result, because the positive result was below the quantitation limit (11mg/Kg). The selenium result for sample BRSWSB02(6-8) is reported as 11mg/Kg (U).

All rinsate BRSWRB01 blank results were reported as non-detected.

MS/MSD Results

Sample BRSWSB17 (9911025-01) was analyzed as the batch MS/MSD sample for laboratory order 9911020. All soil MS/MSD laboratory acceptance criteria were met.

LCS Results

Soil LCS recoveries met the specified acceptance criteria. No results are qualified based upon the LCS results.

Field Duplicates

No field duplicate samples were collected on 11/17/99.

Laboratory Duplicates

Sample BRSWSB17 (9911025-01) was analyzed as the batch laboratory duplicate sample for laboratory order 9911020. The chromium duplicate %RPD was 21.1% and the RPD acceptance limit is $\leq$20%. The chromium results are reported as estimated (J).

Holding Times

All sample analyses holding time requirements were met.

Summary

Based upon the laboratory duplicate results, the chromium results for samples BRSWSB16(6-8), BRSWSB01(6-8) and BRSWSB02(6-8) are reported as estimated (J). The duplicate %RPD was greater than 20%.

The antimony, barium and arsenic results for sample BRSWSB16(6-8) are reported as estimated (J). The results are below the method quantitation limit.

The arsenic, barium, and lead results for sample BRSWSB01(6-8) are reported as estimated (J). The results are below the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

The barium and lead results for sample BRSWSB02(6-8) are reported as estimated (J). The results are below the method quantitation limit.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Soil Recommendation Summary

Antimony	A, J[2]
Arsenic	A, J[3]
Barium	J[4]
Cadmium	A
Chromium	J[1]
Lead	A, J[5]
Mercury	A
Selenium	A
Silver	A

A- Accept all data

J[1]- Chromium results are estimated (J) due to laboratory duplicate precision.

J[2]- The antimony result is reported as estimated (J) for sample BRSWSB16(6-8). This result is between the method detection limit and the method quantitation limit.

J[3]- Arsenic results are reported as estimated (J) for samples BRSWSB16(6-8) and BRSWSB01(6-8). These results are between the method detection limit and the method quantitation limit.

J[4]- Barium results are reported as estimated (J) for samples BRSWSB16(6-8), BRSWSB01(6-8) and BRSWSB02(6-8). These results are between the method detection limit and the method quantitation limit.

J[5]- Lead results are reported as estimated (J) for samples BRSWSB01(6-8) and BRSWSB02(6-8). These results are between the method detection limit and the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

TABLE I **Inorganic Validated Results**

Project No.: 05000.33
Lab Order: 9911020
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB16(6-8)	BRSWSB01(6-8)	BRSWSB02(6-8)	
Sample Location:						
Sample Type:			SOIL/LOW	SOIL/LOW	SOIL/LOW	
Lab Sample Number:			9911020-01D	9911020-03B	9911020-04B	
Percent Solids:			90.8	86.5	90	
Dilution Factor:			1	1	1	
Dilution Factor:						
Date Sampled:			11/17/1999	11/17/1999	11/17/1999	
Notes:						
		Report				
Inorganic Analysis	Method	Limit*	mg/kg	mg/kg	mg/kg	
Antimony	6010B	4	2.7 J	5.7 U	5.4 U	
Arsenic	6010B	5	4.8 J	1.4 J	6.8 U	
Barium	6010B	20	20 J	7.1 J	14 J	
Cadmium	6010B	0.5	0.64	0.71 U	0.68 U	
Chromium	6010B	1	12 J	3.4 J	8.1 J	
Lead	6010B	5	7.7	2.8 J	3.2 J	
Selenium	6010B	8	10 U	11 U	11 U	
Silver	6010B	1.4	1.8 U	2.0 U	1.9 U	
Mercury	7471B	0.025	0.024 U	0.026 U	0.026 U	

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 19, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/18/99
6 Soil samples
Lab Order: 9911026

Semivolatile Organics Analysis

Samples Collected:

BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)
BRSWSB05D(4-6)	BRSWSB06(4-6)	BRSWSB18(4-6)

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
* - rinsate blanks, and method blanks
* - MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries

- holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No field rinsate blank sample was submitted with the 11/18/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA trip blank sample. The only aqueous VOA sample was the aqueous Trip Blank 01.

The sample receipt checklist indicates that the laboratory order number was 9911023 and the narrative references the laboratory order as 9911026.

Field Blanks and Method Blanks

All soil extraction preparation blank results are reported as non-detected.

2,4-Dinitrophenol and bis(2-ethylhexyl)phthalate were detected in rinsate blank sample BRSWRB01 (11/19/99) at concentrations below the method quantitation limit. These compounds were not detected in the soil samples. No data were qualified based upon the rinsate blank results.

Matrix Spike / Matrix Spike Duplicate Results

The aqueous and soil MS/MSD samples were not from laboratory work order 9911026. No validation actions are required based upon the MS/MSD results.

Laboratory Control Sample

All LCS target compound recoveries met the laboratory specified method acceptance criteria.

Field Duplicate Results

Samples BRSWSB05(4-6) and BRSWSB05D(4-6) were the field duplicate samples. All results are non-detected and no results are qualified based upon the field duplicate results.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911026.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All semivolatile soil results are accepted without qualification.

The rinsate blank sample BRSWRB01was collected 11/19/99.

No laboratory duplicate sample was analyzed with laboratory work order 9911026.

The submitted MS/MSD results were from laboratory order 9911018-13 and these results were not used to qualify the 8270C samples from laboratory order 9911025.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil 8270C SVOC results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia SVOC soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB03(4-6)	A
BRSWSB04(6-8)	A
BRSWSB05(4-6)	A
BRSWSB05D(4-6)	A
BRSWSB06(4-6)	A
BRSWSB18(4-6)	A

A Accept all data.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116🖷 Electronic Mail: tlewis1260@aol.com

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)	BRSWSB05D(4-6)
Lab Sample Number:		9911026-01B	9911026-02B	9911026-03B	9911026-04B
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	Field DUP	Field DUP
Dilution Factor:		1	1	1	1
Date Sampled:		11/18/99	11/18/99	11/18/99	11/18/99
Date Extracted:		11/22/1999	11/22/1999	11/22/1999	11/22/1999
Date Analyzed		11/29/1999	11/30/1999	11/30/1999	11/30/1999
Percent Moisture:		18.7	8.5	10.5	9.4
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
N-nitrosodimethylamine	500	610 U	540 U	560 U	550 U
Phenol	250	300 U	270 U	280 U	280 U
bis(2-Chloroethyl) ether	250	300 U	270 U	280 U	280 U
2-Chlorophenol	250	300 U	270 U	280 U	280 U
1,3-Dichlorobenzene	250	300 U	270 U	280 U	280 U
1,4-Dichlorobenzene	250	300 U	270 U	280 U	280 U
Benzyl Alcohol	500	610 U	540 U	560 U	550 U
2-Methylphenol	250	300 U	270 U	280 U	280 U
1,2-Dichlorobenzene	250	300 U	270 U	280 U	280 U
Bis(2-chloroisopropyl)ether	250	300 U	270 U	280 U	280 U
4-Methylphenol	250	300 U	270 U	280 U	280 U
n-Nitroso-di-n-propylamine	250	300 U	270 U	280 U	280 U
Hexachloroethane	250	300 U	270 U	280 U	280 U
Nitrobenzene	250	300 U	270 U	280 U	280 U
Isophorone	250	300 U	270 U	280 U	280 U
2,4-Dimethylphenol	250	300 U	270 U	280 U	280 U
Benzoic Acid	500	610 U	540 U	560 U	550 U
2-Nitrophenol	250	300 U	270 U	280 U	280 U
bis(2-Chloroethoxy) methane	250	300 U	270 U	280 U	280 U
2,4-Dichlorophenol	250	300 U	270 U	280 U	280 U
1,2,4-Trichlorobenzene	250	300 U	270 U	280 U	280 U
Naphthalene	250	300 U	270 U	280 U	280 U
4-Chloroaniline	250	300 U	270 U	280 U	280 U
Hexachlorobutadiene	250	300 U	270 U	280 U	280 U
4-Chloro-3-methylphenol	500	610 U	540 U	560 U	550 U
2-Methylnaphthalene	250	300 U	270 U	280 U	280 U
Hexachlorocyclopentadiene	250	300 U	270 U	280 U	280 U
2,4,6-Trichlorophenol	250	300 U	270 U	280 U	280 U
2,4,5-Trichlorophenol	250	300 U	270 U	280 U	280 U
2-Chloronaphthalene	250	300 U	270 U	280 U	280 U
2-Nitroaniline	500	610 U	540 U	560 U	550 U

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)	BRSWSB05D(4-6)
Lab Sample Number:		9911026-01B	9911026-02B	9911026-03B	9911026-04B
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	Field DUP	Field DUP
Dilution Factor:		1	1	1	1
Date Sampled:		11/18/99	11/18/99	11/18/99	11/18/99
Date Extracted:		11/22/1999	11/22/1999	11/22/1999	11/22/1999
Date Analyzed		11/29/1999	11/30/1999	11/30/1999	11/30/1999
Percent Moisture:		18.7	8.5	10.5	9.4
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Dimethyl phthalate	250	300 U	270 U	280 U	280 U
2,6-Dinitrotoluene	250	300 U	270 U	280 U	280 U
Acenaphthylene	250	300 U	270 U	280 U	280 U
3-Nitroaniline	500	610 U	540 U	560 U	550 U
4-Nitrophenol	500	610 U	540 U	560 U	550 U
2,4-Dinitrophenol	500	610 U	540 U	560 U	550 U
Acenaphthene	250	300 U	270 U	280 U	280 U
2,4-Dinitrotoluene	250	300 U	270 U	280 U	280 U
Dibenzofuran	250	300 U	270 U	280 U	280 U
Diethyl phthalate	250	300 U	270 U	280 U	280 U
4-Chlorophenyl phenyl ether	250	300 U	270 U	280 U	280 U
Fluorene	250	300 U	270 U	280 U	280 U
4-Nitroaniline	500	610 U	540 U	560 U	550 U
4,6-Dinitro-2-methylphenol	500	610 U	540 U	560 U	550 U
n-Nitrosodiphenylamine	250	300 U	270 U	280 U	280 U
1,2-Diphenylhydrazine	250	300 U	270 U	280 U	280 U
4-Bromophenyl phenylether	250	300 U	270 U	280 U	280 U
Hexachlorobenzene	250	300 U	270 U	280 U	280 U
Pentachlorophenol	500	610 U	540 U	560 U	550 U
Phenanthrene	250	300 U	270 U	280 U	280 U
Anthracene	250	300 U	270 U	280 U	280 U
Carbazole	250	300 U	270 U	280 U	280 U
Di-n-butylphthalate	250	300 U	270 U	280 U	280 U
Fluoranthene	250	300 U	270 U	280 U	280 U
Benzidine	250	300 U	270 U	280 U	280 U
Pyrene	250	300 U	270 U	280 U	280 U
Butyl benzyl phthalate	250	300 U	270 U	280 U	280 U
bis(2-ethylhexyl)phthalate	250	300 U	270 U	280 U	280 U
3,3'-Dichlorobenzidine	250	300 U	270 U	280 U	280 U
Benzo(a)anthracene	250	300 U	270 U	280 U	280 U
Chrysene	250	300 U	270 U	280 U	280 U

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)	BRSWSB05D(4-6)
Lab Sample Number:		9911026-01B	9911026-02B	9911026-03B	9911026-04B
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	Field DUP	Field DUP
Dilution Factor:		1	1	1	1
Date Sampled:		11/18/99	11/18/99	11/18/99	11/18/99
Date Extracted:		11/22/1999	11/22/1999	11/22/1999	11/22/1999
Date Analyzed		11/29/1999	11/30/1999	11/30/1999	11/30/1999
Percent Moisture:		18.7	8.5	10.5	9.4
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Di-n-octylphthalate	250	300 U	270 U	280 U	280 U
Benzo(b)fluoranthene	250	300 U	270 U	280 U	280 U
Benzo(k)fluoranthene	250	300 U	270 U	280 U	280 U
Benzo(a)pyrene	250	300 U	270 U	280 U	280 U
Dibenz(a,h)anthracene	250	300 U	270 U	280 U	280 U
Indeno(1,2,3-cd)pyrene	250	300 U	270 U	280 U	280 U
Benzo(g,h,i)perylene	250	300 U	270 U	280 U	280 U

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB06(4-6)	BRSWSB18(4-6)		
Lab Sample Number:		9911026-05B	9911026-0b		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/18/99	11/18/99		
Date Extracted:		11/22/1999	11/22/1999		
Date Analyzed		11/30/1999	11/30/1999		
Percent Moisture:		10.2	12.9		
Compounds	Limit	ug/Kg	ug/Kg		
N-nitrosodimethylamine	500	560 U	570 U		
Phenol	250	280 U	290 U		
bis(2-Chloroethyl) ether	250	280 U	290 U		
2-Chlorophenol	250	280 U	290 U		
1,3-Dichlorobenzene	250	280 U	290 U		
1,4-Dichlorobenzene	250	280 U	290 U		
Benzyl Alcohol	500	560 U	570 U		
2-Methylphenol	250	280 U	290 U		
1,2-Dichlorobenzene	250	280 U	290 U		
Bis(2-chloroisopropyl)ether	250	280 U	290 U		
4-Methylphenol	250	280 U	290 U		
n-Nitroso-di-n-propylamine	250	280 U	290 U		
Hexachloroethane	250	280 U	290 U		
Nitrobenzene	250	280 U	290 U		
Isophorone	250	280 U	290 U		
2,4-Dimethylphenol	250	280 U	290 U		
Benzoic Acid	500	560 U	570 U		
2-Nitrophenol	250	280 U	290 U		
bis(2-Chloroethoxy) methane	250	280 U	290 U		
2,4-Dichlorophenol	250	280 U	290 U		
1,2,4-Trichlorobenzene	250	280 U	290 U		
Naphthalene	250	280 U	290 U		
4-Chloroaniline	250	280 U	290 U		
Hexachlorobutadiene	250	280 U	290 U		
4-Chloro-3-methylphenol	500	560 U	570 U		
2-Methylnaphthalene	250	280 U	290 U		
Hexachlorocyclopentadiene	250	280 U	290 U		
2,4,6-Trichlorophenol	250	280 U	290 U		
2,4,5-Trichlorophenol	250	280 U	290 U		
2-Chloronaphthalene	250	280 U	290 U		
2-Nitroaniline	500	560 U	570 U		

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB06(4-6)	BRSWSB18(4-6)		
Lab Sample Number:		9911026-05B	9911026-0b		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/18/99	11/18/99		
Date Extracted:		11/22/1999	11/22/1999		
Date Analyzed		11/30/1999	11/30/1999		
Percent Moisture:		10.2	12.9		
Compounds	Limit	ug/Kg	ug/Kg		
Dimethyl phthalate	250	280 U	290 U		
2,6-Dinitrotoluene	250	280 U	290 U		
Acenaphthylene	250	280 U	290 U		
3-Nitroaniline	500	560 U	570 U		
4-Nitrophenol	500	560 U	570 U		
2,4-Dinitrophenol	500	560 U	570 U		
Acenaphthene	250	280 U	290 U		
2,4-Dinitrotoluene .	250	280 U	290 U		
Dibenzofuran	250	280 U	290 U		
Diethyl phthalate	250	280 U	290 U		
4-Chlorophenyl phenyl ether	250	280 U	290 U		
Fluorene	250	280 U	290 U		
4-Nitroaniline	500	560 U	570 U		
4,6-Dinitro-2-methylphenol	500	560 U	570 U		
n-Nitrosodiphenylamine	250	280 U	290 U		
1,2-Diphenylhydrazine	250	280 U	290 U		
4-Bromophenyl phenylether	250	280 U	290 U		
Hexachlorobenzene	250	280 U	290 U		
Pentachlorophenol	500	560 U	570 U		
Phenanthrene	250	280 U	290 U		
Anthracene	250	280 U	290 U		
Carbazole	250	280 U	290 U		
Di-n-butyl phthalate	250	280 U	290 U		
Fluoranthene	250	280 U	290 U		
Benzidine	250	280 U	290 U		
Pyrene	250	280 U	290 U		
Butyl benzyl phthalate	250	280 U	290 U		
bis(2-ethylhexyl) phthalate	250	280 U	290 U		
3,3'-Dichlorobenzidine	250	280 U	290 U		
Benzo(a)anthracene	250	280 U	290 U		
Chrysene	250	280 U	290 U		

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB06(4-6)	BRSWSB18(4-6)		
Lab Sample Number:		9911026-05B	9911026-0b		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/18/99	11/18/99		
Date Extracted:		11/22/1999	11/22/1999		
Date Analyzed		11/30/1999	11/30/1999		
Percent Moisture:		10.2	12.9		
Compounds	Limit	ug/Kg	ug/Kg		
Di-n-octyl phthalate	250	280 U	290 U		
Benzo(b)fluoranthene	250	280 U	290 U		
Benzo(k)fluoranthene	250	280 U	290 U		
Benzo(a)pyrene	250	280 U	290 U		
Dibenz(a,h)anthracene	250	280 U	290 U		
Indeno(1,2,3-cd)pyrene	250	280 U	290 U		
Benzo(g,h,i)perylene	250	280 U	290 U		
	10				

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Jan. 19, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/18/99
6 Soil samples
1 trip blank
Lab Order: 9911026

Volatile Organics Analysis

Samples Collected:

BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)	BRSWSB05D(4-6)
BRSWSB06(4-6)	BRSWSB18(4-6)	Trip Blank 01	

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
* - MS/MSD results
- LCS results
- field duplicate results
* - laboratory duplicate results
* - surrogate recoveries

* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No field rinsate blank sample was submitted with the 11/18/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA trip blank sample. The only aqueous VOA sample was the aqueous Trip Blank 01.

Trip Blanks, Field Blanks, and Method Blanks

All Trip Blank 01 results were reported as non-detected. No aqueous method blank results were reported in laboratory order 9911026.

No target compound analytes were detected in field rinsate blank sample BRSWRB01 and no validation actions were required. No target compound analytes were detected in aqueous preparation method blank samples 11/29/99 and 12/02/99.

All 8260B soil method blank results were reported as non-detected.

No validation actions were taken based upon the trip blank, field equipment blank, and method blank results.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWSB15 (9911018-13) was the batch MS/MSD sample for laboratory order 9911026. MS/MSD validation actions typically apply to that sample only. No validation actions were taken based upon the MS/MSD results.

No aqueous MS/MSD results were submitted with laboratory order 9911026.

Laboratory Control Sample

The laboratory soil LCS recovery acceptance criteria are 70-130%. A list of compounds not meeting this criterion is summarized below.

Compound	% Recovery	Action
Cis-1,2-Dichloroethene	62.6	Non-detects UJ; Detects J
Chloroethane	57.6	Non-detects UJ; Detects J
Bromomethane	53.6	Non-detects UJ; Detects J

Based upon the soil LCS recoveries the cis-1,2-dchloroethene, chloroethane, and bromomethane results for all soil samples are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists.

No aqueous LCS results were submitted with laboratory order 9911026.

Field Duplicate Results

Samples BRSWSB05(4-6) and BRSWSB05D(4-6) were the field duplicate samples. Acetone was detected in sample BRSWSB05(4-6) at 51ug/Kg and reported as non-detected (U) in duplicate sample BRSWSB05D(4-6). The validator has reported the positive result as estimated (J) and the non-detected result as non-detected estimated (UJ).

Acetone was also detected in samples BRSWSB03(4-6), BRSWSB04(6-8) and BRSWSB18(4-6) at 200ug/Kg, 21ug/Kg, and 28ug/Kg respectively. These results are reported as estimated (J) based upon the field duplicate precision. Acetone was also not detected in sample BRSWSB06(4-6), and this result is reported as non-detected estimated (UJ) due to the field duplicate results.

Acetone is a common laboratory contaminant and a potential sample preservation artifact. Acetone was not detected in the equipment rinsate blank, the aqueous trip blank, and the method preparation blank indicating that the sample results are not due to blank contamination. The positive acetone results may be due to soil preservation artifacts.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

The MCP-RCS-1 acetone concentration is 3000ug/Kg and no acetone results exceed this concentration.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911026.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The laboratory did not submit aqueous method blank, aqueous LCS and aqueous MS/MSD results. These results should be included in the data package. The only aqueous sample is TRIP BLANK 01. The surrogate recoveries for TRIP BLANK 01 met the method specified acceptance criteria so no TRIP BLANK 01 results were qualified.

Acetone was reported in sample BRSWSB05(4-6) at 51ug/Kg and non-detected in sample BRSWSB05D(4-6). Acetone is reported as estimated (J) in VOA soil samples BRSWSB03(4-6), BRSWSB04(6-8), BRSWSB05(4-6) and BRSWSB18(4-6) due to the field duplicate sample results. Acetone is reported as non-detected estimated (UJ) in samples BRSWSB05D(4-6) and BRSWSB06(4-6).

Acetone was not detected in the method preparation blanks, the rinsate blank sample BRSWRB01, and TRIP BLANK 01. Acetone is a common laboratory contaminant these acetone results could be due to possible sample preservation artifacts. No acetone results exceeded the MCP-RCS-1 3000ug/Kg limit. Positive acetone results are likely biased high.

Methylene chloride is reported as estimated (J) in soil sample BRSWSB03(4-6) at 25ug/Kg. The methylene chloride result is below the method quantitation limit, 37ug/Kg.

Methylene chloride is reported as estimated (J) in soil sample BRSWSB04(6-8) at 17ug/Kg. The methylene chloride result is below the method quantitation limit, 25ug/Kg.

Methylene chloride is reported as estimated (J) in soil sample BRSWSB06(4-6) at 14ug/Kg. The methylene chloride result is below the method quantitation limit, 24ug/Kg.

Methylene chloride is reported as estimated (J) in soil sample BRSWSB18(4-6) at 19ug/Kg. The methylene chloride result is below the method quantitation limit, 27ug/Kg.

Methylene chloride is a common laboratory contaminant. Methylene chloride was not detected in the accompanying blanks. No methylene chloride results exceed the MCP RCS-1 100,000ug/Kg limit.

Based upon the soil LCS recoveries the cis-1,2-dchloroethene, chloroethane, and bromomethane results for all soil samples are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists.

The submitted MS/MSD results were from laboratory order 9911018 and these results were not used to qualify the 8260B samples from laboratory order 9911026.

No laboratory duplicate results were submitted.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous 8260 VOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia 8260B soils
Table Ib 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB03(4-6)	A, J^1, J^2, J^3
BRSWSB04(6-8)	A, J^1, J^2, J^3
BRSWSB05(4-6)	A, J^1, J^2
BRSWSB05D(4-6)	A, J^1, J^2
BRSWSB06(4-6)	A, J^1, J^2, J^3
BRSWSB18(4-6)	A, J^1, J^2, J^3

A Accept all data.

J^1 Acetone results are reported as estimated (J) or non-detected estimated (UJ) based upon the field duplicate results. Positive acetone results may be a sample preservation artifact.

J^2 The Cis-1,2-dchloroethene, chloroethane, and bromomethane results for all soil samples are reported as non-detected estimated (UJ) based upon low LCS recoveries. These results are biased low and the possibility of false negatives exists.

J^3 Methylene chloride is reported as estimated (J). These soil results are below the method quantitation limit.

Table 1b- Volatiles-8260B Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
Trip Blank 01 (aq)	A

A Accept all data.

Table I

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)	BRSWSB05D(4-6)
S&W Sample (cont)					
Lab Sample Number:		9911026-01A	9911026-02A	9911026-03A	9911026-04A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/18/99	11/18/99	11/18/99	11/18/99
Date Extracted:		11/18/99	11/18/99	11/18/99	11/18/99
Date Analyzed:		11/29/1999	11/30/1999	12/02/1999	12/02/1999
Percent Moisture:		18.7	8.5	10.5	9.4
	Report			FIELD DUP	FIELD DUP
Target Compounds	Limit	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dichlorodifluoromethane	4	7.4 U	5.0 U	6.6 U	5.2 U
Chloromethane	4	7.4 U	5.0 U	6.6 U	5.2 U
Vinyl Chloride	4	7.4 U	5.0 U	6.6 U	5.2 U
Chloroethane	4	7.4 UJ	5.0 UJ	6.6 UJ	5.2 UJ
Bromomethane	4	7.4 UJ	5.0 UJ	6.6 UJ	5.2 UJ
Trichlorofluoromethane	4	7.4 U	5.0 U	6.6 U	5.2 U
Acetone	20	200 J	21 J	51 J	26 UJ
1.1-Dichloroethene	4	7.4 U	5.0 U	6.6 U	5.2 U
Carbon disulfide	4	7.4 U	5.0 U	6.6 U	5.2 U
Methylene Chloride	20	25 J	17 J	33 U	26 U
Methyl tert-butyl ether	4	7.4 U	5.0 U	6.6 U	5.2 U
trans-1,2-Dichloroethene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,1-Dichloroethane	4	7.4 U	5.0 U	6.6 U	5.2 U
2-Butanone	20	37 U	25 U	33 U	26 U
2,2-Dichloropropane	4	7.4 U	5.0 U	6.6 U	5.2 U
cis-1,2-Dichloroethene	4	7.4 UJ	5.0 UJ	6.6 UJ	5.2 UJ
Chloroform	4	7.4 U	5.0 U	6.6 U	5.2 U
Bromochloromethane	4	7.4 U	5.0 U	6.6 U	5.2 U
1,1,1-Trichloroethane	4	7.4 U	5.0 U	6.6 U	5.2 U
1,1-Dichloropropene	4	7.4 U	5.0 U	6.6 U	5.2 U
Carbon tetrachloride	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2-Dichloroethane	4	7.4 U	5.0 U	6.6 U	5.2 U
Benzene	4	7.4 U	5.0 U	6.6 U	5.2 U
Trichloroethene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2-Dichloropropane	4	7.4 U	5.0 U	6.6 U	5.2 U
Bromodichloromethane	4	7.4 U	5.0 U	6.6 U	5.2 U
Dibromomethane	4	7.4 U	5.0 U	6.6 U	5.2 U
4-Methyl-2-pentanone	20	37 U	25 U	33 U	26 U
cis-1,3-Dichloropropene	4	7.4 U	5.0 U	6.6 U	5.2 U
Toluene	4	7.4 U	5.0 U	6.6 U	5.2 U
trans-1,3-Dichloropropene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,1,2-Trichloroethane	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2-Dibromoethane	4	7.4 U	5.0 U	6.6 U	5.2 U
2-Hexanone	20	37 U	25 U	33 U	26 U
1,3-Dichloropropane	4	7.4 U	5.0 U	6.6 U	5.2 U
Tetrachloroethene	4	7.4 U	5.0 U	6.6 U	5.2 U

Table I

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)	BRSWSB05D(4-6)
S&W Sample (cont)					
Lab Sample Number:		9911026-01A	9911026-02A	9911026-03A	9911026-04A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/18/99	11/18/99	11/18/99	11/18/99
Date Extracted:		11/18/99	11/18/99	11/18/99	11/18/99
Date Analyzed:		11/29/1999	11/30/1999	12/02/1999	12/02/1999
Percent Moisture:		18.7	8.5	10.5	9.4
Dibromochloromethane	4	7.4 U	5.0 U	6.6 U	5.2 U

Table I

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)	BRSWSB05D(4-6)
S&W Sample (cont)					
Lab Sample Number:		9911026-01A	9911026-02A	9911026-03A	9911026-04A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/18/99	11/18/99	11/18/99	11/18/99
Date Extracted:		11/18/99	11/18/99	11/18/99	11/18/99
Date Analyzed:		11/29/1999	11/30/1999	12/02/1999	12/02/1999
Percent Moisture:		18.7	8.5	10.5	9.4
Chlorobenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,1,1,2-Tetrachloroethane	4	7.4 U	5.0 U	6.6 U	5.2 U
Ethylbenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
m,p-Xylene	4	7.4 U	5.0 U	6.6 U	5.2 U
o-Xylene	4	7.4 U	5.0 U	6.6 U	5.2 U
Styrene	4	7.4 U	5.0 U	6.6 U	5.2 U
Bromoform	4	7.4 U	5.0 U	6.6 U	5.2 U
Isopropylbenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,1,2,2-Tetrachloroethane	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2,3-Trichloropropane	4	7.4 U	5.0 U	6.6 U	5.2 U
Bromobenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
n-Propylbenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
2-Chlorotoluene	4	7.4 U	5.0 U	6.6 U	5.2 U
4-Chlorotoluene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,3,5-Trimethylbenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
tert-Butylbenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2,4,-Trimethylbenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
sec-Butylbenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
4-isopropyltoluene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,3-dichlorobenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,4-dichlorobenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
n-Butylbenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2-Dichlorobenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2-Dibromo-3-chloropropane	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2,4-Trichlorobenzene	4	7.4 U	5.0 U	6.6 U	5.2 U
Hexachlorobutadiene	4	7.4 U	5.0 U	6.6 U	5.2 U
Naphthalene	4	7.4 U	5.0 U	6.6 U	5.2 U
1,2,3-Trichlorobenzene	4	7.4 U	5.0 U	6.6 U	5.2 U

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Soil units mg/Kg based upon 100% total solids

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB06(4-6)	BRSWSB18(4-6)		
S&W Sample (cont)					
Lab Sample Number:		9911026-05A	9911026-06A		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/18/99	11/18/99		
Date Extracted:		11/18/99	11/18/99		
Date Analyzed:		12/02/1999	12/01/1999		
Percent Moisture:		10.2	12.9		
Target Compounds	Report Limit	mg/Kg	mg/Kg		
Dichlorodifluoromethane	4	4.9 U	5.3 U		
Chloromethane	4	4.9 U	5.3 U		
Vinyl Chloride	4	4.9 U	5.3 U		
Chloroethane	4	4.9 UJ	5.3 UJ		
Bromomethane	4	4.9 UJ	5.3 UJ		
Trichlorofluoromethane	4	4.9 U	5.3 U		
Acetone	20	24 UJ	28 J		
1.1-Dichloroethene	4	4.9 U	5.3 U		
Carbon disulfide	4	4.9 U	5.3 U		
Methylene Chloride	20	14 J	19 J		
Methyl tert-butyl ether	4	4.9 U	5.3 U		
trans-1,2-Dichloroethene	4	4.9 U	5.3 U		
1,1-Dichloroethane	4	4.9 U	5.3 U		
2-Butanone	20	24 U	27 U		
2,2-Dichloropropane	4	4.9 U	5.3 U		
cis-1,2-Dichloroethene	4	4.9 UJ	5.3 UJ		
Chloroform	4	4.9 U	5.3 U		
Bromochloromethane	4	4.9 U	5.3 U		
1,1,1-Trichloroethane	4	4.9 U	5.3 U		
1,1-Dichloropropene	4	4.9 U	5.3 U		
Carbon tetrachloride	4	4.9 U	5.3 U		
1,2-Dichloroethane	4	4.9 U	5.3 U		
Benzene	4	4.9 U	5.3 U		
Trichloroethene	4	4.9 U	5.3 U		
1,2-Dichloropropane	4	4.9 U	5.3 U		
Bromodichloromethane	4	4.9 U	5.3 U		
Dibromomethane	4	4.9 U	5.3 U		
4-Methyl-2-pentanone	20	24 U	27 U		
cis-1,3-Dichloropropene	4	4.9 U	5.3 U		
Toluene	4	4.9 U	5.3 U		
trans-1,3-Dichloropropene	4	4.9 U	5.3 U		
1,1,2-Trichloroethane	4	4.9 U	5.3 U		
1,2-Dibromoethane	4	4.9 U	5.3 U		
2-Hexanone	20	24 U	27 U		
1,3-Dichloropropane	4	4.9 U	5.3 U		
Tetrachloroethene	4	4.9 U	5.3 U		

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB06(4-6)	BRSWSB18(4-6)		
S&W Sample (cont)					
Lab Sample Number:		9911026-05A	9911026-06A		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/18/99	11/18/99		
Date Extracted:		11/18/99	11/18/99		
Date Analyzed:		12/02/1999	12/01/1999		
Percent Moisture:		10.2	12.9		
Dibromochloromethane	4	4.9 U	5.3 U		

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB06(4-6)	BRSWSB18(4-6)		
S&W Sample (cont)					
Lab Sample Number:		*9911026-05A*	*9911026-06A*		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/18/99	11/18/99		
Date Extracted:		11/18/99	11/18/99		
Date Analyzed:		12/02/1999	12/01/1999		
Percent Moisture:		10.2	12.9		
Chlorobenzene	4	4.9 U	5.3 U		
1,1,1,2-Tetrachloroethane	4	4.9 U	5.3 U		
Ethylbenzene	4	4.9 U	5.3 U		
m,p-Xylene	4	4.9 U	5.3 U		
o-Xylene	4	4.9 U	5.3 U		
Styrene	4	4.9 U	5.3 U		
Bromoform	4	4.9 U	5.3 U		
Isopropylbenzene	4	4.9 U	5.3 U		
1,1,2,2-Tetrachloroethane	4	4.9 U	5.3 U		
1,2,3-Trichloropropane	4	4.9 U	5.3 U		
Bromobenzene	4	4.9 U	5.3 U		
n-Propylbenzene	4	4.9 U	5.3 U		
2-Chlorotoluene	4	4.9 U	5.3 U		
4-Chlorotoluene	4	4.9 U	5.3 U		
1,3,5-Trimethylbenzene	4	4.9 U	5.3 U		
tert-Butylbenzene	4	4.9 U	5.3 U		
1,2,4,-Trimethylbenzene	4	4.9 U	5.3 U		
scc-Butylbenzene	4	4.9 U	5.3 U		
4-isopropyltoluene	4	4.9 U	5.3 U		
1,3-dichlorobenzene	4	4.9 U	5.3 U		
1,4-dichlorobenzene	4	4.9 U	5.3 U		
n-Butylbenzene	4	4.9 U	5.3 U		
1,2-Dichlorobenzene	4	4.9 U	5.3 U		
1,2-Dibromo-3-chloropropane	4	4.9 U	5.3 U		
1,2,4-Trichlorobenzene	4	4.9 U	5.3 U		
Hexachlorobutadiene	4	4.9 U	5.3 U		
Naphthalene	4	4.9 U	5.3 U		
1,2,3-Trichlorobenzene	4	4.9 U	5.3 U		

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 01				
S&W Sample (cont)						
Lab Sample Number:		9911026-08A				
Matrix/Analysis:		Aq/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		11/18/1999				
Date Extracted:		11/30/1999				
Date Analyzed:		11/30/1999				
Percent Moisture:		NA				
	Report					
Target Compounds	Limit	ug/L				
Dichlorodifluoromethane	5	5.0U				
Chloromethane	5	5.0 U				
Vinyl Chloride	2	2.0U				
Chloroethane	5	5.0 U				
Bromomethane	5	5.0 U				
Trichlorofluoromethane	2	2.0 U				
Acetone	10	10.0 U				
1.1-Dichloroethene	1	1.0 U				
Carbon disulfide	2	2.0 U				
Methylene Chloride	5	5.0 U				
Methyl tert-butyl ether	2	2.0 U				
trans-1,2-Dichloroethene	2	2.0 U				
1,1-Dichloroethane	2	2.0 U				
2-Butanone	10	10.0 U				
2,2-Dichloropropane	2	2.0 U				
cis-1,2-Dichloroethene	2	2.0 U				
Chloroform	2	2.0 U				
Bromochloromethane	2	2.0 U				
1,1,1-Trichloroethane	2	2.0 U				
1,1-Dichloropropene	2	2.0 U				
Carbon tetrachloride	2	2.0 U				
1,2-Dichloroethane	2	2.0 U				
Benzene	2	2.0 U				
Trichloroethene	2	2.0 U				
1,2-Dichloropropane	2	2.0 U				
Bromodichloromethane	2	2.0 U				
Dibromomethane	2	2.0 U				
4-Methyl-2-pentanone	10	10.0 U				
cis-1,3-Dichloropropene	1	1.0 U				
Toluene	2	2.0 U				
trans-1,3-Dichloropropene	1	1.0 U				
1,1,2-Trichloroethane	2	2.0 U				
1,2-Dibromoethane	2	2.0 U				
2-Hexanone	10	10.0 U				
1,3-Dichloropropane	2	2.0 U				
Tetrachloroethene	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 01				
S&W Sample (cont)						
Lab Sample Number:		9911026-08A				
Matrix/Analysis:		Aq/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		11/18/1999				
Date Extracted:		11/30/1999				
Date Analyzed:		11/30/1999				
Percent Moisture:		NA				
Dibromochloromethane	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 01				
S&W Sample (cont)						
Lab Sample Number:		9911026-08A				
Matrix/Analysis:		Aq/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		11/18/1999				
Date Extracted:		11/30/1999				
Date Analyzed:		11/30/1999				
Percent Moisture:		NA				
Chlorobenzene	2	2.0 U				
1,1,1,2-Tetrachloroethane	2	2.0 U				
Ethylbenzene	2	2.0 U				
m,p-Xylene	2	2.0 U				
o-Xylene	2	2.0 U				
Styrene	2	2.0 U				
Bromoform	2	2.0 U				
Isopropylbenzene	2	2.0 U				
1,1,2,2-Tetrachloroethane	2	2.0 U				
1,2,3-Trichloropropane	2	2.0 U				
Bromobenzene	2	2.0 U				
n-Propylbenzene	2	2.0 U				
2-Chlorotoluene	2	2.0 U				
4-Chlorotoluene	2	2.0 U				
1,3,5-Trimethylbenzene	2	2.0 U				
tert-Butylbenzene	2	2.0 U				
1,2,4,-Trimethylbenzene	2	2.0 U				
sec-Butylbenzene	2	2.0 U				
4-isopropyltoluene	2	2.0 U				
1,3-dichlorobenzene	2	2.0 U				
1,4-dichlorobenzene	2	2.0 U				
n-Butylbenzene	2	2.0 U				
1,2-Dichlorobenzene	2	2.0 U				
1,2-Dibromo-3-chloropropa	5	5.0 U				
1,2,4-Trichlorobenzene	2	2.0 U				
Hexachlorobutadiene	2	2.0 U				
Naphthalene	2	2.0 U				
1,2,3-Trichlorobenzene	2	2.0 U				

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Jan. 21, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/18/99
4 Soil samples
Lab Order: 9911026

Extractable Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSB05(4-6)	BRSWSB05D(4-6)	BRSWSB18(4-6)	BRSWSB02A(6-8)

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

- chain of custody documents
- sample log-in documents
- rinsate blanks, and method blanks
* - MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

The COC indicates that trip blank samples were submitted, however the COC did not indicate that the VPH trip blank was to be analyzed. The laboratory did not analyze a trip blank with the samples collected on 11/18/99.

No field rinsate blank sample was submitted with the 11/18/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were properly preserved.

Field Blanks, and Method Blanks

The aqueous EPH rinsate blank BRSWRB01 had a positive result for the C19-C36 aliphatic range compounds. This analyte was not detected in the laboratory extraction blank or the soil samples. This result is possibly a field sampling artifact. No other blank contamination is indicated. Based upon the blank results no data validation actions were taken because the contaminant was not detected in the field samples. The narrative noted that the C19-C36 result was due to
non- petroleum hydrocarbon compounds.

Matrix Spike / Matrix Spike Duplicate Results

The MS/MSD soil samples were not part of this lab order. No validation results were taken based upon these results.

Laboratory Control Samples

All soil EPH LCS recoveries met the method acceptance criteria.

Field Duplicate Results

Samples BRSWSB05(4-6) and BRSWSB05D(4-6) were the field duplicate samples. All results were reported as non-detected. No results are qualified based upon the field duplicate results.

Laboratory Duplicate Results

Soil sample BRSWSB19 was analyzed as the laboratory duplicate sample. All results for both samples were reported as non-detected. No validation actions were taken based upon the soil laboratory duplicate results.

Surrogate Results

All soil sample surrogate recoveries met the method specified acceptance criteria. Specified 8270C method surrogates were reported along with specified EPH surrogates.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All soil EPH results are accepted without qualification.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil EPH results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table 1a EPH soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table 1a- Extractable Petroleum Hydrocarbon Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB05(4-6)	A
BRSWSB05D(4-6)	A
BRSWSB18(4-6)	A
BRSWSB02A(6-8)	A

A Accept all data.

TABLE I **MA DEP EPH Method 98-1 Validated Results**

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB05(4-6)	BRSWSB05D(4-6)	BRSWSB18(4-6)	BRSWSB02A(6-8)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			9911026-03D	9911026-04D	9911026-06D	9911026-07A
Percent Moisture:			10.5	9.4	12.9	12.5
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/18/1999	11/18/1999	11/18/1999	11/18/1999
Date Extracted			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Analyzed Aliphatics:			11/30/1999	11/30/1999	11/30/1999	11/30/1999
Date Analyzed PNA			11/30/1999	11/30/1999	11/30/1999	11/30/1999
Notes:			Field Dup	Field Dup		
		Report				
EPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	mg/Kg
C9-C18 Aliphatic (1)	8270C	49	54 U	54 U	57 U	56 U
C19-C36 Aliphatic (1)	8270C	49	54 U	54 U	57 U	56 U
C11-C22 Aromatics(1,2)	8270C	49	54 U	54 U	57 U	56 U
Targeted PAH Analytes						
Naphthalene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
2-Methylnaphthalene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Acenaphthylene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Acenaphthene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Fluorene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Phenanthrene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Anthracene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Fluoranthene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Pyrene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Benzo(a)anthracene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Chrysene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Benzo(b)fluoranthene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Benzo(k)fluoranthene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Benzo(a)pyrene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Indeno(1,2,3-cd)pyrene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Dibenzo(a,h)anthracene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U
Benzo(g,h,i)perylene	8270C	0.24	0.27 U	0.27 U	0.29 U	0.28 U

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
* Based upon 100% total solids
(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 21, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/18/99
4 Soil samples
Lab Order: 9911026

Volatile Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSB05(4-6)	BRSWSB05D(4-6)	BRSWSB18(4-6)	BRSWSB02A(6-8)

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
*- MS/MSD results
* - LCS results
* - field duplicate results
*- laboratory duplicate results
*- surrogate recoveries
*- holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

The COC indicates that trip blank samples were submitted, however the COC did not indicate that the VPH trip blank was to be analyzed. The laboratory did not analyze a trip blank with the samples collected on 11/18/99.

No field rinsate blank sample was submitted with the 11/18/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were properly preserved.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the VPH soil preparation blank and rinaste blank BRSWRB01 (11/19/99).

The laboratory did not analyze the trip blank sample collected on 11/18/99. All sample results where non-detected so this omission does not impact data quality.

Matrix Spike / Matrix Spike Duplicate Results

Sample 9911033-04B was analyzed as the soil MS/MSD VPH sample. All method analyte recovery and duplicate precision criteria were met.

Laboratory Control Samples

All soil laboratory control sample recoveries met the method specified recovery criteria.

Field Duplicate Results

Samples BRSWSB05(4-6) and BRSWSB05D(4-6) were the field duplicate samples. All results were reported as non-detected. No results are qualified based upon the field duplicate results.

Laboratory Duplicates

Soil sample BRSWSB19 was analyzed as the sample/sample duplicate. All method precision acceptance criteria were met.

Surrogate Results

All soil sample surrogate recoveries met the method specified acceptance criteria. Specified 8260B method surrogates were reported along with VPH surrogate 2,5-Dibromotoluene.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The laboratory did not analyze the trip blank collected on 11/18/99. All VPH sample results were non-detected so this omission does not impact data quality. All VPH results are accepted without qualification.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil VPH results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table Ia VPH soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Volatile Petroleum Hydrocarbon Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB05(4-6)	A
BRSWSB05D(4-6)	A
BRSWSB18(4-6)	A
BRSWSB02A(6-8)	A

A Accept all results without qualification

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB05(4-6)	BRSWSB05D(4-6)	BRSWSB18(4-6)	BRSWSB02A(6-8)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			*9911026-03C*	*9911026-04C*	*9911026-06C*	*9911026-07B*
Percent moisture:			10.5	9.4	12.9	12.5
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/18/1999	11/18/1999	11/18/1999	11/18/1999
Date Analyzed:			12/05/1999	12/05/1999	12/05/1999	12/05/1999
Notes:			Field Dup	Field Dup		
		Report				
VPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	mg/Kg
C5-C8 Aliphatic (1,2)	8260	2.5	2.5 U	2.3 U	2.3 U	2.6 U
C9-C12 Aliphatic(1,3)	8260	0.62	0.62 U	0.58 U	0.57 U	0.66 U
C9-C10 Aromatics(1)	8260	0.62	0.62 U	0.58 U	0.57 U	0.66 U
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	0.050	0.050 U	0.047 U	0.045 U	0.053 U
Benzene	8260	0.050	0.050 U	0.047 U	0.045 U	0.053 U
Toluene	8260	0.050	0.050 U	0.047 U	0.045 U	0.053 U
Ethylbenzene	8260	0.050	0.050 U	0.047 U	0.045 U	0.053 U
m,p-Xylene	8260	0.050	0.050 U	0.047 U	0.045 U	0.053 U
o-Xylene	8260	0.050	0.050 U	0.047 U	0.045 U	0.053 U
Napthalene	8260	0.050	0.050 U	0.047 U	0.045 U	0.053 U

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution
* Reporting limit is based upon 100% total solids and a 1:1 methanol to soil ratio.

Jan. 21, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/18/99
6 Soil samples
Lab Order: 9911026

Inorganic Analysis

BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)
BRSWSB05D(4-6)	BRSWSB06(4-6)	BRSWSB18(4-6)

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Soil samples were analyzed according to SW-846 EPA Method 6010B and mercury was analyzed by SW-846 Method 7471. Arsenic, barium, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B and silver, cadmium, lead, and antimony were analyzed in the aqueous samples according to SW-846 EPA Methods 7761, 7131, 7421, and 7041 respectively. Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
* MS /MSD results
* LCS results
* Field duplicate results

Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No field rinsate blank sample was submitted with the 11/18/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA trip blank sample. The only aqueous VOA sample was the aqueous Trip Blank 01.

The sample receipt checklist indicates that the laboratory order number was 9911023 and the narrative references the laboratory order as 9911026.

Field Blanks and Method Blanks

Chromium and selenium were detected in the soil preparation blanks at 0.452mg/Kg and 1.64 mg/Kg respectively. The resulting action levels were 2.25mg/Kg and 8.20mg/Kg respectively. Chromium sample results were above the action level and no chromium results were qualified based upon the method blank results.

Selenium was reported in samples BRSWSB06(4-6) and BRSWSB18(4-6) at 3.6mg/Kg (J) and 1.4mg/Kg (J) respectively. The blank action level is 8.20mg/Kg. The laboratory reported these selenium results as estimated (J) because the positive results were below the quantitation limit (11mg/Kg). The selenium results for these samples are reported as 11mg/Kg (U).

All rinsate blank BRSWRB01 results were reported as non-detected.

MS/MSD Results

All soil MS/MSD laboratory acceptance criteria were met. Sample BRSWSB17 (9911025-01) was analyzed as the ICP MS/MSD sample. Sediment sample BRSWSD03 (9911033-04) was analyzed as the mercury MS/MSD sample.

LCS Results

Soil LCS recoveries met the specified acceptance criteria. No results are qualified based upon the LCS results.

Field Duplicates

Samples BRSWSB05(4-6) and BRSWSB05D(4-6) were the field duplicate samples. The % RPD is 22.5%. The US EPA Region 1 and Army Corp field duplicate precision acceptance criteria for soils are $\leq$ 50 % and <40% respectively. Chromium results are not qualified based upon field duplicate results.

Arsenic was reported as estimated (J) in sample BRSWSB05(4-6) and as non-detected in field duplicate sample BRSWSB05D(4-6). The BRSWSB05(4-6) result is estimate because it is below the method quantitation limit. These results are due to analytical uncertainty near the detection limit and sampling variability. Neither arsenic result is qualified based upon the field duplicate results.

Laboratory Duplicates

Sample BRSWSB17 (9911025-01) was analyzed as the batch laboratory duplicate sample for laboratory order 9911026. The chromium duplicate %RPD was 21.1%. The Army Corp %RPD acceptance limit is $\leq$ 20%. The laboratory acceptance limit is also $\leq$ 20%. The chromium results are reported as estimated (J).

Holding Times

All sample analyses holding time requirements were met.

Summary

Chromium and selenium were detected in the solid preparation blank at 0.45mg/Kg and 1.64mg/Kg respectively and the action levels were 2.25mg/Kg and 8.2mg/Kg respectively. Chromium results were above the action level so no chromium results required qualification. The selenium results for samples BRSWSB06(4-6) and BRSWSB18(4-6) were reported as non-

detected (U) at the method quantitation level (10ug/Kg) due to the preparation blank contamination. Selenium was originally reported as estimated in theses samples at a concentrations below the selenium blank action level.

All barium and lead results for these samples (J). These results are between the method detection limit and the method quantitation limit. The arsenic results for samples BRSWSB04(6-8), BRSWSB05(4-6), and BRSWSB06(4-6) are reported as estimated (J). These results are below the method quantitation limit.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Soil Recommendation Summary

Antimony	A
Arsenic	A,J[3]
Barium	J[2]
Cadmium	A
Chromium	J[1]
Lead	J[2]
Mercury	A
Selenium	A
Silver	A

A- Accept all data

J[1]- All Chromium results are estimated (J) due to laboratory duplicate precision.

J[2]- Barium and lead results are reported as estimated (J) for all samples. These results are between the method detection limit and the method quantitation limit.

J[3]- Arsenic results for samples BRSWSB04(6-8), BRSWSB05(4-6), and BRSWSB06(4-6) are reported as These results are between the method detection limit and the method quantitation limit.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I **Inorganic Validated Results**

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB03(4-6)	BRSWSB04(6-8)	BRSWSB05(4-6)	BRSWSB05D(4-6)
Sample Location:						
Sample Type:			SOIL/LOW	SOIL/LOW	SOIL/LOW	SOIL/LOW
Lab Sample Number:			9911026-01B	9911026-02B	9911026-03B	9911026-04B
Percent Solids:			81.3	91.5	89.5	90.6
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/18/1999	11/18/1999	11/18/1999	11/18/1999
Notes:					Field Dup	Field Dup
		Report				
Inorganic Analysis	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Antimony	6010B	4	6.1 U	5.3 U	5.5 U	5.3 U
Arsenic	6010B	5	7.6 U	0.90 J	1.3 J	6.7 U
Barium	6010B	20	18 J	12 J	18 J	13 J
Cadmium	6010B	0.5	0.76 U	0.66 U	0.69 U	0.67 U
Chromium	6010B	1	12 J	7.6 J	8.4 J	6.7 J
Lead	6010B	5	4.3 J	3.2 J	4.2 J	3.2 J
Selenium	6010B	8	12 U	11 U	11 U	11 U
Silver	6010B	1.4	2.1 U	1.8 U	1.9 U	1.9 U
Mercury	7471B	0.025	0.029 U	0.025 U	0.026 U	0.023 U

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE 1 **Inorganic Validated Results**

Project No.: 05000.33
Lab Order: 9911026
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB06(4-6)	BRSWSB18(4-6)		
Sample Location:						
Sample Type:			SOIL/LOW	SOIL/LOW		
Lab Sample Number:			9911026-05B	9911026-06B		
Percent Solids:			89.8	87.1		
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/18/1999	11/18/1999		
Notes:						
		Report				
Inorganic Analysis	Method	Limit	mg/Kg	mg/Kg		
Antimony	6010B	4	5.4 U	5.7 U		
Arsenic	6010B	5	1.2 J	7.2 U		
Barium	6010B	20	16 J	11 J		
Cadmium	6010B	0.5	0.68 U	0.72 U		
Chromium	6010B	1	9.3 J	4.1 J		
Lead	6010B	5	4.4 J	5.0 J		
Selenium	6010B	8	11 U	11 U		
Silver	6010B	1.4	1.9 U	2.0 U		
Mercury	7471B	0.025	0.027 U	0.026 U		

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Date Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - Value is rejected.

Jan. 13, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/16/99
1 Soil sample
Lab Order: 9911018

Semivolatile Organics Analysis

Samples Collected:

BRSWSB15		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- rinsate blanks, and method blanks
- MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. The COC and the sample receipt checklist do not indicate if custody seals were present and intact on the coolers.

No field rinsate blank sample was submitted with the 11/16/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

The laboratory requested that Stone & Webster resubmit the COCs. The original COCs did not specify the MS/MSD sample, the sample matrices were not specified, the EPH compound lists were not specified, and several sampling depths were different between the sample bottles and the COCs. Revised COCs were received at the laboratory on 11/18/99.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 3° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that samples were properly preserved. The checklist does not indicate if cooler custody seals were or were not present.

Field Blanks and Method Blanks

No contamination was detected in the method blank. No field rinsate blank sample was submitted with the 11/16/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

Matrix Spike / Matrix Spike Duplicate Results

The soil MS/MSD results that did not meet the laboratory method specified acceptance criteria are summarized below. The benzidine result, for sample BRSWSB15, is rejected because both the MS/MSD recoveries were below 10%. Benzidine was not listed in the QAPP 8270C Data Quality Objectives compound list.

Compound	MS %	MSD %	Acceptance Window	Action
1,3-Dichlorobenzene	51.1	47.7	53-147	UJ nons, J detectcs
1,4-Dichlorobenzene	52.3	48.2	55-145	UJ nons, J detectcs
1,2-Dichlorobenzene	52	49.2	54-146	UJ nons, J detectcs
Benzidine	7.7	7.1	10-230	Reject
Hexachloroethane	49.5	46.2	48-152	UJ nons, J detectcs
1,2,4-trichlorobenzene	57.7	53.4	54-146	UJ nons, J detectcs

All SVOC results, for sample BRSWSB15, were reported as non-detected (U) by the laboratory.
1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, hexachloroethane, and 1,2,4-trichlorobezene are qualified as non-detected estimated (UJ). The possibility of false negatives exists.

Laboratory Control Sample

All LCS acceptance criteria were met.

Field Duplicate Results

No field duplicate samples were collected on 11/16/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911018.

Surrogate Results

All sample and QC surrogate recoveries met the method acceptance criteria.

Holding Times

All sample holding times were met.

Summary

The benzidine results were rejected. The MS/MSD recoveries were below 10%. The MS/MSD recoveries for 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, hexachloroethane, and 1,2,4-trichlorobezene were below the laboratory method specified

acceptance criteria. These results are qualified as non-detected estimated (UJ). The possibility of false negatives exists.

No field duplicate or laboratory duplicate results were submitted with laboratory order 9911025.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous 8270C SVOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a SVOC soils

295 Lower Flying Point Road ☐ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB15	A, J^1, R

A Accept all data.

J^1 1,3-Dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, hexachloroethane, and 1,2,4-trichlorobenzene results are reported as non-detected estimated due to the low MS/MSD recoveries. False negatives are possible.

R Reject the benzidine result. The MS/MSD recoveries were below 10%.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB15			
Lab Sample Number:		9911018-13D			
Matrix/Analysis:		Soil/Low			
Sample Type:		ROUTINE			
Dilution Factor:		1			
Date Sampled:		11/16/99			
Date Extracted:		11/22/1999			
Date Analyzed		11/29/1999			
Percent Moisture:		10.2			
Compounds	Limit	ug/Kg			
N-nitrosodimethylamine	500	560 U			
Phenol	250	280 U			
bis(2-Chloroethyl) ether	250	280 U			
2-Chlorophenol	250	280 U			
1,3-Dichlorobenzene	250	280 UJ			
1,4-Dichlorobenzene	250	280 UJ			
Benzyl Alcohol	500	560 U			
2-Methylphenol	250	280 U			
1,2-Dichlorobenzene	250	280 UJ			
Bis(2-chloroisopropyl)ether	250	280 U			
4-Methylphenol	250	280 U			
n-Nitroso-di-n-propylamine	250	280 U			
Hexachloroethane	250	280 UJ			
Nitrobenzene	250	280 U			
Isophorone	250	280 U			
2,4-Dimethylphenol	250	280 U			
Benzoic Acid	500	560 U			
2-Nitrophenol	250	280 U			
bis(2-Chloroethoxy) methane	250	280 U			
2,4-Dichlorophenol	250	280 U			
1,2,4-Trichlorobenzene	250	280 UJ			
Naphthalene	250	280 U			
4-Chloroaniline	250	280 U			
Hexachlorobutadiene	250	280 U			
4-Chloro-3-methylphenol	500	560 U			
2-Methylnaphthalene	250	280 U			
Hexachlorocyclopentadiene	250	280 U			
2,4,6-Trichlorophenol	250	280 U			
2,4,5-Trichlorophenol	250	280 U			
2-Chloronaphthalene	250	280 U			
2-Nitroaniline	500	560 U			

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB15			
Lab Sample Number:		9911018-13D			
Matrix/Analysis:		Soil/Low			
Sample Type:		ROUTINE			
Dilution Factor:		1			
Date Sampled:		11/16/99			
Date Extracted:		11/22/1999			
Date Analyzed		11/29/1999			
Percent Moisture:		10.2			
Compounds	Limit	ug/Kg			
Dimethyl phthalate	250	280 U			
2,6-Dinitrotoluene	250	280 U			
Acenaphthylene	250	280 U			
3-Nitroaniline	500	560 U			
4-Nitrophenol	500	560 U			
2,4-Dinitrophenol	500	560 U			
Acenaphthene	250	280 U			
2,4-Dinitrotoluene	250	280 U			
Dibenzofuran	250	280 U			
Diethyl phthalate	250	280 U			
4-Chlorophenyl phenyl ether	250	280 U			
Fluorene	250	280 U			
4-Nitroaniline	500	560 U			
4,6-Dinitro-2-methylphenol	500	560 U			
n-Nitrosodiphenylamine	250	280 U			
1,2-Diphenylhydrazine	250	280 U			
4-Bromophenyl phenylether	250	280 U			
Hexachlorobenzene	250	280 U			
Pentachlorophenol	500	560 U			
Phenanthrene	250	280 U			
Anthracene	250	280 U			
Carbazole	250	280 U			
Di-n-butylphthalate	250	280 U			
Fluoranthene	250	280 U			
Benzidine	250	R			
Pyrene	250	280 U			
Butyl benzyl phthalate	250	280 U			
bis(2-ethylhexyl)phthalate	250	280 U			
3,3'-Dichlorobenzidine	250	280 U			
Benzo(a)anthracene	250	280 U			
Chrysene	250	280 U			

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB15			
Lab Sample Number:		9911018-13D			
Matrix/Analysis:		Soil/Low			
Sample Type:		ROUTINE			
Dilution Factor:		1			
Date Sampled:		11/16/99			
Date Extracted:		11/22/1999			
Date Analyzed		11/29/1999			
Percent Moisture:		10.2			
Compounds	Limit	ug/Kg			
Di-n-octylphthalate	250	280 U			
Benzo(b)fluoranthene	250	280 U			
Benzo(k)fluoranthene	250	280 U			
Benzo(a)pyrene	250	280 U			
Dibenz(a,h)anthracene	250	280 U			
Indeno(1,2,3-cd)pyrene	250	280 U			
Benzo(g,h,i)perylene	250	280 U			

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB15			
Sample Location:						
Sample Type:			SOIL/LOW			
Lab Sample Number:			9911025-01B			
Percent Solids:			89.8			
Dilution Factor:			1			
Dilution Factor:						
Date Sampled:			11/16/1999			
Notes:						
		Report				
Inorganic Analysis	Method	Limit*	mg/kg			
Antimony	6010B	4	20 J			
Arsenic	6010B	5	6.7 U			
Barium	6010B	20	13 J			
Cadmium	6010B	0.5	0.67 U			
Chromium	6010B	1	11 J			
Lead	6010B	5	3.9 J			
Selenium	6010B	8	11 U			
Silver	6010B	1.4	1.9 U			
Mercury	7471	0.025	0.027 U			

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB15			
Sample Location:						
Sample Type:			SOIL/LOW			
Lab Sample Number:			9911025-01B			
Percent Solids:			89.8			
Dilution Factor:			1			
Dilution Factor:						
Date Sampled:			11/16/1999			
Notes:						
		Report				
Inorganic Analysis	Method	Limit*	mg/kg			
Antimony	6010B	4	20 J			
Arsenic	6010B	5	6.7 U			
Barium	6010B	20	13 J			
Cadmium	6010B	0.5	0.67 U			
Chromium	6010B	1	11 J			
Lead	6010B	5	3.9 J			
Selenium	6010B	8	11 U			
Silver	6010B	1.4	1.9 U			
Mercury	7471	0.025	0.027 U			

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 14, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/16/99
1 Soil sample
1 Aqueous trip blank
Lab Order: 9911018

Volatile Organics Analysis

Samples Collected:

BRSWSB15	Trip Blank (aq)		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results

* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. The COC and the sample receipt checklist do not indicate if custody seals were present and intact on the coolers.

No field rinsate blank sample was submitted with the 11/16/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

The laboratory requested that Stone & Webster resubmit the COCs. The original COCs did not specify the MS/MSD sample, the sample matrices were not specified, the EPH compound lists were not specified, and several sampling depths were different between the sample bottles and the COCs. Revised COCs were received at the laboratory on 11/18/99.

The trip blank submitted with soil samples collected on 11/16/99 is an aqueous trip blank. No aqueous samples were submitted. Stone & Webster was contacted to determine the matrix blank matrix.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 3° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that samples were properly preserved. However, the aqueous pH for the trip blank sample was not reported. The checklist does not indicate if cooler custody seals were or were not present.

Trip Blanks, Field Blanks, and Method Blanks

The aqueous method blank results were not submitted.

No target compounds were detected in the 8260B soil preparation blank.

Methylene chloride was detected in the aqueous trip blank sample (9911018-14A) at 0.9ug/L and the action level is 4.5ug/L. The quantiation limit is 5.0ug/L. Methylene chloride was not detected in soil sample BRSWSB15 and the aqueous trip blank result has no impact on the soil sample result.

No target compound analytes were detected in field rinsate blank sample BRSWRB01 and no validation actions were required.

Matrix Spike / Matrix Spike Duplicate Results

Sample 9911018-13C (BRSWSB15) was analyzed as the MS/MSD sample. The MS results were not reported due to poor internal standard recoveries. A list of MSD compounds not meeting the 70-130% acceptance criteria are summarized below.

Compound	% Recovery	Action
Dichlorodifluoromethane	57.9	Non-detects UJ; Detects J
2-Butanone	131	Non-detects U; Detects J
Cis-1,2-dichoroethene	62.8	Non-detects UJ; Detects J
Dibromochloromethane	68.8	Non-detects UJ; Detects J
Bromoform	63.8	Non-detects UJ; Detects J
4-Chlorotoluene	67.6	Non-detects UJ; Detects J
1.2-Dichlorobenzene	66.2	Non-detects UJ; Detects J
1,2-Dibromo-3-chloropropane	58.4	Non-detects UJ; Detects J
1,2,4-Trichlorobenzene	60	Non-detects UJ; Detects J
Naphthalene	64	Non-detects UJ; Detects J
1,2,3-Trichlorobenzene	58.1	Non-detects UJ; Detects J

All 8260 B sample BRSBSW15 results are reported as non-detected. The non-detected results for those compounds having low MSD recoveries are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negative results exists. The 2-butanone result is reported as non-detected (U). The high MSD recovery has no impact on the non-detected result.

No aqueous MS/MSD sample was submitted or analyzed with samples collected on 11/16/99.

Laboratory Control Sample

The laboratory soil LCS recovery acceptance criteria are 70-130%. A list of compounds not meeting this criterion is summarized below.

Compound	% Recovery	Action
Cis-1,2-Dichloroethene	62.6	Non-detects UJ; Detects J
Chloroethane	57.6	Non-detects UJ; Detects J
Bromomethane	53.6	Non-detects UJ; Detects J

Based upon the soil LCS recoveries the cis-1,2-dchloroethene, chloroethane, and bromomethane, results for soil sample BRSWSB15 are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists.

The laboratory submitted no aqueous LCS results.

Field Duplicate Results

No field duplicate samples were collected on 11/16/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 99110018.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

No field duplicate or laboratory duplicate results were submitted with laboratory order 9911018.

The laboratory did not submit aqueous method blank results or aqueous LCS results for the 9911018 8260B analyses. The only aqueous sample submitted was an aqueous trip blank. All trip blank results, except methylene chloride, were reported as non-detected. The surrogate recoveries for the aqueous trip blank met the acceptance criteria so the results were accepted without qualification. Methylene chloride is reported as estimated (J) at 0.90ug/L. The result is below the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Due to low internal standard recoveries MS results were not reported. Based upon the MSD and LCS recoveries chloroethane, bromomethane, cis-1,2-dichloroethene, dichlorodifluoromethane, dibromochloromethane, bromoform, 4-chlorotoluene, 1,2-dichlorobenzene, naphthalene, 1,2-dibromo-3-chloropropane, 1,2,4-trichlorobenzene and 1,2,3-trichlorobenzene results are reported as non-detected estimated (UJ). A low bias is indicated and the possibility of false negatives exists.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous 8260 VOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia 8260B soils
Table Ib 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB15	A, J^1

A Accept all data.

J^1 Due to low MSD and LCS recoveries the bromomethane, naphthalene, cis-1,2-dichloroethene, 1,2-dichlorobenzene, chloroethane, bromoform, dichlorodifluoromethane, dibromochloromethane, 1,2-dibromo-3-chloropropane, 4-chlorotoluene, 1,2,4-trichlorobenzene and 1,2,3-trichlorobenzene results are reported as non-detected estimated (UJ).

Table 1b- Volatiles-8260B Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
Trip Blank (aq)	A, J^l

A Accept all data.

J^l Methylene chloride is reported as estimated 0.9ug/L (J). The result is below the method quantitation level (5.0ug/L).

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB15				
S&W Sample (cont)						
Lab Sample Number:		9911018-13C				
Matrix/Analysis:		Soil/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/16/99				
Date Extracted:		11/18/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		10.2				
Target Compounds	Report Limit	ug/Kg				
Dichlorodifluoromethane	4	4.4 UJ				
Chloromethane	4	4.4 U				
Vinyl Chloride	4	4.4 U				
Chloroethane	4	4.4 UJ				
Bromomethane	4	4.4 UJ				
Trichlorofluoromethane	4	4.4 U				
Acetone	20	22 U				
1.1-Dichloroethene	4	4.4 U				
Carbon disulfide	4	4.4 U				
Methylene Chloride	20	22 U				
Methyl tert-butyl ether	4	4.4 U				
trans-1,2-Dichloroethene	4	4.4 U				
1,1-Dichloroethane	4	4.4 U				
2-Butanone	20	22 U				
2,2-Dichloropropane	4	4.4 U				
cis-1,2-Dichloroethene	4	4.4 UJ				
Chloroform	4	4.4 U				
Bromochloromethane	4	4.4 U				
1,1,1-Trichloroethane	4	4.4 U				
1,1-Dichloropropene	4	4.4 U				
Carbon tetrachloride	4	4.4 U				
1,2-Dichloroethane	4	4.4 U				
Benzene	4	4.4 U				
Trichloroethene	4	4.4 U				
1,2-Dichloropropane	4	4.4 U				
Bromodichloromethane	4	4.4 U				
Dibromomethane	4	4.4 U				
4-Methyl-2-pentanone	20	22 U				
cis-1,3-Dichloropropene	4	4.4 U				
Toluene	4	4.4 U				
trans-1,3-Dichloropropene	4	4.4 U				
1,1,2-Trichloroethane	4	4.4 U				
1,2-Dibromoethane	4	4.4 U				
2-Hexanone	20	22 U				
1,3-Dichloropropane	4	4.4 U				
Tetrachloroethene	4	4.4 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB15				
S&W Sample (cont)						
Lab Sample Number:		9911018-13C				
Matrix/Analysis:		Soil/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/16/99				
Date Extracted:		11/18/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		10.2				
Dibromochloromethane	4	4.4 UJ				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB15				
S&W Sample (cont)						
Lab Sample Number:		9911018-13C				
Matrix/Analysis:		Soil/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/16/99				
Date Extracted:		11/18/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		10.2				
Chlorobenzene	4	4.4 U				
1,1,1,2-Tetrachloroethane	4	4.4 U				
Ethylbenzene	4	4.4 U				
m,p-Xylene	4	4.4 U				
o-Xylene	4	4.4 U				
Styrene	4	4.4 U				
Bromoform	4	4.4 UJ				
Isopropylbenzene	4	4.4 U				
1,1,2,2-Tetrachloroethane	4	4.4 U				
1,2,3-Trichloropropane	4	4.4 U				
Bromobenzene	4	4.4 U				
n-Propylbenzene	4	4.4 U				
2-Chlorotoluene	4	4.4 U				
4-Chlorotoluene	4	4.4 UJ				
1,3,5-Trimethylbenzene	4	4.4 U				
tert-Butylbenzene	4	4.4 U				
1,2,4,-Trimethylbenzene	4	4.4 U				
sec-Butylbenzene	4	4.4 U				
4-isopropyltoluene	4	4.4 U				
1,3-dichlorobenzene	4	4.4 U				
1,4-dichlorobenzene	4	4.4 U				
n-Butylbenzene	4	4.4 U				
1,2-Dichlorobenzene	4	4.4 UJ				
1,2-Dibromo-3-chloropropane	4	4.4 UJ				
1,2,4-Trichlorobenzene	4	4.4 UJ				
Hexachlorobutadiene	4	4.4 U				
Naphthalene	4	4.4 UJ				
1,2,3-Trichlorobenzene	4	4.4 UJ				

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Soil unitsug/Kg based upon 100% total solids

TABLE 1

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSS09(0-3)	BRSWSB09(6-8)	BRSWSB07(0-3)	BRSWSB07D(0-3)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			9911018-01B	9911018-02B	9911018-03B	9911018-04B
Percent Moisture:			12.2	11.3	9.1	6.4
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/16/1999	11/16/1999	11/16/1999	11/16/1999
Date Extracted			11/19/1999	11/19/1999	11/19/1999	11/19/1999
Date Analyzed Aliphatics:			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Analyzed PNA			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Notes:					Field Dup	Field Dup
		Report				
EPH ANALYTES	Method	Limit*				
C9-C18 Aliphatic (1)	8270C	49	57 U	55 U	55 U	52 U
C19-C36 Aliphatic (1)	8270C	49	58 EB	55 U	87 EB	52 U
C11-C22 Aromatics(1,2)	8270C	49	57 U	55 U	65	52 U
Targeted PAH Analytes						
Naphthalene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
2-Methylnaphthalene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Acenaphthylene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Acenaphthene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Fluorene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Phenanthrene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Anthracene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Fluoranthene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Pyrene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(a)anthracene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Chrysene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(b)fluoranthene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(k)fluoranthene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(a)pyrene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Indeno(1,2,3-cd)pyrene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Dibenzo(a,h)anthracene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(g,h,i)perylene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
* Based upon 100% total solids
(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank				
S&W Sample (cont)						
Lab Sample Number:		9911018-14A				
Matrix/Analysis:		Aq/Low				
Sample Type:						
Dilution Factor:						
Date Sampled:		11/16/1999				
Date Extracted:		11/29/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		NA				
Dibromochloromethane	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank				
S&W Sample (cont)						
Lab Sample Number:		9911018-14A				
Matrix/Analysis:		Aq/Low				
Sample Type:						
Dilution Factor:						
Date Sampled:		11/16/1999				
Date Extracted:		11/29/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		NA				
Chlorobenzene	2	2.0 U				
1,1,1,2-Tetrachloroethane	2	2.0 U				
Ethylbenzene	2	2.0 U				
m,p-Xylene	2	2.0 U				
o-Xylene	2	2.0 U				
Styrene	2	2.0 U				
Bromoform	2	2.0 U				
Isopropylbenzene	2	2.0 U				
1,1,2,2-Tetrachloroethane	2	2.0 U				
1,2,3-Trichloropropane	2	2.0 U				
Bromobenzene	2	2.0 U				
n-Propylbenzene	2	2.0 U				
2-Chlorotoluene	2	2.0 U				
4-Chlorotoluene	2	2.0 U				
1,3,5-Trimethylbenzene	2	2.0 U				
tert-Butylbenzene	2	2.0 U				
1,2,4,-Trimethylbenzene	2	2.0 U				
sec-Butylbenzene	2	2.0 U				
4-isopropyltoluene	2	2.0 U				
1,3-dichlorobenzene	2	2.0 U				
1,4-dichlorobenzene	2	2.0 U				
n-Butylbenzene	2	2.0 U				
1,2-Dichlorobenzene	2	2.0 U				
1,2-Dibromo-3-chloropropane	5	5.0 U				
1,2,4-Trichlorobenzene	2	2.0 U				
Hexachlorobutadiene	2	2.0 U				
Naphthalene	2	2.0 U				
1,2,3-Trichlorobenzene	2	2.0 U				

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Jan. 16, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/16/99
13 Soil samples
Lab Order: 9911018

Extractable Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSS09(0-3)	BRSWSB09(6-8)	BRSWSB07(0-3)	BRSWSB07D(0-3)
BRSWSB08(0-3)	BRSWSS10(0-3)	BRSWSB10(3-5)	BRSWSS11(0-3)
BRSWSB11(3-6)	BRSWSS12(0-3)	BRSWSB12(3-6)	BRSWSB13(0-3)
BRSWSB15			

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

- chain of custody documents
- sample log-in documents
- rinsate blanks, and method blanks

* - MS/MSD results
* - LCS results
*- field duplicate results
* - laboratory duplicate results
* - surrogate recoveries

* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. The COC and the sample receipt checklist do not indicate if custody seals were present and intact on the coolers.

No field rinsate blank sample was submitted with the 11/16/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

The laboratory requested that Stone & Webster resubmit the COCs. The original COCs did not specify the MS/MSD sample, the sample matrices were not specified, the EPH compound lists were not specified, and several sampling depths were different between the sample bottles and the COCs. Revised COCs were received at the laboratory on 11/18/99. The full EPH analyte list was requested, and this information was provided by the laboratory.

Sample BRSWSB15 was specified as the MS/MSD sample.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 3° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that samples were properly preserved.

Field Blanks, and Method Blanks

The aqueous EPH rinsate blank BRSWRB01 had a positive result for the C19-C36 aliphatic range compounds, 140ug/L. This C19-C36 aliphatic range result was non-detected in the laboratory extraction blank. The rinsate blank result is possibly a field sampling artifact. Positive C19-C36 results were reported for samples BRSWSS09(0-3), BRSWSB15, and BRSWSB07(0-3). The laboratory noted that the reported C19-C36 aliphatic result for sample BRSWSB07(0-3) was due to phthalate contamination. Based upon the rinsate blank results the C19-C36 aliphatic results for samples BRSWSS09(0-3), BRSWSB15, and BRSWSB07(0-3) are

reported with the EB notation to indicate possible contamination from the field sampling procedures.

The laboratory noted that the reported C11-C22 aromatic result for sample BRSWSB07(0-3) was also due to phthalate contamination.

Matrix Spike / Matrix Spike Duplicate Results

All MS/MSD spike recovery and precision acceptance criteria were met.

Laboratory Control Samples

All soil EPH LCS recoveries met the method acceptance criteria.

Field Duplicate Results

Samples BRSWSB07(0-3) and BRSWSB07D(0-3) were field duplicate samples. Positive results were reported for C19-C16 aliphatics and C11-C22 aromatics in sample BRSWSB07(0-3). These results are reported as non-detected in sample BRSWSB07D(0-3). The laboratory noted that the C19-C16 aliphatics and C11-C22 aromatic results were due to phthalate contamination. No validation actions were taken based upon the field duplicate results.

Laboratory Duplicate Results

The EPH soil duplicate sample was not part of this laboratory order. No validation actions were taken based upon the soil laboratory duplicate results.

Surrogate Results

All soil sample surrogate recoveries met the method specified acceptance criteria. Specified 8270C method surrogates were reported along with specified EPH surrogates.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The fluoranthene and pyrene results for sample BRSWSS12(0-3) were reported as estimated (J) at 0.16mg/Kg and 0.14mg/Kg respectively. These results are below the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

The C19-C36 results for samples BRSWSS09(0-3), BRSWSB07(0-3), and BRSWSB15 are reported with the EB notation to indicate the presence of this analyte in the equipment rinsate blank sample. The laboratory noted in the narrative that n-octacosane (C28 aliphatic) was detected in the 11/19/99 method extraction blank at a concentration below the method quantitation limit. This compound would show up in the C19-C36 fraction. The laboratory also noted that the C19-C16 aliphatic result and the C11-C22 aromatic result for sample BRSWSB07(0-3) are due to phthalate ester contamination. It is possiblle that these positive results are due to field sampling procedures and laboratory contamination.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil EPH results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table Ia EPH soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Extractable Petroleum Hydrocarbon Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSS09(0-3)	A
BRSWSB09(6-8)	A
BRSWSB07(0-3)	A
BRSWSB07D(0-3)	A
BRSWSB08(0-3)	A
BRSWSS10(0-3)	A
BRSWSB10(3-5)	A
BRSWSS11(0-3)	A
BRSWSB11(3-6)	A
BRSWSS12(0-3)	A, J^1
BRSWSB12(3-6)	A
BRSWSB13(0-3)	A
BRSWSB15	A

A Accept all data.

J^1 Report fluoranthene and pyrene as estimated (J). These results are below the method quantitation limit

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE 1

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSS09(0-3)	BRSWSB09(6-8)	BRSWSB07(0-3)	BRSWSB07D(0-3)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			9911018-01B	9911018-02B	9911018-03B	9911018-04B
Percent Moisture:			12.2	11.3	9.1	6.4
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/16/1999	11/16/1999	11/16/1999	11/16/1999
Date Extracted			11/19/1999	11/19/1999	11/19/1999	11/19/1999
Date Analyzed Aliphatics:			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Analyzed PNA			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Notes:					Field Dup	Field Dup
		Report				
EPH ANALYTES	Method	Limit*				
C9-C18 Aliphatic (1)	8270C	49	57 U	55 U	55 U	52 U
C19-C36 Aliphatic (1)	8270C	49	58 EB	55 U	87 EB	52 U
C11-C22 Aromatics(1,2)	8270C	49	57 U	55 U	65	52 U
Targeted PAH Analytes						
Naphthalene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
2-Methylnaphthalene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Acenaphthylene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Acenaphthene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Fluorene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Phenanthrene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Anthracene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Fluoranthene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Pyrene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(a)anthracene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Chrysene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(b)fluoranthene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(k)fluoranthene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(a)pyrene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Indeno(1,2,3-cd)pyrene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Dibenzo(a,h)anthracene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U
Benzo(g,h,i)perylene	8270C	0.24	0.28 U	0.27 U	0.27 U	0.26 U

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.
* Based upon 100% total solids
(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB08(0-3)	BRSWSS10(0-3)	BRSWSB10(3-5)	BRSWSS11(0-3)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			9911018-05B	9911018-06B	9911018-07B	9911018-08B
Percent Moisture:			8.8	7.8	10.3	9.1
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/16/1999	11/16/1999	11/16/1999	11/16/1999
Date Extracted			11/19/1999	11/19/1999	11/19/1999	11/19/1999
Date Analyzed Aliphatics:			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Analyzed PNA			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Notes:						
		Report				
EPH ANALYTES	Method	Limit*				
C9-C18 Aliphatic (1)	8270C	49	55 U	53 U	55 U	54 U
C19-C36 Aliphatic (1)	8270C	49	55 U	53 U	55 U	54 U
C11-C22 Aromatics(1,2)	8270C	49	55 U	53 U	55 U	54 U
Targeted PAH Analytes						
Naphthalene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
2-Methylnaphthalene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Acenaphthylene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Acenaphthene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Fluorene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Phenanthrene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Anthracene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Fluoranthene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Pyrene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Benzo(a)anthracene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Chrysene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Benzo(b)fluoranthene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Benzo(k)fluoranthene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Benzo(a)pyrene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Indeno(1,2,3-cd)pyrene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Dibenzo(a,h)anthracene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U
Benzo(g,h,i)perylene	8270C	0.24	0.27 U	0.27 U	0.28 U	0.27 U

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

U - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB11(3-6)	BRSWSS12(0-3)	BRSWSB12(3-6)	BRSWSB13(0-3)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			9911018-09B	9911018-10B	9911018-11B	9911018-12B
Percent Moisture:			8.3	8.9	8.3	8.5
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/16/1999	11/16/1999	11/16/1999	11/16/1999
Date Extracted			11/19/1999	11/19/1999	11/19/1999	11/19/1999
Date Analyzed Aliphatics:			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Analyzed PNA			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Notes:						
		Report				
EPH ANALYTES	Method	Limit*				
C9-C18 Aliphatic (1)	8270C	49	53 U	55 U	53 U	53 U
C19-C36 Aliphatic (1)	8270C	49	53 U	55 U	53 U	53 U
C11-C22 Aromatics(1,2)	8270C	49	53 U	55 U	53 U	53 U
Targeted PAH Analytes						
Naphthalene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
2-Methylnaphthalene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Acenaphthylene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Acenaphthene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Fluorene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Phenanthrene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Anthracene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Fluoranthene	8270C	0.24	0.27 U	0.16 J	0.27 U	0.27 U
Pyrene	8270C	0.24	0.27 U	0.14 J	0.27 U	0.27 U
Benzo(a)anthracene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Chrysene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Benzo(b)fluoranthene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Benzo(k)fluoranthene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Benzo(a)pyrene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Indeno(1,2,3-cd)pyrene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Dibenzo(a,h)anthracene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U
Benzo(g,h,i)perylene	8270C	0.24	0.27 U	0.27 U	0.27 U	0.27 U

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I **MA DEP EPH Method 98-1 Validated Results**

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB15			
Sample Location:						
Sample Type:			SOIL			
Lab Sample Number:			9911018-13B			
Percent Moisture:			10.2			
Dilution Factor:			1			
Dilution Factor:						
Date Sampled:			11/16/1999			
Date Extracted			11/19/1999			
Date Analyzed Aliphatics:			11/23/1999			
Date Analyzed PNA			11/23/1999			
Notes:						
		Report				
EPH ANALYTES	Method	Limit*				
C9-C18 Aliphatic (1)	8270C	49	54 U			
C19-C36 Aliphatic (1)	8270C	49	71 EB			
C11-C22 Aromatics(1,2)	8270C	49	54 U			
Targeted PAH Analytes						
Naphthalene	8270C	0.24	0.27 U			
2-Methylnaphthalene	8270C	0.24	0.27 U			
Acenaphthylene	8270C	0.24	0.27 U			
Acenaphthene	8270C	0.24	0.27 U			
Fluorene	8270C	0.24	0.27 U			
Phenanthrene	8270C	0.24	0.27 U			
Anthracene	8270C	0.24	0.27 U			
Fluoranthene	8270C	0.24	0.27 U			
Pyrene	8270C	0.24	0.27 U			
Benzo(a)anthracene	8270C	0.24	0.27 U			
Chrysene	8270C	0.24	0.27 U			
Benzo(b)fluoranthene	8270C	0.24	0.27 U			
Benzo(k)fluoranthene	8270C	0.24	0.27 U			
Benzo(a)pyrene	8270C	0.24	0.27 U			
Indeno(1,2,3-cd)pyrene	8270C	0.24	0.27 U			
Dibenzo(a,h)anthracene	8270C	0.24	0.27 U			
Benzo(g,h,i)perylene	8270C	0.24	0.27 U			

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 15, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/16/99
14 Soil samples including the trip blank
Lab Order: 9911018

Volatile Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSS09(0-3)	BRSWSB09(6-8)	BRSWSB07(0-3)	BRSWSB07D(0-3)
BRSWSB08(0-3)	BRSWSS10(0-3)	BRSWSB10(3-5)	BRSWSS11(0-3)
BRSWSB11(3-6)	BRSWSS12(0-3)	BRSWSB12(3-6)	BRSWSB13(0-3)
BRSWSB15	Trip Blank (soil)		

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

- chain of custody documents
- sample log-in documents
* - trip blanks, rinsate blanks, and method blanks
- MS/MSD results
* - LCS results

* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. The COC and the sample receipt checklist do not indicate if custody seals were present and intact on the coolers.

No field rinsate blank sample was submitted with the 11/16/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

The laboratory requested that Stone & Webster resubmit the COCs. The original COCs did not specify the MS/MSD sample, the sample matrices were not specified, the EPH compound lists were not specified, and several sampling depths were different between the sample bottles and the COCs. Revised COCs were received at the laboratory on 11/18/99.

Sample BRSWSB15 was specified as the MS/MSD sample.

The VPH trip blank submitted with soil samples collected on 11/16/99 is methanol.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 3° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that samples were properly preserved. All VPH samples were methanol preserved. The sample receipt checklist does not indicate if custody seals were or were not present.

The jar weight for sample BRSWSB13(0-3) could not be determined from the label. After analysis, the dry weight was determined by drying and weighing the sample in the vial. This method deviation should have no impact upon the data quality.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the VPH soil preparation blank, rinaste blank BRSWRB01 (11/19/99) and the soil trip blank.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWSB15 was analyzed as the specified MS/MSD sample. The naphthalene MS recovery was 63.7%; below the method specified 70-130% recovery. The MSD recovery was 95.4% and the naphthalene MS/MSD % RPD was 38.4%. The naphthalene result for sample BRSWSB15 is reported as non-detected estimated (UJ). The MS result indicates a potential low bias and the %RPD indicates possible laboratory or sample matrix problems. The naphthalene recovery met the method acceptance criteria. The naphthalene LCS recovery was 95%.

Laboratory Control Samples

All soil laboratory control sample recoveries met the method specified recovery criteria.

Field Duplicate Results

Samples BRSWSB07(0-3) and BRSWSB07D(0-3) were collected as field duplicate samples. All results are non-detected and no validation actions are recommended.

Laboratory Duplicates

Sample BRSWSB12(3-6) was analyzed as the laboratory duplicate sample. All results were reported as non-detected. No validation actions are recommended.

Surrogate Results

The surrogate recoveries for sample BRSWSS10(0-3) were below the 70-130% method acceptance criteria. The sample was reanalyzed and these surrogate recoveries met the acceptance criteria. The results from the reanalysis were reported.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The naphthalene result for sample BRSWSB15 is reported as non-detected estimated (UJ) due to the low naphthalene MS recovery.

The toluene result for sample BRSWSB07(0-3) is reported as estimated (J). The result is below the method quantitation level.

All remaining VPH results are accepted without qualification.

Tables 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous VPH results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table Ia VPH soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table 1a- Volatile Petroleum Hydrocarbon Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSS09(0-3)	A
BRSWSB09(6-8)	A
BRSWSB07(0-3)	A, J[2]
BRSWSB07D(0-3)	A
BRSWSB08(0-3)	A
BRSWSS10(0-3)	A
BRSWSB10(3-5)	A
BRSWSS11(0-3)	A
BRSWSB11(3-6)	A
BRSWSS12(0-3)	A
BRSWSB12(3-6)	A
BRSWSB13(0-3)	A
BRSWSB15	A, J[1]
Trip Blank (soil)	A

A Accept all data.

J[1] Report the naphthalene results as non-detected estimated (UJ). The MS recovery was low (63.7%) and the %RPD for the MS/MSD result was 38.4%.

J[2] Toluene is reported as estimated. The result is below the method quantitation level.

TABLE I **MA DEP VPH Method 98-1 Validated Results**

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSS09(0-3)	BRSWSB09(6-8)	BRSWSB07(0-3)	BRSWSB07D(0-3)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			9911018-01A	9911018-02A	9911018-03A	9911018-04A
Percent moisture:			12.2	11.3	9.1	6.4
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/16/1999	11/16/1999	11/16/1999	11/16/1999
Date Analyzed:			12/03/1999	12/03/1999	12/03/1999	12/03/1999
Notes:					Field Dup	Field Dup
		Report				
VPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	mg/Kg
C5-C8 Aliphatic (1,2)	8260	2.5	1.3 U	2.0 U	2.2 U	1.9 U
C9-C12 Aliphatic(1,3)	8260	0.62	0.32U	0.50 U	0.56 U	0.48 U
C9-C10 Aromatics(1)	8260	0.62	0.32 U	0.50 U	0.56 U	0.48 U
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	0.050	0.025 U	0.040U	0.045 U	0.038 U
Benzene	8260	0.050	0.025 U	0.040U	0.045 U	0.038 U
Toluene	8260	0.050	0.025 U	0.040U	0.023 J	0.038 U
Ethylbenzene	8260	0.050	0.025 U	0.040U	0.045 U	0.038 U
m,p-Xylene	8260	0.050	0.025 U	0.040U	0.045 U	0.038 U
o-Xylene	8260	0.050	0.025 U	0.040U	0.045 U	0.038 U
Napthalene	8260	0.050	0.025 U	0.040U	0.045 U	0.038 U

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution
* Reporting limit is based upon 100% total solids and a 1:1 methanol to soil ratio.

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB08(0-3)	BRSWSS10(0-3)	BRSWSB10(3-5)	BRSWSS11(0-3)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			9911018-05A	9911018-06Arr	9911018-07A	9911018-08A
Percent moisture:			8.8	7.8	10.3	9.1
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/16/1999	11/16/1999	11/16/1999	11/16/1999
Date Analyzed:			12/03/1999	12/03/1999	12/03/1999	12/03/1999
Notes:						
		Report				
VPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	mg/Kg
C5-C8 Aliphatic (1,2)	8260	2.5	1.9 U	1.6 U	2.3 U	2.1 U
C9-C12 Aliphatic(1,3)	8260	0.62	0.47 U	0.39 U	0.58 U	0.52 U
C9-C10 Aromatics(1)	8260	0.62	0.47 U	0.39 U	0.58 U	0.52 U
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	0.050	0.038U	0.032 U	0.047 U	0.041 U
Benzene	8260	0.050	0.038U	0.032 U	0.047 U	0.041 U
Toluene	8260	0.050	0.038U	0.032 U	0.047 U	0.041 U
Ethylbenzene	8260	0.050	0.038U	0.032 U	0.047 U	0.041 U
m,p-Xylene	8260	0.050	0.038U	0.032 U	0.047 U	0.041 U
o-Xylene	8260	0.050	0.038U	0.032 U	0.047 U	0.041 U
Napthalene	8260	0.050	0.038U	0.032 U	0.047 U	0.041 U

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution
* Reporting limit is based upon 100% total solids and a 1:1 methanol to soil ratio.

TABLE 1

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB11(3-6)	BRSWSS12(0-3)	BRSWSB12(3-6)	BRSWSB13(0-3)
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	SOIL
Lab Sample Number:			9911018-09A	9911018-10A	9911018-11A	9911018-12A
Percent moisture:			8.3	8.9	8.3	8.5
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/16/1999	11/16/1999	11/16/1999	11/16/1999
Date Analyzed:			12/03/1999	12/03/1999	12/03/1999	12/03/1999
Notes:						
		Report				
VPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	mg/Kg
C5-C8 Aliphatic (1,2)	8260	2.5	2.4 U	1.7 U	2.0 U	1.9 U
C9-C12 Aliphatic(1,3)	8260	0.62	0.60 U	0.42 U	0.50 U	0.47 U
C9-C10 Aromatics(1)	8260	0.62	0.60 U	0.42 U	0.50 U	0.47 U
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	0.050	0.048 U	0.034 U	0.040 U	0.037 U
Benzene	8260	0.050	0.048 U	0.034 U	0.040 U	0.037 U
Toluene	8260	0.050	0.048 U	0.034 U	0.040 U	0.037 U
Ethylbenzene	8260	0.050	0.048 U	0.034 U	0.040 U	0.037 U
m,p-Xylene	8260	0.050	0.048 U	0.034 U	0.040 U	0.037 U
o-Xylene	8260	0.050	0.048 U	0.034 U	0.040 U	0.037 U
Napthalene	8260	0.050	0.048 U	0.034 U	0.040 U	0.037 U

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution
* Reporting limit is based upon 100% total solids and a 1:1 methanol to soil ratio.

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB15	Trip Blank		
Sample Location:						
Sample Type:			SOIL	SOIL		
Lab Sample Number:			9911018-13A	9911018-14B		
Percent moisture:			10.2	NA		
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/16/1999	11/16/1999		
Date Analyzed:			12/03/1999	11/29/1999		
Notes:				Trip Blank		
		Report				
VPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg		
C5-C8 Aliphatic (1,2)	8260	2.5	2.2 U	2.5 U		
C9-C12 Aliphatic(1,3)	8260	0.62	0.56 U	0.62 U		
C9-C10 Aromatics(1)	8260	0.62	0.56 U	0.62 U		
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	0.050	0.045 U	0.050 U		
Benzene	8260	0.050	0.045 U	0.050 U		
Toluene	8260	0.050	0.045 U	0.050 U		
Ethylbenzene	8260	0.050	0.045 U	0.050 U		
m,p-Xylene	8260	0.050	0.045 U	0.050 U		
o-Xylene	8260	0.050	0.045 U	0.050 U		
Napthalene	8260	0.050	0.045 UJ	0.050 U		

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution
* Reporting limit is based upon 100% total solids and a 1:1 methanol to soil ratio.

Jan. 13, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/16/99
1 Soil sample
Lab Order: 9911018

Inorganic Analysis

BRSWSB15		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Soil samples were analyzed according to SW-846 EPA Method 6010B and mercury was analyzed by SW-846 Method 7421. Arsenic, barium, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B and silver, cadmium, lead, and antimony were analyzed in the aqueous samples according to SW-846 EPA Methods 7761, 7131, 7421, and 7041 respectively. Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
MS /MSD results
* LCS results
* Field duplicate results

Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. The COC and the sample receipt checklist do not indicate if custody seals were present and intact on the coolers.

No field rinsate blank sample was submitted with the 11/16/99 batch of samples. Rinsate blank sample BRSWRB01 results, collected 11/19/99 (9911025-02), were used to evaluate possible field sampling contamination.

The laboratory requested that Stone & Webster resubmit the COCs. The original COCs did not specify the MS/MSD sample, the sample matrices were not specified, the EPH compound lists were not specified, and several sampling depths were different between the sample bottles and the COCs. Revised COCs were received at the laboratory on 11/18/99.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 3° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that samples were properly preserved. The checklist does not indicate if cooler custody seals were or were not present.

Field Blanks and Method Blanks

Antimony, arsenic, chromium, and selenium were detected in the soil method preparation blank MB-230. The results and action levels are summarized below.

Element	Result mg/Kg	Action Level mg/Kg
Antimony	0.80	4.00
Arsenic	0.81	4.04
Chromium	0.78	3.90
Selenium	0.82	4.10

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Antimony and chromium results, for sample BRSWSB15, exceed the action levels.

Reported selenium and arsenic results are reported as estimated (J). These results are below the method quantitation limit and below the blank action levels. Based upon the preparation blank results the arsenic and selenium results are reported as non-detected at 6.7mg/Kg (U) and 111mg/Kg (U) respectively. The results are reported as non-detected at the quantitation limit for these elements in this sample.

All rinsate blank results, for BRSWRB01, were reported as non-detected for these elements.

MS/MSD Results

Sample BRSWSB15 was analyzed as the MS/MSD sample. The recovery acceptance criterion was 75-125%. The antimony MS/MSD recoveries were 63.4% and 63.2% respectively. Antimony is reported as estimated (J). The result may be biased low.

LCS Results

Soil LCS recoveries met the specified acceptance criteria. No results are qualified based upon the LCS results.

Field Duplicates

No field duplicate samples were collected on 11/16/99.

Laboratory Duplicates

Sample BRSWSB15 was analyzed as the laboratory duplicate sample. The antimony and chromium laboratory duplicate % RPD did not meet the laboratory method acceptance criteria, $\leq$20%. The chromium %RPD was 20.1%. The chromium results were 10.7mg/kg and 8.7mg/Kg respectively. Army Corp laboratory duplicate acceptance criteria for ICP analyzed elements is $\leq$ 20% for sample results exceeding 5X the reporting limit.

The antimony sample result was 20mg/Kg and the duplicate sample result was 3.0mg/Kg. The duplicate antimony result was reported as detected below the method quantitation level.

Antimony and chromium results, for sample BRSWSB15, were reported as estimated (J).

Holding Times

All sample analyses holding time requirements were met.

Summary

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

The chromium and antimony results are reported as estimated (J), due to laboratory duplicate %RPD results. The antimony result was also estimated (J) because the MS/MSD spike recoveries were below the 75-125% acceptance range. The antimony result may be biased low.

Barium and lead results are reported as estimated (J) at concentrations below the quantitation limits.

Antimony, arsenic, chromium, and selenium were detected in the soil method preparation blank MB-230. The chromium and antimony sample results are above the method blank action levels. Arsenic and selenium results are below the method blank action levels. Arsenic and selenium are reported as non-detected (U) at the quantitation limits.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Soil Recommendation Summary

Antimony	J^1
Arsenic	A
Barium	J^2
Cadmium	A
Chromium	J^1
Lead	J^2
Mercury	A
Selenium	A
Silver	A

A- Accept all data

J^1- Antimony and chromium results are reported as estimated (J) for sample BRSWSB15. The % RPDs for the laboratory duplicate results were greater than 20%.

J^2- Barium and lead results are reported as estimated (J) for sample BRSWSB15. These results are between the method detection limit and the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB15				
S&W Sample (cont)						
Lab Sample Number:		9911018-13C				
Matrix/Analysis:		Soil/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/16/99				
Date Extracted:		11/18/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		10.2				
Target Compounds	Report Limit	mg/Kg				
Dichlorodifluoromethane	4	4.4 UJ				
Chloromethane	4	4.4 U				
Vinyl Chloride	4	4.4 U				
Chloroethane	4	4.4 UJ				
Bromomethane	4	4.4 UJ				
Trichlorofluoromethane	4	4.4 U				
Acetone	20	22 U				
1.1-Dichloroethene	4	4.4 U				
Carbon disulfide	4	4.4 U				
Methylene Chloride	20	22 U				
Methyl tert-butyl ether	4	4.4 U				
trans-1,2-Dichloroethene	4	4.4 U				
1,1-Dichloroethane	4	4.4 U				
2-Butanone	20	22 U				
2,2-Dichloropropane	4	4.4 U				
cis-1,2-Dichloroethene	4	4.4 UJ				
Chloroform	4	4.4 U				
Bromochloromethane	4	4.4 U				
1,1,1-Trichloroethane	4	4.4 U				
1,1-Dichloropropene	4	4.4 U				
Carbon tetrachloride	4	4.4 U				
1,2-Dichloroethane	4	4.4 U				
Benzene	4	4.4 U				
Trichloroethene	4	4.4 U				
1,2-Dichloropropane	4	4.4 U				
Bromodichloromethane	4	4.4 U				
Dibromomethane	4	4.4 U				
4-Methyl-2-pentanone	20	22 U				
cis-1,3-Dichloropropene	4	4.4 U				
Toluene	4	4.4 U				
trans-1,3-Dichloropropene	4	4.4 U				
1,1,2-Trichloroethane	4	4.4 U				
1,2-Dibromoethane	4	4.4 U				
2-Hexanone	20	22 U				
1,3-Dichloropropane	4	4.4 U				
Tetrachloroethene	4	4.4 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB15				
S&W Sample (cont)						
Lab Sample Number:		9911018-13C				
Matrix/Analysis:		Soil/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/16/99				
Date Extracted:		11/18/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		10.2				
Dibromochloromethane	4	4.4 UJ				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB15				
S&W Sample (cont)						
Lab Sample Number:		9911018-13C				
Matrix/Analysis:		Soil/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/16/99				
Date Extracted:		11/18/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		10.2				
Chlorobenzene	4	4.4 U				
1,1,1,2-Tetrachloroethane	4	4.4 U				
Ethylbenzene	4	4.4 U				
m,p-Xylene	4	4.4 U				
o-Xylene	4	4.4 U				
Styrene	4	4.4 U				
Bromoform	4	4.4 UJ				
Isopropylbenzene	4	4.4 U				
1,1,2,2-Tetrachloroethane	4	4.4 U				
1,2,3-Trichloropropane	4	4.4 U				
Bromobenzene	4	4.4 U				
n-Propylbenzene	4	4.4 U				
2-Chlorotoluene	4	4.4 U				
4-Chlorotoluene	4	4.4 UJ				
1,3,5-Trimethylbenzene	4	4.4 U				
tert-Butylbenzene	4	4.4 U				
1,2,4,-Trimethylbenzene	4	4.4 U				
sec-Butylbenzene	4	4.4 U				
4-isopropyltoluene	4	4.4 U				
1,3-dichlorobenzene	4	4.4 U				
1,4-dichlorobenzene	4	4.4 U				
n-Butylbenzene	4	4.4 U				
1,2-Dichlorobenzene	4	4.4 UJ				
1,2-Dibromo-3-chloropropane	4	4.4 UJ				
1,2,4-Trichlorobenzene	4	4.4 UJ				
Hexachlorobutadiene	4	4.4 U				
Naphthalene	4	4.4 UJ				
1,2,3-Trichlorobenzene	4	4.4 UJ				

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Soil units mg/Kg based upon 100% total solids

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank				
S&W Sample (cont)						
Lab Sample Number:		9911018-14A				
Matrix/Analysis:		Aq/Low				
Sample Type:						
Dilution Factor:						
Date Sampled:		11/16/1999				
Date Extracted:		11/29/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		NA				
Target Compounds	Report Limit	ug/L				
Dichlorodifluoromethane	5	5.0 U				
Chloromethane	5	5.0 U				
Vinyl Chloride	2	2.0 U				
Chloroethane	5	5.0 U				
Bromomethane	5	5.0 U				
Trichlorofluoromethane	2	2.0 U				
Acetone	10	10.0 U				
1.1-Dichloroethene	1	1.0 U				
Carbon disulfide	2	2.0 U				
Methylene Chloride	5	0.90 J				
Methyl tert-butyl ether	2	2.0 U				
trans-1,2-Dichloroethene	2	2.0 U				
1,1-Dichloroethane	2	2.0 U				
2-Butanone	10	10.0 U				
2,2-Dichloropropane	2	2.0 U				
cis-1,2-Dichloroethene	2	2.0 U				
Chloroform	2	2.0 U				
Bromochloromethane	2	2.0 U				
1,1,1-Trichloroethane	2	2.0 U				
1,1-Dichloropropene	2	2.0 U				
Carbon tetrachloride	2	2.0 U				
1,2-Dichloroethane	2	2.0 U				
Benzene	2	2.0 U				
Trichloroethene	2	2.0 U				
1,2-Dichloropropane	2	2.0 U				
Bromodichloromethane	2	2.0 U				
Dibromomethane	2	2.0 U				
4-Methyl-2-pentanone	10	10.0 U				
cis-1,3-Dichloropropene	1	1.0 U				
Toluene	2	2.0 U				
trans-1,3-Dichloropropene	1	1.0 U				
1,1,2-Trichloroethane	2	2.0 U				
1,2-Dibromoethane	2	2.0 U				
2-Hexanone	10	10.0 U				
1,3-Dichloropropane	2	2.0 U				
Tetrachloroethene	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank				
S&W Sample (cont)						
Lab Sample Number:		9911018-14A				
Matrix/Analysis:		Aq/Low				
Sample Type:						
Dilution Factor:						
Date Sampled:		11/16/1999				
Date Extracted:		11/29/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		NA				
Dibromochloromethane	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911018
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank				
S&W Sample (cont)						
Lab Sample Number:		9911018-14A				
Matrix/Analysis:		Aq/Low				
Sample Type:						
Dilution Factor:						
Date Sampled:		11/16/1999				
Date Extracted:		11/29/1999				
Date Analyzed:		11/29/1999				
Percent Moisture:		NA				
Chlorobenzene	2	2.0 U				
1,1,1,2-Tetrachloroethane	2	2.0 U				
Ethylbenzene	2	2.0 U				
m,p-Xylene	2	2.0 U				
o-Xylene	2	2.0 U				
Styrene	2	2.0 U				
Bromoform	2	2.0 U				
Isopropylbenzene	2	2.0 U				
1,1,2,2-Tetrachloroethane	2	2.0 U				
1,2,3-Trichloropropane	2	2.0 U				
Bromobenzene	2	2.0 U				
n-Propylbenzene	2	2.0 U				
2-Chlorotoluene	2	2.0 U				
4-Chlorotoluene	2	2.0 U				
1,3,5-Trimethylbenzene	2	2.0 U				
tert-Butylbenzene	2	2.0 U				
1,2,4,-Trimethylbenzene	2	2.0 U				
sec-Butylbenzene	2	2.0 U				
4-isopropyltoluene	2	2.0 U				
1,3-dichlorobenzene	2	2.0 U				
1,4-dichlorobenzene	2	2.0 U				
n-Butylbenzene	2	2.0 U				
1,2-Dichlorobenzene	2	2.0 U				
1,2-Dibromo-3-chloropropane	5	5.0 U				
1,2,4-Trichlorobenzene	2	2.0 U				
Hexachlorobutadiene	2	2.0 U				
Naphthalene	2	2.0 U				
1,2,3-Trichlorobenzene	2	2.0 U				

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Jan. 11, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/19/99
2 Soil samples
1 Rinsate blank
Lab Order: 9911025

Semivolatile Organics Analysis

Samples Collected:

BRSWSB17	BRSWBS19	BRSWRB01 (rinsate)

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

* - chain of custody documents
* - sample log-in documents
  - rinsate blanks, and method blanks
* - MS/MSD results
  - LCS results
* - field duplicate results
* - laboratory duplicate results
  - surrogate recoveries

- holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 1° C. The cooler temperature range is 2-6° C. The data quality is not impacted by this deviation.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA samples. The only aqueous SVOA sample was the *rinsate blank sample* BRSWRB01.

Field Blanks and Method Blanks

All soil extraction preparation blank results are reported as non-detected. 2,4-Dinitrophenol and bis(2-ethylhexyl)phthalate were detected in rinsate blank sample BRSWRB01 at concentrations below the method quantitation limit. These compounds were not detected in samples BRSWSB17 and BRSWSB19. No data were qualified based upon the rinsate blank results. Rinsate blank sample BRSWRB01 was re-extracted, outside the holding time, and reanalyzed. All results were non-detected (U). These results are reported as non-detected estimated (UJ) due to the holding time exceedance.

Bis(2-ethylhexyl)phthalate was detected in the aqueous preparation blank sample at 1.8ug/L, and the quantitation limit is 10ug/l. This compound is a common laboratory contaminant. The resulting action level is 18ug/L. Bis(2-ethylhexyl)phthalate was detected in rinsate sample BRSWRB01at 1.5ug/L. Bis(2-ethylhexyl)phthalate is reported as 10ug/L (U) for sample BRSWRB01 based upon the method extraction blank result.

Matrix Spike / Matrix Spike Duplicate Results

The aqueous and soil MS/MSD samples were not from laboratory work order 9911025. No validation actions are required based upon the MS/MSD results.

Laboratory Control Sample

The original aqueous LCS (11/23/99) did not meet the laboratory derived acid surrogate recoveries and the laboratory derived acid compounds recoveries, indicating extraction problems. All recoveries were low. The acid surrogate recoveries for the accompanying method blank were also low and outside the acceptance criteria. All acid surrogate and acid spike compounds were greater than 10%. The acid compound results, for the original extraction of sample BRSWRB01, are reported as non-detected estimated (UJ). The acid surrogate recoveries for rinsate sample BRSWRB01 were within the method acceptance criteria for the original extraction and the re-extraction, indicating that the extraction problems were limited to the laboratory QC samples and not the rinsate blank sample.

These blank results do not impact the soil field sample results. The soil acid surrogate recoveries and the soil acid spike compound recoveries for the soil LCS and the soil method extraction blank met the laboratory derived method acceptance criteria. The acid surrogate recoveries for soil samples BRSWSB17 and BRSWSB19 also met the method acceptance criteria.

Field Duplicate Results

No field duplicate samples were collected on 11/19/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911025.

Surrogate Results

The acid surrogate recoveries for the 11/23/99 aqueous LCS and extraction method blank were low and outside the laboratory derived acceptance criteria. The acid surrogate recoveries, for rinsate blank sample BRSWRB01, met the laboratory derived acceptance criteria. The sample was
re-extracted outside of holding time, and reanalyzed. The acid surrogate recoveries for the aqueous LCS and method blank, accompanying the re-extraction, met the acceptance criteria.

Holding Times

All holding times were initially met. The aqueous rinsate blank sample BRSWRB01 was re-extracted after the holding time, and reanalyzed. BRSWRB01 was reanalyzed because acid surrogate and spike recoveries in the associated method blank and LCS in the original extraction

batch did not meet the method acceptance criteria. All rinsate blank results, for the re-extracted sample, are reported as non-detected estimated (UJ) due to the holding time exceedance.

Summary

The 4-chloroaniline result for sample BRSWSB19 is reported as estimated (J), at 140ug/Kg. The dibenzofuran result for sample BRSWSB19 is reported as estimated (J), at 64ug/Kg. The fluorene result for sample BRSWSB19 is reported as estimated (J), at 110ug/L. These results are all below the method quantitation limit, 270ug/Kg.

Bis(2-ethylhexyl)phthalate is reported as non-detected (U), at the method quantitation level, in the first rinsate sample BRSWRB01. Bis(2-ethylhexyl)phthalate was detected in the aqueous extraction blank at 1.8ug/L and the action level is 18ug/L. Bis(2-ethylhexyl)phthalate was detected in sample BRSWRB01 at 1.5ug/L. The method quantitation level is 10ug/L. The rinsate blank was re-extracted , due to acid compound recoveries, and bis(2-ethylhexyl)phthalate was not detected in the re-extracted sample.

2,4-Dinitrophenol was detected in the first rinsate sample BRSWRB01at 4.6ug/L. This result is below the method quantitation level, 20ug/L. The 2,4-dinitrophenol result is reported as estimated (J). 2,4-Dinitrophenol was not detected in the BRSWRB01 re-extraction.

All acid compounds, in sample BRSWRB01, are reported as non-detected estimated (UJ). The method blank acid surrogate recoveries and the LCS acid surrogate recoveries and the LCS acid compound recoveries were below the method acceptance criteria. The acid surrogate recoveries for sample BRSWRB01 met the method specific acceptance criteria, indicating that the acid recovery problems were specific to the QC samples.

All results for the rinsate sample BRSWRB01 re-extraction are reported as non-detected estimated (UJ). The sample was re-extracted outside of the extraction holding time.

The rinsate blank sample validation qualifications do not impact the SVOC results for soil samples BRSWSB17 and BRSWSB19. Sample acid surrogate recoveries, acid method blank surrogate recoveries, LCS acid surrogate recoveries, and LCS acid compound recoveries met the method acceptance criteria.

The submitted MS/MSD results were from laboratory order 9911018-13 and these results were not used to qualify the 8270C samples from laboratory order 9911025.

No field duplicate or laboratory duplicate results were submitted with laboratory order 9911025.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous 8270C SVOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia SVOC soils
Table Ib SVOC aqueous

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB17	A
BRSWSB19	A, J^1

A Accept all data.

J^1 4-Chloroanilne, dibenzofuran, and fluorene are reported as estimated (J). The results are below the method quantitation level.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table 1b- Semivolatile 8270C Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB01	A, J^1
BRSWRB01RE	J^2

A Accept all data.

J^1 All acid compounds are reported as estimated (J) or non-detected estimated (UJ), due to low acid surrogate recoveries in the method blank and LCS, and low acid LCS compound recoveries.

J^2 All results are reported as non-detected estimated due to the exceedance of sample extraction holding time.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB17	BRSWSB19		
Lab Sample Number:		9911025-01B	9911025-03B		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/19/99	11/19/99		
Date Extracted:		11/22/1999	11/22/1999		
Date Analyzed		11/29/1999	11/29/1999		
Percent Moisture:		8.8	9.2		
Compounds	Limit	ug/Kg	ug/Kg		
N-nitrosodimethylamine	500	540 U	540 U		
Phenol	250	270 U	270 U		
bis(2-Chloroethyl) ether	250	270 U	270 U		
2-Chlorophenol	250	270 U	270 U		
1,3-Dichlorobenzene	250	270 U	270 U		
1,4-Dichlorobenzene	250	270 U	270 U		
Benzyl Alcohol	500	540 U	540 U		
2-Methylphenol	250	270 U	270 U		
1,2-Dichlorobenzene	250	270 U	270 U		
Bis(2-chloroisopropyl)ether	250	270 U	270 U		
4-Methylphenol	250	270 U	270 U		
n-Nitroso-di-n-propylamine	250	270 U	270 U		
Hexachloroethane	250	270 U	270 U		
Nitrobenzene	250	270 U	270 U		
Isophorone	250	270 U	270 U		
2,4-Dimethylphenol	250	270 U	270 U		
Benzoic Acid	500	540 U	540 U		
2-Nitrophenol	250	270 U	270 U		
bis(2-Chloroethoxy) methane	250	270 U	270 U		
2,4-Dichlorophenol	250	270 U	270 U		
1,2,4-Trichlorobenzene	250	270 U	270 U		
Naphthalene	250	270 U	140 J		
4-Chloroaniline	250	270 U	270 U		
Hexachlorobutadiene	250	270 U	270 U		
4-Chloro-3-methylphenol	500	540 U	540 U		
2-Methylnaphthalene	250	270 U	270 U		
Hexachlorocyclopentadiene	250	270 U	270 U		
2,4,6-Trichlorophenol	250	270 U	270 U		
2,4,5-Trichlorophenol	250	270 U	270 U		
2-Chloronaphthalene	250	270 U	270 U		
2-Nitroaniline	500	540 U	540 U		

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB17	BRSWSB19		
Lab Sample Number:		9911025-01B	9911025-03B		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/19/99	11/19/99		
Date Extracted:		11/22/1999	11/22/1999		
Date Analyzed		11/29/1999	11/29/1999		
Percent Moisture:		8.8	9.2		
Compounds	Limit	ug/Kg	ug/Kg		
Dimethyl phthalate	250	270 U	270 U		
2,6-Dinitrotoluene	250	270 U	270 U		
Acenaphthylene	250	270 U	270 U		
3-Nitroaniline	500	540 U	540 U		
4-Nitrophenol	500	540 U	540 U		
2,4-Dinitrophenol	500	540 U	540 U		
Acenaphthene	250	270 U	270 U		
2,4-Dinitrotoluene	250	270 U	270 U		
Dibenzofuran	250	270 U	64 J		
Diethyl phthalate	250	270 U	270 U		
4-Chlorophenyl phenyl ether	250	270 U	270 U		
Fluorene	250	270 U	110 J		
4-Nitroaniline	500	540 U	540 U		
4,6-Dinitro-2-methylphenol	500	540 U	540 U		
n-Nitrosodiphenylamine	250	270 U	270 U		
1,2-Diphenylhydrazine	250	270 U	270 U		
4-Bromophenyl phenylether	250	270 U	270 U		
Hexachlorobenzene	250	270 U	270 U		
Pentachlorophenol	500	540 U	540 U		
Phenanthrene	250	270 U	300		
Anthracene	250	270 U	270 U		
Carbazole	250	270 U	270 U		
Di-n-butylphthalate	250	270 U	270 U		
Fluoranthene	250	270 U	270 U		
Benzidine	250	270 U	270 U		
Pyrene	250	270 U	270 U		
Butyl benzyl phthalate	250	270 U	270 U		
bis(2-ethylhexyl)phthalate	250	270 U	270 U		
3,3'-Dichlorobenzidine	250	270 U	270 U		
Benzo(a)anthracene	250	270 U	270 U		
Chrysene	250	270 U	270 U		

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSB17	BRSWSB19		
Lab Sample Number:		9911025-01B	9911025-03B		
Matrix/Analysis:		Soil/Low	Soil/Low		
Sample Type:		ROUTINE	ROUTINE		
Dilution Factor:		1	1		
Date Sampled:		11/19/99	11/19/99		
Date Extracted:		11/22/1999	11/22/1999		
Date Analyzed		11/29/1999	11/29/1999		
Percent Moisture:		8.8	9.2		
Compounds	Limit	ug/Kg	ug/Kg		
Di-n-octylphthalate	250	270 U	270 U		
Benzo(b)fluoranthene	250	270 U	270 U		
Benzo(k)fluoranthene	250	270 U	270 U		
Benzo(a)pyrene	250	270 U	270 U		
Dibenz(a,h)anthracene	250	270 U	270 U		
Indeno(1,2,3-cd)pyrene	250	270 U	270 U		
Benzo(g,h,i)perylene	250	270 U	270 U		

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB01	BRSWRB01RE		
Lab Sample Number:		9911025-02C	9911025-02C		
Matrix/Analysis:		Aqueous/Low	Aqueous/Low		
Sample Type:		Rinsate Blank	Rinsate Blank		
Dilution Factor:		1	1		
Date Sampled:		11/19/1999	11/19/1999		
Date Extracted:		11/23/1999	11/30/1999		
Date Analyzed		11/29/1999	12/01/1999		
Percent Moisture:		NA	NA		
	Reporting				
Compounds	Limit	ug/L	ug/L		
N-nitrosodimethylamine	20	20 U	20 UJ		
Phenol	10	10 UJ	10 UJ		
bis(2-Chloroethyl) ether	10	10 U	10 UJ		
2-Chlorophenol	10	10 UJ	10 UJ		
1,3-Dichlorobenzene	10	10 U	10 UJ		
1,4-Dichlorobenzene	10	10 U	10 UJ		
Benzyl Alcohol	20	20 U	20 UJ		
2-Methylphenol	10	10 UJ	10 UJ		
1,2-Dichlorobenzene	10	10 U	10 UJ		
Bis(2-chloroisopropyl)ether	10	10 U	10 UJ		
4-Methylphenol	10	10 UJ	10 UJ		
n-Nitroso-di-n-propylamine	10	10 U	10 UJ		
Hexachloroethane	10	10 U	10 UJ		
Nitrobenzene	10	10 U	10 UJ		
Isophorone	10	10 U	10 UJ		
2,4-Dimethylphenol	10	10 UJ	10 UJ		
Benzoic Acid	20	20 UJ	20 UJ		
2-Nitrophenol	10	10 UJ	10 UJ		
bis(2-Chloroethoxy) methane	10	10 U	10 UJ		
2,4-Dichlorophenol	10	10 UJ	10 UJ		
1,2,4-Trichlorobenzene	10	10 U	10 UJ		
Naphthalene	10	10 U	10 UJ		
4-Chloroaniline	10	10 U	10 UJ		
Hexachlorobutadiene	10	10 U	10 UJ		
4-Chloro-3-methylphenol	20	20 UJ	20 UJ		
2-Methylnaphthalene	10	10 U	10 UJ		
Hexachlorocyclopentadiene	10	10 U	10 UJ		
2,4,6-Trichlorophenol	10	10 UJ	10 UJ		
2,4,5-Trichlorophenol	10	10 UJ	10 UJ		
2-Chloronaphthalene	10	10 U	10 UJ		
2-Nitroaniline	20	20 U	20 UJ		

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB01	BRSWRB01RE		
Lab Sample Number:		9911025-02C	9911025-02C		
Matrix/Analysis:		Aqueous/Low	Aqueous/Low		
Sample Type:		Rinsate Blank	Rinsate Blank		
Dilution Factor:		1	1		
Date Sampled:		11/19/1999	11/19/1999		
Date Extracted:		11/23/1999	11/30/1999		
Date Analyzed		11/29/1999	12/01/1999		
Percent Moisture:		NA	NA		
	Reporting				
Compounds	Limit	ug/L	ug/L		
Dimethyl phthalate	10	10 U	10 UJ		
2,6-Dinitrotoluene	10	10 U	10 UJ		
Acenaphthylene	10	10 U	10 UJ		
3-Nitroaniline	20	20 U	20 UJ		
4-Nitrophenol	20	20 UJ	20 UJ		
2,4-Dinitrophenol	20	4.6 J	20 UJ		
Acenaphthene	10	10 U	10 UJ		
2,4-Dinitrotoluene	10	10 U	10 UJ		
Dibenzofuran	10	10 U	10 UJ		
Diethyl phthalate	10	10 U	10 UJ		
4-Chlorophenyl phenyl ether	10	10 U	10 UJ		
Fluorene	10	10 U	10 UJ		
4-Nitroaniline	20	20 U	20 UJ		
4,6-Dinitro-2-methylphenol	20	20UJ	20UJ		
n-Nitrosodiphenylamine	10	10 U	10 UJ		
1,2-Diphenylhydrazine	10	10 U	10 UJ		
4-Bromophenyl phenylether	10	10 U	10 UJ		
Hexachlorobenzene	10	10 U	10 UJ		
Pentachlorophenol	20	20 UJ	20 UJ		
Phenanthrene	10	10 U	10 UJ		
Anthracene	10	10 U	10 UJ		
Carbazole	10	10 U	10 UJ		
Di-n-butyl phthalate	10	10 U	10 UJ		
Fluoranthene	10	10 U	10 UJ		
Benzidine	20	20 U	20 UJ		
Pyrene	10	10 U	10 UJ		
Butyl benzyl phthalate	10	10 U	10 UJ		
bis(2-ethylhexyl) phthalate	10	10 U	10 UJ		
3,3'-Dichlorobenzidine	10	10 U	10 UJ		
Benzo(a)anthracene	10	10 U	10 UJ		
Chrysene	10	10 U	10 UJ		

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB01	BRSWRB01RE		
Lab Sample Number:		9911025-02C	9911025-02C		
Matrix/Analysis:		Aqueous/Low	Aqueous/Low		
Sample Type:		Rinsate Blank	Rinsate Blank		
Dilution Factor:		1	1		
Date Sampled:		11/19/1999	11/19/1999		
Date Extracted:		11/23/1999	11/30/1999		
Date Analyzed		11/29/1999	12/01/1999		
Percent Moisture:		NA	NA		
	Reporting				
Compounds	Limit	ug/L	ug/L		
Di-n-octyl phthalate	10	10 U	10 UJ		
Benzo(b)fluoranthene	10	10 U	10 UJ		
Benzo(k)fluoranthene	10	10 U	10 UJ		
Benzo(a)pyrene	10	10 U	10 UJ		
Dibenz(a,h)anthracene	10	10 U	10 UJ		
Indeno(1,2,3-cd)pyrene	10	10 U	10 UJ		
Benzo(g,h,i)perylene	10	10 U	10 UJ		

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Jan. 20, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/19/99
3 Soil samples including the trip blank
1 rinsate blank and 1 trip blank
Lab Order: 9911025

Volatile Organics Analysis

Samples Collected:

BRSWSB17	BRSWBS19	BRSWRB01 (rinsate)	Trip Blank IV (aq)
Trip Blank IV (soil)			

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

* - chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
* - MS/MSD results
- LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries

* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

The COC documents indicate that 8260B analysis was requested on soil trip blank IV. Results were not submitted for this sample. The laboratory was requested to submit these results if available. Stone & Webster was notified and confirmed a methanol soil trip blank was submitted for analysis.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 1° C. The cooler temperature range is 2-6° C. The data quality is not impacted by this deviation.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA samples. The only aqueous VOA samples were the rinsate blank sample BRSWRB01 and aqueous Trip Blank IV.

Trip Blanks, Field Blanks, and Method Blanks

A soil trip blank sample was submitted for 8260B analyses. No results were submitted for this sample. The laboratory provided no explanation, for this omission. The laboratory was requested to submit these results if available. Stone & Webster was notified and confirmed a methanol soil trip blank was submitted for analysis. The laboratory did not analyze soil TRIP BLANK IV, as stated by the laboratory response, "because it was a methanol preserved vial and inappropriate for the sample vials which were low level $NAHSO_4$ preserved." No soil VOA trip blank results were reported. Potential low level contamination can not be thoroughly evaluated.

Methylene chloride was detected in the 11/23/99soil preparation blank at 17.0ug/Kg and the action level is 170 ug/Kg. Methylene chloride was detected in soil sample BRSWSB17 at 17ug/Kg and the quantitation limit is 22ug/Kg. This result is reported as non-detected (U) at the reporting limit 22ug/Kg. Methylene chloride is a common laboratory contaminant.

Methylene chloride was detected in aqueous trip blank sample Trip Blank IV at 1ug/L and the laboratory quantitation limit is 5ug/L. Methylene chloride is reported as estimated in Trip Blank IV as estimated 1ug/L (J).

No target compound analytes were detected in field rinsate blank sample BRSWRB01 and no validation actions were required. No target compound analytes were detected in aqueous preparation method blank samples 11/29/99 and 12/02/99.

Matrix Spike / Matrix Spike Duplicate Results

The aqueous and soil MS/MSD samples were not from laboratory work order 9911025. No validation actions are required based upon the MS/MSD results.

Laboratory Control Sample

The laboratory soil LCS recovery acceptance criteria are 70-130%. A list of compounds not meeting this criterion is summarized below.

Compound	% Recovery	Action
Dichlorodifluoromethane	59.8	Non-detects UJ; Detects J
Chloroethane	65.9	Non-detects UJ; Detects J
Bromomethane	65.5	Non-detects UJ; Detects J
trans-1,2-Dichloroethene	132	Non-detects U; Detects J
1,1-Dichloroethane	132	Non-detects U; Detects J
2-Butanone	158	Non-detects U; Detects J
2,2-Dichloropropane	133	Non-detects U; Detects J
1,2-Dichloropropane	138	Non-detects U; Detects J
Chloroform	145	Non-detects U; Detects J

Based upon the soil LCS recoveries the dichlorodifluoromethane, chloroethane, and bromomethane, results for soil samples BRSWSB17 and BRSWSB19 are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists. The remaining compounds are all non-detects and are not qualified because a high bias is indicated.

Two aqueous LCS samples were analyzed. The 11/29/99 LCS is applied to rinsate blank sample BRSWRB01. The QAPP has listed the 8260B LCS acceptance recoveries for select compounds as 80-120% and the laboratory forms indicate that the laboratory acceptance criterion is 70-130%. The validator used the 80-120% QAPP criterion for specified compounds 1,1-Dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene and the laboratory specified 70-130% acceptance criterion for non-QAPP specified compounds. A list of compounds not meeting these criteria is summarized below.

Compound	% Recovery	Action
Dichlorodifluoromethane	65.2	Non-detects UJ; Detects J
Chloromethane	69.8	Non-detects UJ; Detects J
Chloroethane	67.7	Non-detects UJ; Detects J

The dichlorodifluoromethane, chloromethane, and chloroethane results for sample BRSWRB01 are reported as non-detected estimated (UJ) and the results may be biased low.

The 12/02/99 LCS is applied to Trip Blank IV (9911025-04A). A list of compounds not meeting these criteria is summarized below.

Compound	% Recovery	Action
Trichlorofluoromethane	48.8	Non-detects UJ; Detects J

The trichlorofluoromethane result for sample Trip Blank IV is reported as non-detected estimated (UJ). The result may be biased low.

Field Duplicate Results

No field duplicate samples were collected on 11/19/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 99110025.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The chain of custody indicates that a trip blank IV soil sample was submitted for 8260B analyses. Discussions with Stone and Webster confirm that this sample was submitted. The laboratory did not submit 8260B results for soil Trip Blank IV.

Acetone is reported as estimated (J) in soil sample BRSWSB17 at 18ug/Kg. This reported result is below the method quantitation level (22ug/Kg). Acetone was not detected in the method preparation blanks or in the rinsate blank sample BRSWRB01. Acetone is a common laboratory contaminant.

Ethylbenzene is reported as estimated (J) in soil sample BRSWSB19 at 2.1ug/Kg. This reported result is below the method quantitation level (4.2ug/Kg).

Low level laboratory methylene chloride contamination is indicated.

Methylene chloride is reported as estimated (J) in aqueous sample Trip Blank IV at 1ug/L. This reported result is below the method quantitation level (5ug/L).

Methylene chloride, a common laboratory contaminant, is reported in soil sample BRSWSB17 at 17ug/Kg. The method quantitation level is 22ug/Kg. Methylene chloride was not detected in rinsate blank sample BRSWSB19, but methylene chloride was detected in the 11/23/99 preparation blank at 17ug/Kg. The action level is 170ug/Kg. Methylene chloride is reported as non-detected at the method quantitation level, 22ug/Kg.

The QAPP LCS acceptance criteria for the aqueous 8260B results were 80-120%, for 1,1-Dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene. Laboratory LCS forms indicate that the laboratory used 70-130% acceptance criteria for all compounds. The validator used the QAPP specified criteria (80-120) for the specified compounds and the laboratory specified acceptance criteria (70-130) for the remaining compounds.

Based upon the soil LCS recoveries the dichlorodifluoromethane, chloroethane, and bromomethane, results for soil samples BRSWSB17 and BRSWSB19 are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists. The remaining compounds are all non-detects and are not qualified because a high bias is indicated.

Based upon the two aqueous LCS recoveries the dichlorodifluoromethane, chloromethane, and chloroethane results for sample BRSWRB01 are reported as non-detected estimated (UJ) and the results may be biased low, and the trichlorofluoromethane result for sample Trip Blank IV is reported as non-detected estimated (UJ). This result may be biased low.

The submitted MS/MSD results were from laboratory order 9911033 and these results were not used to qualify the 8260B samples from laboratory order 9911025.

No field duplicate or laboratory duplicate results were submitted with laboratory order 9911025.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous 8260 VOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia 8260B soils
Table Ib 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB17	A, J^1, J^2
BRSWSB19	A, J^1, J^3

A Accept all data.

J^1 Dichlorodifluoromethane, chloroethane, and bromomethane results are reported as non-detected estimated (UJ). LCS recoveries were low and false negatives are possible.

J^2 Acetone is reported as estimated 18ug/Kg (J). The result is below the method quantitation level.

J^3 Ethylbenzene is reported as estimated 2.1ug/Kg (J). The result is below the method quantitation level (4.2ug/Kg).

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1b- Volatiles-8260B Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB01	A, J^1
Trip Blank IV (aq)	A, J^2, J^3

A Accept all data.

J^1 Dichlorodifluoromethane, chloromethane, and chloroethane results are reported as non-detected estimated (UJ). LCS recoveries were low and false negatives are possible.

J^2 The trichlorofluoromethane result is reported as non-detected estimated (UJ). The LCS recovery was low and false negatives are possible.

J^3 Methylene chloride is reported as estimated 1ug/L (J). The result is below the method quantitation level (5.0ug/L).

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB17	BRSWSB19			
S&W Sample (cont)						
Lab Sample Number:		9911025-01A	9911025-03A			
Matrix/Analysis:		Soil/Low	Soil/Low			
Sample Type:		ROUTINE	ROUTINE			
Dilution Factor:		1	1			
Date Sampled:		11/19/99	11/19/99			
Date Extracted:		11/20/1999	11/20/1999			
Date Analyzed:		12/01/1999	12/01/1999			
Percent Moisture:		8.8	9.2			
Target Compounds	Report Limit	mg/Kg	mg/Kg			
Dichlorodifluoromethane	4	4.3 UJ	4.2 UJ			
Chloromethane	4	4.3 U	4.2 U			
Vinyl Chloride	4	4.3 U	4.2 U			
Chloroethane	4	4.3 UJ	4.2 UJ			
Bromomethane	4	4.3 UJ	4.2 UJ			
Trichlorofluoromethane	4	4.3 U	4.2 U			
Acetone	20	18 J	21 U			
1,1-Dichloroethene	4	4.3 U	4.2 U			
Carbon disulfide	4	4.3 U	4.2 U			
Methylene Chloride	20	22 U	21 U			
Methyl tert-butyl ether	4	4.3 U	4.2 U			
trans-1,2-Dichloroethene	4	4.3 U	4.2 U			
1,1-Dichloroethane	4	4.3 U	4.2 U			
2-Butanone	20	22 U	21 U			
2,2-Dichloropropane	4	4.3 U	4.2 U			
cis-1,2-Dichloroethene	4	4.3 U	4.2 U			
Chloroform	4	4.3 U	4.2 U			
Bromochloromethane	4	4.3 U	4.2 U			
1,1,1-Trichloroethane	4	4.3 U	4.2 U			
1,1-Dichloropropene	4	4.3 U	4.2 U			
Carbon tetrachloride	4	4.3 U	4.2 U			
1,2-Dichloroethane	4	4.3 U	4.2 U			
Benzene	4	4.3 U	4.2 U			
Trichloroethene	4	4.3 U	4.2 U			
1,2-Dichloropropane	4	4.3 U	4.2 U			
Bromodichloromethane	4	4.3 U	4.2 U			
Dibromomethane	4	4.3 U	4.2 U			
4-Methyl-2-pentanone	20	22 U	21 U			
cis-1,3-Dichloropropene	4	4.3 U	4.2 U			
Toluene	4	4.3 U	4.2 U			
trans-1,3-Dichloropropene	4	4.3 U	4.2 U			
1,1,2-Trichloroethane	4	4.3 U	4.2 U			
1,2-Dibromoethane	4	4.3 U	4.2 U			
2-Hexanone	20	22 U	21 U			
1,3-Dichloropropane	4	4.3 U	4.2 U			
Tetrachloroethene	4	4.3 U	4.2 U			

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB17	BRSWSB19			
S&W Sample (cont)						
Lab Sample Number:		9911025-01A	9911025-03A			
Matrix/Analysis:		Soil/Low	Soil/Low			
Sample Type:		ROUTINE	ROUTINE			
Dilution Factor:		1	1			
Date Sampled:		11/19/99	11/19/99			
Date Extracted:		11/20/1999	11/20/1999			
Date Analyzed:		12/01/1999	12/01/1999			
Percent Moisture:		8.8	9.2			
Dibromochloromethane	4	4.3 U	4.2 U			

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSB17	BRSWSB19			
S&W Sample (cont)						
Lab Sample Number:		9911025-01A	9911025-03A			
Matrix/Analysis:		Soil/Low	Soil/Low			
Sample Type:		ROUTINE	ROUTINE			
Dilution Factor:		1	1			
Date Sampled:		11/19/99	11/19/99			
Date Extracted:		11/20/1999	11/20/1999			
Date Analyzed:		12/01/1999	12/01/1999			
Percent Moisture:		8.8	9.2			
Chlorobenzene	4	4.3 U	4.2 U			
1,1,1,2-Tetrachloroethane	4	4.3 U	4.2 U			
Ethylbenzene	4	4.3 U	2.1 J			
m,p-Xylene	4	4.3 U	19.0			
o-Xylene	4	4.3 U	4.6			
Styrene	4	4.3 U	4.2 U			
Bromoform	4	4.3 U	4.2 U			
Isopropylbenzene	4	4.3 U	36			
1,1,2,2-Tetrachloroethane	4	4.3 U	4.2 U			
1,2,3-Trichloropropane	4	4.3 U	4.2 U			
Bromobenzene	4	4.3 U	4.2 U			
n-Propylbenzene	4	4.3 U	69			
2-Chlorotoluene	4	4.3 U	4.2 U			
4-Chlorotoluene	4	4.3 U	4.2 U			
1,3,5-Trimethylbenzene	4	4.3 U	38			
tert-Butylbenzene	4	4.3 U	4.2 U			
1,2,4,-Trimethylbenzene	4	4.3 U	230			
sec-Butylbenzene	4	4.3 U	75			
4-isopropyltoluene	4	4.3 U	44			
1,3-dichlorobenzene	4	4.3 U	4.2 U			
1,4-dichlorobenzene	4	4.3 U	4.2 U			
n-Butylbenzene	4	4.3 U	4.2 U			
1,2-Dichlorobenzene	4	4.3 U	4.2 U			
1,2-Dibromo-3-chloropropane	4	4.3 U	4.2 U			
1,2,4-Trichlorobenzene	4	4.3 U	4.2 U			
Hexachlorobutadiene	4	4.3 U	4.2 U			
Naphthalene	4	4.3 U	190			
1,2,3-Trichlorobenzene	4	4.3 U	4.2 U			

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Soil units mg/Kg based upon 100% total solids

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWRB01	Trip Blank IV			
S&W Sample (cont)						
Lab Sample Number:		9911025-02A	9911025-04A			
Matrix/Analysis:		AQ/Low	Aq/Low			
Sample Type:						
Dilution Factor:						
Date Sampled:		11/19/1999	11/19/1999			
Date Extracted:		11/28/1999	12/03/1999			
Date Analyzed:		11/29/1999	12/03/1999			
Percent Moisture:		NA	NA			
	Report					
Target Compounds	Limit	ug/L	ug/L			
Dichlorodifluoromethane	5	5.0 UJ	5.0U			
Chloromethane	5	5.0 UJ	5.0 U			
Vinyl Chloride	2	2.0 U	2.0U			
Chloroethane	5	5.0 UJ	5.0 U			
Bromomethane	5	5.0 U	5.0 U			
Trichlorofluoromethane	2	2.0 U	2.0 UJ			
Acetone	10	10.0 U	10.0 U			
1.1-Dichloroethene	1	1.0 U	1.0 U			
Carbon disulfide	2	2.0 U	2.0 U			
Methylene Chloride	5	5.0 U	1.0 J			
Methyl tert-butyl ether	2	2.0 U	2.0 U			
trans-1,2-Dichloroethene	2	2.0 U	2.0 U			
1,1-Dichloroethane	2	2.0 U	2.0 U			
2-Butanone	10	10.0 U	10.0 U			
2,2-Dichloropropane	2	2.0 U	2.0 U			
cis-1,2-Dichloroethene	2	2.0 U	2.0 U			
Chloroform	2	2.0 U	2.0 U			
Bromochloromethane	2	2.0 U	2.0 U			
1,1,1-Trichloroethane	2	2.0 U	2.0 U			
1,1-Dichloropropene	2	2.0 U	2.0 U			
Carbon tetrachloride	2	2.0 U	2.0 U			
1,2-Dichloroethane	2	2.0 U	2.0 U			
Benzene	2	2.0 U	2.0 U			
Trichloroethene	2	2.0 U	2.0 U			
1,2-Dichloropropane	2	2.0 U	2.0 U			
Bromodichloromethane	2	2.0 U	2.0 U			
Dibromomethane	2	2.0 U	2.0 U			
4-Methyl-2-pentanone	10	10.0 U	10.0 U			
cis-1,3-Dichloropropene	1	1.0 U	1.0 U			
Toluene	2	2.0 U	2.0 U			
trans-1,3-Dichloropropene	1	1.0 U	1.0 U			
1,1,2-Trichloroethane	2	2.0 U	2.0 U			
1,2-Dibromoethane	2	2.0 U	2.0 U			
2-Hexanone	10	10.0 U	10.0 U			
1,3-Dichloropropane	2	2.0 U	2.0 U			
Tetrachloroethene	2	2.0 U	2.0 U			

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWRB01	Trip Blank IV			
S&W Sample (cont)						
Lab Sample Number:		9911025-02A	9911025-04A			
Matrix/Analysis:		AQ/Low	Aq/Low			
Sample Type:						
Dilution Factor:						
Date Sampled:		11/19/1999	11/19/1999			
Date Extracted:		11/28/1999	12/03/1999			
Date Analyzed:		11/29/1999	12/03/1999			
Percent Moisture:		NA	NA			
Dibromochloromethane	2	2.0 U	2.0 U			

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWRB01	Trip Blank IV			
S&W Sample (cont)						
Lab Sample Number:		9911025-02A	9911025-04A			
Matrix/Analysis:		AQ/Low	Aq/Low			
Sample Type:						
Dilution Factor:						
Date Sampled:		11/19/1999	11/19/1999			
Date Extracted:		11/28/1999	12/03/1999			
Date Analyzed:		11/29/1999	12/03/1999			
Percent Moisture:		NA	NA			
Chlorobenzene	2	2.0 U	2.0 U			
1,1,1,2-Tetrachloroethane	2	2.0 U	2.0 U			
Ethylbenzene	2	2.0 U	2.0 U			
m,p-Xylene	2	2.0 U	2.0 U			
o-Xylene	2	2.0 U	2.0 U			
Styrene	2	2.0 U	2.0 U			
Bromoform	2	2.0 U	2.0 U			
Isopropylbenzene	2	2.0 U	2.0 U			
1,1,2,2-Tetrachloroethane	2	2.0 U	2.0 U			
1,2,3-Trichloropropane	2	2.0 U	2.0 U			
Bromobenzene	2	2.0 U	2.0 U			
n-Propylbenzene	2	2.0 U	2.0 U			
2-Chlorotoluene	2	2.0 U	2.0 U			
4-Chlorotoluene	2	2.0 U	2.0 U			
1,3,5-Trimethylbenzene	2	2.0 U	2.0 U			
tert-Butylbenzene	2	2.0 U	2.0 U			
1,2,4,-Trimethylbenzene	2	2.0 U	2.0 U			
sec-Butylbenzene	2	2.0 U	2.0 U			
4-isopropyltoluene	2	2.0 U	2.0 U			
1,3-dichlorobenzene	2	2.0 U	2.0 U			
1,4-dichlorobenzene	2	2.0 U	2.0 U			
n-Butylbenzene	2	2.0 U	2.0 U			
1,2-Dichlorobenzene	2	2.0 U	2.0 U			
1,2-Dibromo-3-chloropropane	5	5.0 U	5.0 U			
1,2,4-Trichlorobenzene	2	2.0 U	2.0 U			
Hexachlorobutadiene	2	2.0 U	2.0 U			
Naphthalene	2	2.0 U	2.0 U			
1,2,3-Trichlorobenzene	2	2.0 U	2.0 U			

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Jan. 10, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/19/99
2 Soil samples
1 Aqueous Rinsate Blank
Lab Order: 9911025

Extractable Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSB17	*BRSWSB19*	*BRSWRB01(rinsate)*

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

* - chain of custody documents
* - sample log-in documents
* - trip blanks, rinsate blanks, and method blanks
* - MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.

** Not included in data package

Tables 1a and 1b summarize the validation recommendations which are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 1° C. The cooler temperature range is 2-6° C. The data quality is not impacted by this deviation. The sample receipt checklist indicates that samples were properly preserved and pH information was provided for the aqueous VPH samples.

Field Blanks, and Method Blanks

The aqueous EPH rinsate blank BRSWRB01 had a positive result for the C19-C36 aliphatic range compounds. This analyte was not detected in the laboratory extraction blank or the soil samples. This result is possibly a field sampling artifact. No other blank contamination is indicated. Based upon the blank results no data validation actions were taken because the contaminant was not detected in the field samples. The narrative noted that the C19-C36 result was due to
non- petroleum hydrocarbon compounds.

Matrix Spike / Matrix Spike Duplicate Results

The MS/MSD soil samples were not part of this lab order. No validation results were taken based upon these results.

The MS/MSD aqueous samples were not part of this lab order. No validation results were taken based upon these results.

Laboratory Control Samples

All soil EPH LCS recoveries met the method acceptance criteria.

All aqueous EPH LCS recoveries met the method acceptance criteria.

Field Duplicate Results

No field duplicate samples were collected on 11/19/99.

Laboratory Duplicate Results

Soil sample BRSWSB19 was analyzed as the laboratory duplicate sample. All results for both samples were reported as non-detected. No validation actions were taken based upon the soil laboratory duplicate results.

The EPH aqueous duplicate sample was not part of this laboratory order. No validation actions were taken based upon the aqueous laboratory duplicate results.

Surrogate Results

All soil and aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8270C method surrogates were reported along with specified EPH surrogates.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All soil and aqueous EPH results are accepted without qualification.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous EPH results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table Ia EPH soils
Table Ib EPH aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table 1a- Extractable Petroleum Hydrocarbon Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB17	A
BRSWSB19	A

A Accept all data.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1b- Extractable Petroleum Hydrocarbon
Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB01	A

A Accept all data.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

The laboratory reported only the aliphatic and aromatic range results. The individual target compound results were not reported. The COC did not specify whether the complete list or the ranges were requested.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 11/30/99 and received at the laboratory 3.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. Sample preservation information was provided and indicates that the EPH sample was properly preserved to a pH <2 with HCl.

Field Blanks, and Method Blanks

All method blank results were reported as non-detected. No results were qualified based upon the method blank results.

Matrix Spike / Matrix Spike Duplicate Results

Aqueous sample BRSWGW13 (9912007-01E, collected 12/03/99) was analyzed as the MS/MSD sample. The n-nonane and the n-tetradecane MS/MSD recoveries were low and did not meet the method specified 40-140% acceptance criteria. Typically MS/MSD results apply to only the non-spiked sample, therefore no results were qualified due to the MS/MSD recoveries. The n-nonane LCS recovery was 41.4% and the LCS recovery method acceptance range is 40-140%.

Laboratory Control Samples

TABLE I

UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSW03	BRSWSW03D		
Sample Location:						
Sample Type:			Aqueous	Aqueous		
Lab Sample Number:			9911033-09	9911033-10		
Percent Moisture:			N/A	N/A		
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/23/1999	11/23/1999		
Date Extracted			11/29/1999	11/29/1999		
Date Analyzed Aliphatics:			11/30/1999	11/30/1999		
Date Analyzed PNA			11/30/1999	11/30/1999		
Notes:			Field DUP	Field DUP		
		Report				
EPH ANALYTES	Method	Limit	ug/L	ug/L		
C9-C18 Aliphatic (1)	8270C	100	100 U	100 U		
C19-C36 Aliphatic (1)	8270C	100	330	170		
C11-C22 Aromatics(1,2)	8270C	100	130	100 U		
Targeted PAH Analytes						
Naphthalene	8270C	1	1.0 U	1.0 U		
2-Methylnaphthalene	8270C	1	1.0 U	1.0 U		
Acenaphthylene	8270C	1	1.0 U	1.0 U		
Acenaphthene	8270C	1	1.0 U	1.0 U		
Fluorene	8270C	1	1.0 U	1.0 U		
Phenanthrene	8270C	1	1.0 U	1.0 U		
Anthracene	8270C	1	1.0 U	1.0 U		
Fluoranthene	8270C	1	1.0 U	1.0 U		
Pyrene	8270C	1	1.0 U	1.0 U		
Benzo(a)anthracene	8270C	1	1.0 U	1.0 U		
Chrysene	8270C	1	1.0 U	1.0 U		
Benzo(b)fluoranthene	8270C	1	1.0 U	1.0 U		
Benzo(k)fluoranthene	8270C	1	1.0 U	1.0 U		
Benzo(a)pyrene	8270C	1	1.0 U	1.0 U		
Indeno(1,2,3-cd)pyrene	8270C	1	1.0 U	1.0 U		
Dibenzo(a,h)anthracene	8270C	1	1.0 U	1.0 U		
Benzo(g,h,i)perylene	8270C	1	1.0 U	1.0 U		

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 14, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/19/99
3 Soil samples including the trip blank
2 Aqueous samples, 1 rinsate blank and 1 trip blank
Lab Order: 9911025

Volatile Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSB17	BRSWSB19	Trip Blank IV(soil)	BRSWRB01 (rinsate)
Trip Blank IV			

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

*- chain of custody documents
* - sample log-in documents
*- trip blanks, rinsate blanks, and method blanks
*- MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results

* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Documents

All chain of custodies were properly signed and dated. The sample preservation information was not presented on the chain of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 1° C. The cooler temperature range is 2-6° C. The data quality is not impacted by this deviation. The sample receipt checklist indicates that the samples were properly preserved and pH information was provided for the aqueous VPH samples.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the VPH soil preparation blank, rinaste blank BRSWRB01 (11/19/99) and the soil trip blank.

Matrix Spike / Matrix Spike Duplicate Results

Sample 9911033-04B was analyzed as the soil MS/MSD VPH sample. All method analyte recovery and duplicate precision criteria were met.

Sample 9911041-03B was analyzed as the aqueous MS/MSD VPH sample. The naphthalene %RPD was 30.3% and the QC limit is 25%. Naphthalene results are not qualified based upon these results. The MS/MSD spike recoveries met the method acceptance criteria (70-130%) and naphthalene was not detected in the aqueous rinsate blank sample (BRSWRB01) and the aqueous trip blank sample (Trip BlankIV).

Laboratory Control Samples

All soil laboratory control sample recoveries met the method specified recovery criteria.

Al l aqueous laboratory control sample recoveries met the method specified recovery criteria

Field Duplicate Results

No field duplicate samples were collected on 11/19/99.

Laboratory Duplicates

Soil sample BRSWSB19 was analyzed as the sample/sample duplicate. All method precision acceptance criteria were met.

The aqueous duplicate sample was not part of lab order 9911025. Naphthalene was not detected in the sample and was detected in the sample duplicate at 3.1ug/L. The reporting limit is 2.0ug/L. The narrative states "The high RPD was most likely caused by carryover from the previous run contaminating the 24913006 duplicate analysis with naphthalene. Aqueous naphthalene results, for samples BRSWRB01, and Trip Blank IV are not qualified based upon the aqueous laboratory duplicate results.

Surrogate Results

All soil and aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8260B method surrogates were reported along with VPH surrogate 2,5-Dibromotoluene.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All VPH results are accepted without qualification.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous VPH results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Attachments: Table Ia VPH soils
Table Ib VPH aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 🖳 Electronic Mail: tlewis1260@aol.com

Table 1a- Volatile Petroleum Hydrocarbon Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSB17	A
BRSWSB19	A
Trip Blank IV (soil)	A

A Accept all results without qualification

Table 1b- Volatile Petroleum Hydrocarbon Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB01	A
Trip Blank IV (aq)	A

A Accept all results without qualification

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Sample Number:			Trip Blank IV	BRSWSB17	BRSWSB19	
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	
Lab Sample Number:			9911025-05A	9911025-01D	9911025-03D	
Percent moisture:			N/A	8.8	9.2	
Dilution Factor:			1	1	1	
Dilution Factor:						
Date Sampled:			11/19/1999	11/19/1999	11/19/1999	
Date Analyzed:			12/04/1999	12/05/1999	12/05/1999	
Notes:						
		Report				
VPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	
C5-C8 Aliphatic (1,2)	8260	2.5	2.5 U	2.0 U	2.1 U	
C9-C12 Aliphatic(1,3)	8260	0.62	0.62 U	0.51 U	1.4	
C9-C10 Aromatics(1)	8260	0.62	0.62 U	0.51 U	1.7	
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	0.050	0.050 U	0.041 U	0.041 U	
Benzene	8260	0.050	0.050 U	0.041 U	0.041 U	
Toluene	8260	0.050	0.050 U	0.041 U	0.041 U	
Ethylbenzene	8260	0.050	0.050 U	0.041 U	0.041 U	
m,p-Xylene	8260	0.050	0.050 U	0.041 U	0.041 U	
o-Xylene	8260	0.050	0.050 U	0.041 U	0.041 U	
Napthalene	8260	0.050	0.050 U	0.041 U	0.052	

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution
* Reporting limit is based upon 100% total solids and a 1:1 methanol to soil ratio.

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Sample Number:			BRSWRB01	Trip Blank IV		
Sample Location:						
Sample Type:			Aqueous	Aqueous		
Lab Sample Number:			9911025-02B	9911025-04A		
Percent moisture:						
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/19/1999	11/19/1999		
Date Analyzed:			11/29/1999	12/03/1999		
Notes:						
		Report				
VPH ANALYTES	Method	Limit*	ug/L	ug/L		
C5-C8 Aliphatic (1,2)	8260	100	100 U	100 U		
C9-C12 Aliphatic(1,3)	8260	25	25 U	25 U		
C9-C10 Aromatics(1)	8260	25	25 U	25 U		
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	2.0	2.0 U	2.0 U		
Benzene	8260	2.0	2.0 U	2.0 U		
Toluene	8260	2.0	2.0 U	2.0 U		
Ethylbenzene	8260	2.0	2.0 U	2.0 U		
m,p-Xylene	8260	2.0	2.0 U	2.0 U		
o-Xylene	8260	2.0	2.0 U	2.0 U		
Napthalene	8260	2.0	2.0 U	2.0 U		

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution

Jan. 18, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/19/99
2 Soil samples
1 Aqueous Rinsate Blank
Lab Order: 9911025

Inorganic Analysis

BRSWSB17	*BRSWSB19*	*BRSWRB01(rinsate)*

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Soil samples were analyzed according to SW-846 EPA Method 6010B and mercury was analyzed by SW-846 Method 7471. Arsenic, barium, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B and silver, cadmium, lead, and antimony were analyzed in the aqueous samples according to SW-846 EPA Methods 7761, 7131, 7421, and 7041 respectively. Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
MS /MSD results
* LCS results
* Field duplicate results

Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Tables 1a and 1b summarize the validation recommendations which are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 1° C. The cooler temperature range is 2-6° C. The data quality is not impacted by this deviation. The sample receipt checklist indicates that samples were properly preserved, however pH information is not provided for the aqueous VOA and aqueous elements samples. The only aqueous element sample was the rinsate blank sample.

Field Blanks and Method Blanks

Chromium and selenium were detected in the soil preparation blanks at 0.452mg/Kg and 1.64 mg/Kg respectively. The resulting action levels were 2.25mg/Kg and 8.20mg/Kg respectively. Chromium sample results were above the action level and no chromium results were qualified based upon the method blank results.

Selenium was reported in sample BRSWSB17 at 2.6mg/Kg (J), and the blank action level was 8.20mg/Kg. The laboratory estimated the selenium result, because the positive result was below the quantitation limit (10mg/Kg). The selenium result for sample BRSWSB17 is reported as 10mg/Kg (U).

All aqueous method blank results were reported as non-detected.

All rinsate blank results were reported as non-detected.

MS/MSD Results

All soil MS/MSD laboratory acceptance criteria were met.

Aqueous sample BRSWSW03 (Lab order 9911033) was prepared as the batch MS/MSD samples. Silver and cadmium MS/MSD recoveries did not meet the laboratory acceptance criteria of 75-125%. These recoveries were low. The sample MS/MSD digestates were diluted and reanalyzed for silver and cadmium. The recoveries were still outside the acceptance limits. The silver and cadmium results for sample BRSWRB01 are reported as non-detected estimated (UJ), and false negatives are possible.

As noted in the narrative, the post digestion spike recoveries for cadmium and silver, in sample BRSWRB01 were between 40-85%. These low post digestion spike recoveries indicate possible matrix problems and negative biases are indicated.

LCS Results

Soil and aqueous LCS recoveries met the specified acceptance criteria. No results are qualified based upon the LCS results.

Field Duplicates

No field duplicate samples were collected on 11/19/99.

Laboratory Duplicates

Soil sample BRSWSB17 (9911025-01) was analyzed as the batch laboratory duplicate sample. The chromium duplicate %RPD was 21.1% and the RPD acceptance limit is $\leq$20%. Army Corp laboratory duplicate acceptance criteria for ICP analyzed elements is $\leq$ 20% for sample results exceeding 5X the reporting limit. The chromium results are reported as estimated (J).

No aqueous laboratory duplicate sample result was submitted.

Holding Times

All sample analyses holding time requirements were met.

Summary

Silver and cadmium are reported as non-detected estimated (UJ) in aqueous rinsate blank sample BRSWRB01. The post digestion spike recoveries were between 40-85%, and the MS/MSD recoveries for these elements were below 75%. The results are low biased and the possibility of false negatives exists.

Chromium and selenium were detected in the solid preparation blank at 0.45mg/Kg and 1.64mg/Kg respectively and the action levels were 2.25mg/Kg and 8.2mg/Kg respectively. Chromium results were above the action level so no chromium results required qualification.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

The selenium result for sample BRSWSB17 was reported as non-detected (U) at the method quantitation level (10mg/Kg) due to the preparation blank contamination. Selenium was reported in the sample at a concentration below the selenium blank action level.

Antimony, arsenic, barium and lead results for sample BRSWSB17 are reported as estimated (J). These results are between the method detection limit and the method quantitation limit. Barium and lead results for sample BRSWSB19 are reported as estimated (J). These results are between the method detection limit and the method quantitation limit.

Chromium results are reported as estimated (J) based upon the laboratory duplicate precision 21.1% RPD.

Tables 1a and 1b summarize the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic soils
Table 1b Inorganic aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Soil Recommendation Summary

Antimony	A, J[1]
Arsenic	A, J[1]
Barium	J[2]
Cadmium	A
Chromium	J[3]
Lead	J[2]
Mercury	A
Selenium	A
Silver	A

A- Accept all data

J[1]- Antimony and arsenic results are reported as estimated (J) for sample BRSWSB17. These results are between the method detection limit and the method quantitation limit.

J[2]- Barium and lead results are reported as estimated (J) for samples BRSWSB17 and BRSWSB19. These results are between the method detection limit and the method quantitation limit.

J[3]- Chromium results are estimated (J) due to laboratory duplicate precision.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Water Recommendation Summary

Antimony	A
Arsenic	A
Barium	A
Cadmium	J^1
Chromium	A
Lead	A
Mercury	A
Selenium	A
Silver	J^1

A- Accept all data
J^1- Cadmium and silver results are reported as non-detected estimated (UJ). The MS/MSD recoveries were below the 75-125% acceptance criteria. The possibility of false negatives exists.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE 1 **Inorganic Validated Results**

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSB17	BRSWSB19		
Sample Location:						
Sample Type:			SOIL/LOW	SOIL/LOW		
Lab Sample Number:			9911025-01B	9911025-03B		
Percent Solids:			91.2	90.8		
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/19/1999	11/19/1999		
Notes:						
		Report				
Inorganic Analysis	Method	Limit*	mg/kg	mg/kg		
Antimony	6010B	4	2.0 J	5.2 U		
Arsenic	6010B	5	1.5 J	6.6 U		
Barium	6010B	20	12 J	14 J		
Cadmium	6010B	0.5	0.65 U	0.66 U		
Chromium	6010B	1	7.6 J	8.2 J		
Lead	6010B	5	4.0 J	3.4 J		
Selenium	6010B	8	10 U	10 U		
Silver	6010B	1.4	1.8 U	1.8 U		
Mercury	7471B	0.025	0.026U	0.025 U		

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE 1

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9911025
Site: Gordon Craig Army Reserve

Sample Number:			BRSWRB01			
Sample Location:						
Sample Type:			Aqueous			
Lab Sample Number:			9911025-02E			
Percent Solids:			0.0			
Dilution Factor:			1			
Dilution Factor:						
Date Sampled:			11/19/1999			
Notes:						
		Report				
Inorganic Analysis	Method	Limit	ug/L			
Antimony	7041	5	5 U			
Arsenic	6010B	25	25 U			
Barium	6010B	200	200 U			
Cadmium	7131	0.5	0.5 UJ			
Chromium	6010B	10	10 U			
Lead	7421	5	5 U			
Selenium	6010B	40	40 U			
Silver	7761	0.5	0.5 UJ			
Mercury	7470	0.2	0.2 U			

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Date Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - Value is rejected.

Jan. 29, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/24/99
1 Rinsate blank
Lab Order: 9911036

Semivolatile Organics Analysis

Samples Collected:

BRSWRB02 (rinsate)		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
* - sample log-in documents
* - rinsate blanks, and method blanks
- MS/MSD results
- LCS results
* - field duplicate results
* - laboratory duplicate results
- surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were not received in individual plastic bags. Custody seals were not present.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 2° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved. Preservation information was provided and indicates that all samples were properly preserved.

Field Blanks and Method Blanks

All method preparation blank results were non-detected.

Matrix Spike / Matrix Spike Duplicate Results

All aqueous MS/MSD laboratory acceptance criteria were met. Due to laboratory error the full SVOC compound list was not added to the MS/MSD samples. The full analyte list was used for the laboratory LCS sample.

Laboratory Control Sample

The LCS benzidine recovery was 0%. The benzidine result is rejected (R). Benzidine is not listed on The DQO list for the Gordon Craig Site.

Field Duplicate Results

No field duplicate samples were collected on 11/24/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911036.

Surrogate Results

The nitrobenzene-d5 surrogate recovery exceeded the laboratory acceptance range. All results are reported as non-detected (U), therefore no results are qualified.

Holding Times

All analytical holding times were met.

Summary

The benzidine LCS recovery was 0%. The benzidine result is rejected.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8270C SVOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia SVOC aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB02	A, R

A Accept all data.

R Reject benzidine result. The LCS recovery was 0%.

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB02			
Lab Sample Number:		9911036-01C			
Matrix/Analysis:		Aqueous/Low			
Sample Type:		Rinsate Blank			
Dilution Factor:		1			
Date Sampled:		11/24/1999			
Date Extracted:		11/29/1999			
Date Analyzed		12/02/1999			
Percent Moisture:		NA			
	Reporting				
Compounds	Limit	ug/L			
N-nitrosodimethylamine	20	20 U			
Phenol	10	10 U			
bis(2-Chloroethyl) ether	10	10 U			
2-Chlorophenol	10	10 U			
1,3-Dichlorobenzene	10	10 U			
1,4-Dichlorobenzene	10	10 U			
Benzyl Alcohol	20	20 U			
2-Methylphenol	10	10 U			
1,2-Dichlorobenzene	10	10 U			
Bis(2-chloroisopropyl)ether	10	10 U			
4-Methylphenol	10	10 U			
n-Nitroso-di-n-propylamine	10	10 U			
Hexachloroethane	10	10 U			
Nitrobenzene	10	10 U			
Isophorone	10	10 U			
2,4-Dimethylphenol	10	10 U			
Benzoic Acid	20	20 U			
2-Nitrophenol	10	10 U			
bis(2-Chloroethoxy) methane	10	10 U			
2,4-Dichlorophenol	10	10 U			
1,2,4-Trichlorobenzene	10	10 U			
Naphthalene	10	10 U			
4-Chloroaniline	10	10 U			
Hexachlorobutadiene	10	10 U			
4-Chloro-3-methylphenol	20	20 U			
2-Methylnaphthalene	10	10 U			
Hexachlorocyclopentadiene	10	10 U			
2,4,6-Trichlorophenol	10	10 U			
2,4,5-Trichlorophenol	10	10 U			
2-Chloronaphthalene	10	10 U			
2-Nitroaniline	20	20 U			

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB02			
Lab Sample Number:		9911036-01C			
Matrix/Analysis:		Aqueous/Low			
Sample Type:		Rinsate Blank			
Dilution Factor:		1			
Date Sampled:		11/24/1999			
Date Extracted:		11/29/1999			
Date Analyzed		12/02/1999			
Percent Moisture:		NA			
	Reporting				
Compounds	Limit	ug/L			
Dimethyl phthalate	10	10 U			
2,6-Dinitrotoluene	10	10 U			
Acenaphthylene	10	10 U			
3-Nitroaniline	20	20 U			
4-Nitrophenol	20	20 U			
2,4-Dinitrophenol	20	10 U			
Acenaphthene	10	10 U			
2,4-Dinitrotoluene	10	10 U			
Dibenzofuran	10	10 U			
Diethyl phthalate	10	10 U			
4-Chlorophenyl phenyl ether	10	10 U			
Fluorene	10	10 U			
4-Nitroaniline	20	20 U			
4,6-Dinitro-2-methylphenol	20	20 U			
n-Nitrosodiphenylamine	10	10 U			
1,2-Diphenylhydrazine	10	10 U			
4-Bromophenyl phenylether	10	10 U			
Hexachlorobenzene	10	10 U			
Pentachlorophenol	20	20 U			
Phenanthrene	10	10 U			
Anthracene	10	10 U			
Carbazole	10	10 U			
Di-n-butyl phthalate	10	10 U			
Fluoranthene	10	10 U			
Benzidine	20	R			
Pyrene	10	10 U			
Butyl benzyl phthalate	10	10 U			
bis(2-ethylhexyl) phthalate	10	10 U			
3,3'-Dichlorobenzidine	10	10 U			
Benzo(a)anthracene	10	10 U			
Chrysene	10	10 U			

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB02			
Lab Sample Number:		9911036-01C			
Matrix/Analysis:		Aqueous/Low			
Sample Type:		Rinsate Blank			
Dilution Factor:		1			
Date Sampled:		11/24/1999			
Date Extracted:		11/29/1999			
Date Analyzed		12/02/1999			
Percent Moisture:		NA			
	Reporting				
Compounds	Limit	ug/L			
Di-n-octyl phthalate	10	10 U			
Benzo(b)fluoranthene	10	10 U			
Benzo(k)fluoranthene	10	10 U			
Benzo(a)pyrene	10	10 U			
Dibenz(a,h)anthracene	10	10 U			
Indeno(1,2,3-cd)pyrene	10	10 U			
Benzo(g,h,i)perylene	10	10 U			

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Jan. 30, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/24/99
1 rinsate blank and 1 trip blank
Lab Order: 9911036

Volatile Organics Analysis

Samples Collected:

BRSWRB02(rinsate)	Trip Blank VII (aq)		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results

* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were not received in individual plastic bags. Custody seals were not present

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 2° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved. Preservation information was provided and indicates that all samples were properly preserved.

Trip Blanks, Field Blanks, and Method Blanks

All VOA results for the aqueous method blank were reported as non-detected. No results are qualified based upon the VOA preparation blank results.

Methylene chloride was detected in Trip Blank VII at 0.94ug/L. The result is below the method quantitation limit and is reported as estimated (J). Methylene chloride was not detected in the accompanying samples. No results are qualified based upon the Trip Blank VII results.

Matrix Spike / Matrix Spike Duplicate Results

The aqueous MS/MSD sample was BRSWSW03 (9911033-09, collected 11/23/99). These sample results were not used to evaluate samples BRSWRB02 and Trip Blank VII. No validation actions are required based upon the MS/MSD results.

Laboratory Control Sample

The QAPP has listed the 8260B LCS acceptance recoveries for select compounds as 80-120% and the laboratory forms indicate that the laboratory acceptance criterion is 70-130%. The validator used the 80-120% QAPP criterion for specified compounds 1,1-Dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene and the laboratory specified 70-130%

acceptance criterion for non-QAPP specified compounds. A list of compounds not meeting these criteria is summarized below.

Compound	% Recovery	Action
Dichlorodifluoromethane	52.4	Non-detects UJ; Detects J
Chloromethane	65.9	Non-detects UJ; Detects J
Trichlorofluoromethane	44.7	Non-detects U; Detects J

The dichlorodifluoromethane, chloromethane, and trichlorofluoromethane results for sample BRSWRB02 and Trip Blank VII are reported as non-detected estimated (UJ) and the results may be biased low.

Field Duplicate Results

No field duplicate samples were collected on 11/24/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911036.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended. Note that the QAPP specified acceptance range for VOA surrogates is 80-120% and the laboratory form 1 surrogate recovery criteria is 70-130%. The validator used the QAPP specified 80-120% criteria for this validation.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The methylene chloride result for sample Trip Blank VII was reported as estimated (J). The result is below the method quantitation level.

The LCS recoveries for dichlorodifluoromethane, chloromethane, and trichlorofluoromethane did not meet the 70-130% laboratory acceptance criteria. These compound results for sample BRSWRB02 and Trip Blank VII are reported as non-detected estimated (UJ) and the results may be biased low.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8260 VOC results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB02	A, J^1
Trip Blank VII	A, J^1, J^2

A Accept all data.

J^1 Dichlorodifluoromethane, chloromethane, and trichlorofluoromethane results are reported as non-detected estimated (UJ). LCS recoveries were low and false negatives are possible.

J^2 Methylene chloride is reported as estimated 0.94ug/L (J). The result is below the method quantitation level.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWRB02	Trip Blank VII			
S&W Sample (cont)						
Lab Sample Number:		9911036-01A	9911036-02A			
Matrix/Analysis:		Aq/Low	Aq/Low			
Sample Type:						
Dilution Factor:						
Date Sampled:		11/24/1999	11/24/1999			
Date Extracted:		11/30/1999	11/30/1999			
Date Analyzed:		11/30/1999	11/30/1999			
Percent Moisture:		NA	NA			
	Report					
Target Compounds	Limit	ug/L	ug/L			
Dichlorodifluoromethane	5	5.0 UJ	5.0 UJ			
Chloromethane	5	5.0 UJ	5.0 UJ			
Vinyl Chloride	2	2.0 U	2.0U			
Chloroethane	5	5.0 U	5.0 U			
Bromomethane	5	5.0 U	5.0 U			
Trichlorofluoromethane	2	2.0 UJ	2.0 UJ			
Acetone	10	10.0U	10.0U			
1.1-Dichloroethene	1	1.0 U	1.0 U			
Carbon disulfide	2	2.0 U	2.0 U			
Methylene Chloride	5	5.0 U	0.94 J			
Methyl tert-butyl ether	2	2.0 U	2.0 U			
trans-1,2-Dichloroethene	2	2.0 U	2.0 U			
1,1-Dichloroethane	2	2.0 U	2.0 U			
2-Butanone	10	10.0 U	10.0 U			
2,2-Dichloropropane	2	2.0 U	2.0 U			
cis-1,2-Dichloroethene	2	2.0 U	2.0 U			
Chloroform	2	2.0 U	2.0 U			
Bromochloromethane	2	2.0 U	2.0 U			
1,1,1-Trichloroethane	2	2.0 U	2.0 U			
1,1-Dichloropropene	2	2.0 U	2.0 U			
Carbon tetrachloride	2	2.0 U	2.0 U			
1,2-Dichloroethane	2	2.0 U	2.0 U			
Benzene	2	2.0 U	2.0 U			
Trichloroethene	2	2.0 U	2.0 U			
1,2-Dichloropropane	2	2.0 U	2.0 U			
Bromodichloromethane	2	2.0 U	2.0 U			
Dibromomethane	2	2.0 U	2.0 U			
4-Methyl-2-pentanone	10	10.0 U	10.0 U			
cis-1,3-Dichloropropene	1	1.0 U	1.0 U			
Toluene	2	2.0 U	2.0 U			
trans-1,3-Dichloropropene	1	1.0 U	1.0 U			
1,1,2-Trichloroethane	2	2.0 U	2.0 U			
1,2-Dibromoethane	2	2.0 U	2.0 U			
2-Hexanone	10	10.0 U	10.0 U			
1,3-Dichloropropane	2	2.0 U	2.0 U			
Tetrachloroethene	2	2.0 U	2.0 U			

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWRB02	Trip Blank VII			
S&W Sample (cont)						
Lab Sample Number:		9911036-01A	9911036-02A			
Matrix/Analysis:		Aq/Low	Aq/Low			
Sample Type:						
Dilution Factor:						
Date Sampled:		11/24/1999	11/24/1999			
Date Extracted:		11/30/1999	11/30/1999			
Date Analyzed:		11/30/1999	11/30/1999			
Percent Moisture:		NA	NA			
Dibromochloromethane	2	2.0 U	2.0 U			

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWRB02	Trip Blank VII			
S&W Sample (cont)						
Lab Sample Number:		9911036-01A	9911036-02A			
Matrix/Analysis:		Aq/Low	Aq/Low			
Sample Type:						
Dilution Factor:						
Date Sampled:		11/24/1999	11/24/1999			
Date Extracted:		11/30/1999	11/30/1999			
Date Analyzed:		11/30/1999	11/30/1999			
Percent Moisture:		NA	NA			
Chlorobenzene	2	2.0 U	2.0 U			
1,1,1,2-Tetrachloroethane	2	2.0 U	2.0 U			
Ethylbenzene	2	2.0 U	2.0 U			
m,p-Xylene	2	2.0 U	2.0 U			
o-Xylene	2	2.0 U	2.0 U			
Styrene	2	2.0 U	2.0 U			
Bromoform	2	2.0 U	2.0 U			
Isopropylbenzene	2	2.0 U	2.0 U			
1,1,2,2-Tetrachloroethane	2	2.0 U	2.0 U			
1,2,3-Trichloropropane	2	2.0 U	2.0 U			
Bromobenzene	2	2.0 U	2.0 U			
n-Propylbenzene	2	2.0 U	2.0 U			
2-Chlorotoluene	2	2.0 U	2.0 U			
4-Chlorotoluene	2	2.0 U	2.0 U			
1,3,5-Trimethylbenzene	2	2.0 U	2.0 U			
tert-Butylbenzene	2	2.0 U	2.0 U			
1,2,4,-Trimethylbenzene	2	2.0 U	2.0 U			
sec-Butylbenzene	2	2.0 U	2.0 U			
4-isopropyltoluene	2	2.0 U	2.0 U			
1,3-dichlorobenzene	2	2.0 U	2.0 U			
1,4-dichlorobenzene	2	2.0 U	2.0 U			
n-Butylbenzene	2	2.0 U	2.0 U			
1,2-Dichlorobenzene	2	2.0 U	2.0 U			
1,2-Dibromo-3-chloropropane	5	5.0 U	5.0 U			
1,2,4-Trichlorobenzene	2	2.0 U	2.0 U			
Hexachlorobutadiene	2	2.0 U	2.0 U			
Naphthalene	2	2.0 U	2.0 U			
1,2,3-Trichlorobenzene	2	2.0 U	2.0 U			

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Jan. 29, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/24/99
1 Aqueous Rinsate Blank
Lab Order: 9911036

Extractable Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWRB02		

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

* - chain of custody documents
* - sample log-in documents
* - rinsate blanks, and method blanks
* - MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were not received in individual plastic bags. Custody seals were not present.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 2° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved. Preservation information was provided and indicates that all samples were properly preserved.

Field Blanks, and Method Blanks

All method blank results were reported as non-detected. No results were qualified based upon the method blank results.

Matrix Spike / Matrix Spike Duplicate Results

Aqueous sample BRSWSW03 was analyzed as the MS/MSD sample. All laboratory acceptance criteria were met.

Laboratory Control Samples

All aqueous EPH LCS recoveries met the method acceptance criteria.

Field Duplicate Results

No field duplicate samples were collected on 11/24/99.

Laboratory Duplicate Results

The rinsate blank sample BRSWRB02 was analyzed as the EPH laboratory duplicate sample.

All results were reported as non-detected and no validation actions were taken based upon the laboratory duplicate results.

Rinsate blank samples should not be used as laboratory duplicate samples.

Surrogate Results

All aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8270C method surrogates were reported along with specified EPH surrogates.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All aqueous EPH results are accepted without qualification.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous EPH results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table 1a EPH aqueous

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Extractable Petroleum Hydrocarbon
Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB02	A

A Accept all data.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE 1

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

Sample Number:			BRSWRB02			
Sample Location:						
Sample Type:			Aqueous			
Lab Sample Number:			9911036-01D			
Percent Moisture:			N/A			
Dilution Factor:			1			
Dilution Factor:						
Date Sampled:			11/24/1999			
Date Extracted			11/29/1999			
Date Analyzed Aliphatics:			12/01/1999			
Date Analyzed PNA			12/01/1999			
Notes:						
		Report				
EPH ANALYTES	Method	Limit	ug/L			
C9-C18 Aliphatic (1)	8270C	100	100 U			
C19-C36 Aliphatic (1)	8270C	100	100 U			
C11-C22 Aromatics(1,2)	8270C	100	100 U			
Targeted PAH Analytes						
Naphthalene	8270C	1	1.0 U			
2-Methylnaphthalene	8270C	1	1.0 U			
Acenaphthylene	8270C	1	1.0 U			
Acenaphthene	8270C	1	1.0 U			
Fluorene	8270C	1	1.0 U			
Phenanthrene	8270C	1	1.0 U			
Anthracene	8270C	1	1.0 U			
Fluoranthene	8270C	1	1.0 U			
Pyrene	8270C	1	1.0 U			
Benzo(a)anthracene	8270C	1	1.0 U			
Chrysene	8270C	1	1.0 U			
Benzo(b)fluoranthene	8270C	1	1.0 U			
Benzo(k)fluoranthene	8270C	1	1.0 U			
Benzo(a)pyrene	8270C	1	1.0 U			
Indeno(1,2,3-cd)pyrene	8270C	1	1.0 U			
Dibenzo(a,h)anthracene	8270C	1	1.0 U			
Benzo(g,h,i)perylene	8270C	1	1.0 U			

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 30, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/24/99
1 rinsate blank and 1 trip blank
Lab Order: 9911036

Volatile Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWRB02	Trip Blank VII		

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

*- chain of custody documents
* - sample log-in documents
*- trip blanks, rinsate blanks, and method blanks
*- MS/MSD results
*- LCS results
*- field duplicate results
*- laboratory duplicate results
*- surrogate recoveries
*- holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were not received in individual plastic bags. Custody seals were not present.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 2° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved. Preservation information was provided and indicates that all samples were properly preserved.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the VPH preparation blank, rinaste blank BRSWRB02 (11/24/99) and trip blank VII.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWSW03 (9911033-09) was analyzed as the aqueous MS/MSD VPH sample. All MS/MSD acceptance criteria were met. No results were qualified based upon the MS/MSD results.

Laboratory Control Samples

Al l aqueous laboratory control sample recoveries met the method specified recovery criteria

Field Duplicate Results

No field duplicate samples were collected on 11/24/99.

Laboratory Duplicates

All laboratory duplicate sample results were reported as non-detected. The laboratory duplicate VPH sample was not from the Gordon Craig site. No validation actions were taken based upon the laboratory duplicate results.

Surrogate Results

All aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8260B method surrogates were reported along with VPH surrogate 2,5-Dibromotoluene.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All VPH results are accepted without qualification.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous VPH results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table 1a VPH aqueous results

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Volatile Petroleum Hydrocarbon Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB02	A
Trip Blank VII (aq)	A

A Accept all results without qualification

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

Sample Number:			BRSWRB02	Trip BlankVII		
Sample Location:						
Sample Type:			Aqueous	Aqueous		
Lab Sample Number:			9911036-01B	9911036-02B		
Percent moisture:						
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/24/1999	11/24/1999		
Date Analyzed:			11/30/1999	11/30/1999		
Notes:						
		Report				
VPH ANALYTES	Method	Limit*	ug/L	ug/L		
C5-C8 Aliphatic (1,2)	8260	100	100 U	100 U		
C9-C12 Aliphatic(1,3)	8260	25	25 U	25 U		
C9-C10 Aromatics(1)	8260	25	25 U	25 U		
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	2.0	2.0 U	2.0 U		
Benzene	8260	2.0	2.0 U	2.0 U		
Toluene	8260	2.0	2.0 U	2.0 U		
Ethylbenzene	8260	2.0	2.0 U	2.0 U		
m,p-Xylene	8260	2.0	2.0 U	2.0 U		
o-Xylene	8260	2.0	2.0 U	2.0 U		
Napthalene	8260	2.0	2.0 U	2.0 U		

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution

Feb 11, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/24/99
1 Rinsate Blank Sample
Lab Order: 9911036

Inorganic Analysis

BRSWRB02			

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Arsenic, barium, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B and silver, cadmium, lead, and antimony were analyzed in the aqueous samples according to SW-846 EPA Methods 7761, 7131, 7421, and 7041 respectively. Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
MS /MSD results
* LCS results
Field duplicate results
* Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were not received in individual plastic bags. Custody seals not were present.

This rinsate blank sample was evaluated for samples submitted on 11/22/99 and 11/23/99.

The original data package did not include cadmium, silver, and lead results. The laboratory was asked to submit these results on 01/26/2000. The validator received these results on 02/04/2000.

Sample BRSWSW03 was the MS/MSD sample submitted on 11/23/99.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 2° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved. The sample was preserved, with HNO_3, to a pH <2. The laboratory reported the sample pH.

Field Blanks and Method Blanks

All aqueous method blank results were reported as non-detected. No aqueous results were qualified based upon these blank results.

MS/MSD Results

Aqueous sample BRSWSW03 (Lab order 9911033) was prepared as the batch MS/MSD samples. Silver and cadmium MS/MSD recoveries did not meet the laboratory acceptance criteria of 75-125%. These recoveries were low typically 60-74%, and sample matrix problems are indicated. The silver and cadmium results for sample BRSWRB02 are reported as non-detected estimated (UJ). A low bias is indicated and false negatives are possible.

LCS Results

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Aqueous LCS recoveries met the specified acceptance criteria. No results are qualified based upon the LCS results.

Field Duplicates

Aqueous samples BRSWSW03 and BRSWSW03D were a field duplicate pair. The cadmium field duplicate result % RPD was 31% and the Region 1 acceptance criterion is ± 30%. Cadmium is reported as non-detected estimated (UJ) in sample BRSWRB02 due to the low MS/MSD recoveries.

Laboratory Duplicates

No laboratory duplicate sample results were submitted with laboratory work order 9911036.

Holding Times

All sample analyses holding time requirements were met.

Summary

Silver and cadmium are reported as non-detected estimated (UJ) in rinsate blank sample BRSWRB02. The MS/MSD recoveries for these elements were below 75%. The results are low biased and the possibility of false negatives exists.

All other element results are reported as non-detected (U).

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Water Recommendation Summary

Antimony	A
Arsenic	A
Barium	A
Cadmium	J^1
Chromium	A
Lead	A
Mercury	A
Selenium	A
Silver	J^1

A- Accept all results

J^1- Estimate cadmium and silver results as non-detected estimated (UJ) due to low MS/MSD recoveries. False negative results are possible.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

Sample Number:			BRSWRB02			
Sample Location:						
Sample Type:			Aqueous			
Lab Sample Number:			9911036-01E			
Percent Solids:			0.0			
Dilution Factor:						
Dilution Factor:						
Date Sampled:			11/24/1999			
Notes:			Rinsate Blank			
		Report				
Inorganic Analysis	Method	Limit	ug/L			
Antimony	7041	5	5.0 U			
Arsenic	6010B	25	25 U			
Barium	6010B	200	200 U			
Cadmium	7131	0.5	0.50 UJ			
Chromium	6010B	10	10 U			
Lead	7421	5	5.0 U			
Selenium	6010B	40	40 U			
Silver	7761	0.5	0.50 UJ			
Mercury	7470	0.2	0.2 U			

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Date Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - Value is rejected.

Jan. 31, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/30/99
2 Groundwater samples 1 rinsate blank
Lab Order: 9911041

Calcium Magnesium Hardness Analysis

BRSWGW01	BRSWGW02	BRSWRB03

Dear Ms. Doherty:

A modified Tier II data validation was performed on calcium magnesium hardness analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Calcium and magnesium were determined by ICP method 6010B. Hardness was calculated from the calcium and magnesium results.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

* Chain of custody documents
* Sample log-in documents
* Field blanks, and method blanks
* MS /MSD results
* LCS results
* Field duplicate results
* Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

The original form 1 identified sample BRSWRB03 as BRSWGW03. Stone & Webster notified the laboratory and corrected forms were submitted.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 11/30/99 and received at the laboratory 3.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. Sample preservation information was provided and indicates that the hardness samples were properly preserved to a pH <2 with HNO_3.

Field Blanks and Method Blanks

The hardness method blank was reported as non-detected (U). No results are qualified based upon the blank results.

The hardness result for rinsate blank, BRSWRB03, (collected 11/30/99) was reported as non-detected (U).

MS/MSD Results

Sample BRSWGW13 (collected 12/03/99) was analyzed as the MS/MSD sample. All precision and recovery criteria were met. No results are qualified based upon the MS/MSD results.

LCS Results

The LCS acceptance criterion was met. No hardness results are qualified based upon the LCS result.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 🖳 Electronic Mail: tlewis1260@aol.com

Field Duplicates

No field duplicate samples were submitted with the samples collected on 11/30/99.

Laboratory Duplicates

No laboratory duplicate samples were analyzed with laboratory order 9911041.

Holding Times

All sample analyses holding time requirements were met.

Summary

All hardness results are accepted without qualification.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Calcium Magnesium Hardness

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Aqueous Hardness Recommendation Summary

BRSWGW01	A
BRSWGW02	A
BRSWRB03	A

A- Accept all data

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

Calcium Magnesium Hardness Validated Results

Project No.: 05000.33
Lab Order: 9911036
Site: Gordon Craig Army Reserve

Sample Number:			BRSWRB02				
Sample Location:							
Sample Type:			Aqueous Low				
Lab Sample Number:			9911036-01E				
Percent moisture:			NA				
Dilution Factor:			1				
Dilution Factor:							
Date Sampled:			11/24/99				
Date Analyzed:			12/01/99				
Notes:							
		Report					
ANALYTES	Method	Limit*	mg/L				
Ca-Mg Hardness	6010B	33	33 U				

Analytical Method:
Hardness determined by calculation using calcium and magnesium results obtained by ICP (method 6010B) analyses.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 31, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/30/99
2 Aqueous samples 1 Rinsate blank
Lab Order: 9911041

Semivolatile Organics Analysis

Samples Collected:

BRSWGW01	BRSWGW02	BRSWRB03 (rinsate)

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
* - rinsate blanks, and method blanks
- MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
- surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

The original SVOA form 1 identified sample BRSWRB03 as BRSWGW03. Stone & Webster notified the laboratory and corrected forms were submitted.

The laboratory reported only the aliphatic and aromatic range results. The individual target compound results were not reported. The COC did not specify whether the complete list or the ranges were requested.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 11/30/99 and received at the laboratory 3.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

Field Blanks and Method Blanks

All method preparation blank results were non-detected. All rinsate blank sample BRSWRB03 semivolatile results were reported as non-detected. No results are qualified based upon the blank results.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWGW13 (9912007-01, collected 12/3/99) was analyzed as the MS/MSD sample pair. MS/MSD results are typically used to qualify results from the non-spiked sample. The MS/MSD recoveries for benzidine 0% and 4.5% respectively. The LCS benzidine recovery was 64%. No validation actions were taken based upon the MS/MSD results. Benzidine is not listed in the QAPP as a contaminant of concern.

Laboratory Control Sample

All LCS recovery criteria were met.

Field Duplicate Results

No field duplicate samples were collected on 11/30/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911041.

Surrogate Results

The terphenyl-d14 surrogate recovery, for sample BRSWGW01, exceeded the laboratory acceptance range at 97.4%. All results are reported as non-detected (U), therefore no results are qualified.

The phenol-d5 QAPP surrogate recovery acceptance range is 26-53%. The phenol-d5 surrogate recovery for the method blank is 25.5% and indicates potential laboratory extraction problems. The phenol-d5 acceptance criteria were met for the field samples. Phenol was detected in samples BRSWGW01 and BRSWGW02 at concentrations below the method quantitation limit. These results are reported as estimated (J). Based upon the surrogate recoveries these phenol results are likely biased low.

Holding Times

All analytical holding times were met.

Summary

The phenol results for samples BRSWGW01 and BRSWGW02 are reported as estimated (J). The results are between the method detection limit and the method quantitation limit. The phenol-d5 surrogate recoveries for these samples meet the laboratory acceptance criteria, however the surrogate recoveries do indicate a significant low bias. These phenol-d5 recoveries were between 27% and 33%. The phenol-d5 recovery for the extraction method blank was low and did not meet the laboratory acceptance criteria. Possible sample preparation problems are indicated.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8270C SVOC results respectively. Validated result tables are appended to this submittal.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a SVOC aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW01	A, J^1
BRSWGW02	A, J^1
BRSWRB03	A

A Accept all data.

J^1 Phenol results are reported as estimated (J). The reported results are below the method quantitation level. The phenol results may be biased low based upon phenol-d5 surrogate recoveries.

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW01	BRSWGW02	BRSWRB03	
Lab Sample Number:		9911041-01B	9911041-02B	9911041-03B	
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	
Sample Type:				Rinsate Blank	
Dilution Factor:		1	1	1	
Date Sampled:		11/30/99	11/30/99	11/30/99	
Date Extracted:		12/06/99	12/06/99	12/06/99	
Date Analyzed		12/07/99	12/07/99	12/07/99	
Percent Moisture:		NA	NA	NA	
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	
N-nitrosodimethylamine	20	20 U	20 U	20 U	
Phenol	10	2.1 J	1.8 J	10 U	
bis(2-Chloroethyl) ether	10	10 U	10 U	10 U	
2-Chlorophenol	10	10 U	10 U	10 U	
1,3-Dichlorobenzene	10	10 U	10 U	10 U	
1,4-Dichlorobenzene	10	10 U	10 U	10 U	
Benzyl Alcohol	20	20 U	20 U	20 U	
2-Methylphenol	10	10 U	10 U	10 U	
1,2-Dichlorobenzene	10	10 U	10 U	10 U	
Bis(2-chloroisopropyl)ether	10	10 U	10 U	10 U	
4-Methylphenol	10	10 U	10 U	10 U	
n-Nitroso-di-n-propylamine	10	10 U	10 U	10 U	
Hexachloroethane	10	10 U	10 U	10 U	
Nitrobenzene	10	10 U	10 U	10 U	
Isophorone	10	10 U	10 U	10 U	
2,4-Dimethylphenol	10	10 U	10 U	10 U	
Benzoic Acid	20	20 U	20 U	20 U	
2-Nitrophenol	10	10 U	10 U	10 U	
bis(2-Chloroethoxy) methane	10	10 U	10 U	10 U	
2,4-Dichlorophenol	10	10 U	10 U	10 U	
1,2,4-Trichlorobenzene	10	10 U	10 U	10 U	
Naphthalene	10	10 U	10 U	10 U	
4-Chloroaniline	10	10 U	10 U	10 U	
Hexachlorobutadiene	10	10 U	10 U	10 U	
4-Chloro-3-methylphenol	20	20 U	20 U	20 U	
2-Methylnaphthalene	10	10 U	10 U	10 U	
Hexachlorocyclopentadiene	10	10 U	10 U	10 U	
2,4,6-Trichlorophenol	10	10 U	10 U	10 U	
2,4,5-Trichlorophenol	10	10 U	10 U	10 U	
2-Chloronaphthalene	10	10 U	10 U	10 U	
2-Nitroaniline	20	20 U	20 U	20 U	

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW01	BRSWGW02	BRSWRB03	
Lab Sample Number:		9911041-01B	9911041-02B	9911041-03B	
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	
Sample Type:				Rinsate Blank	
Dilution Factor:		1	1	1	
Date Sampled:		11/30/99	11/30/99	11/30/99	
Date Extracted:		12/06/99	12/06/99	12/06/99	
Date Analyzed		12/07/99	12/07/99	12/07/99	
Percent Moisture:		NA	NA	NA	
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	
Dimethyl phthalate	10	10 U	10 U	10 U	
2,6-Dinitrotoluene	10	10 U	10 U	10 U	
Acenaphthylene	10	10 U	10 U	10 U	
3-Nitroaniline	20	20 U	20 U	20 U	
4-Nitrophenol	20	20 U	20 U	20 U	
2,4-Dinitrophenol	20	10 U	10 U	10 U	
Acenaphthene	10	10 U	10 U	10 U	
2,4-Dinitrotoluene	10	10 U	10 U	10 U	
Dibenzofuran	10	10 U	10 U	10 U	
Diethyl phthalate	10	10 U	10 U	10 U	
4-Chlorophenyl phenyl ether	10	10 U	10 U	10 U	
Fluorene	10	10 U	10 U	10 U	
4-Nitroaniline	20	20 U	20 U	20 U	
4,6-Dinitro-2-methylphenol	20	20 U	20 U	20 U	
n-Nitrosodiphenylamine	10	10 U	10 U	10 U	
1,2-Diphenylhydrazine	10	10 U	10 U	10 U	
4-Bromophenyl phenylether	10	10 U	10 U	10 U	
Hexachlorobenzene	10	10 U	10 U	10 U	
Pentachlorophenol	20	20 U	20 U	20 U	
Phenanthrene	10	10 U	10 U	10 U	
Anthracene	10	10 U	10 U	10 U	
Carbazole	10	10 U	10 U	10 U	
Di-n-butyl phthalate	10	10 U	10 U	10 U	
Fluoranthene	10	10 U	10 U	10 U	
Benzidine	20	20 U	20 U	20 U	
Pyrene	10	10 U	10 U	10 U	
Butyl benzyl phthalate	10	10 U	10 U	10 U	
bis(2-ethylhexyl) phthalate	10	10 U	10 U	10 U	
3,3'-Dichlorobenzidine	10	10 U	10 U	10 U	
Benzo(a)anthracene	10	10 U	10 U	10 U	
Chrysene	10	10 U	10 U	10 U	

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW01	BRSWGW02	BRSWRB03	
Lab Sample Number:		9911041-01B	9911041-02B	9911041-03B	
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	
Sample Type:				Rinsate Blank	
Dilution Factor:		1	1	1	
Date Sampled:		11/30/99	11/30/99	11/30/99	
Date Extracted:		12/06/99	12/06/99	12/06/99	
Date Analyzed		12/07/99	12/07/99	12/07/99	
Percent Moisture:		NA	NA	NA	
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	
Di-n-octyl phthalate	10	10 U	10 U	10 U	
Benzo(b)fluoranthene	10	10 U	10 U	10 U	
Benzo(k)fluoranthene	10	10 U	10 U	10 U	
Benzo(a)pyrene	10	10 U	10 U	10 U	
Dibenz(a,h)anthracene	10	10 U	10 U	10 U	
Indeno(1,2,3-cd)pyrene	10	10 U	10 U	10 U	
Benzo(g,h,i)perylene	10	10 U	10 U	10 U	

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Feb. 01, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/30/99
2 Groundwater samples 1 rinsate blank and 1 trip blank
Lab Order: 9911041

Volatile Organics Analysis

Samples Collected:

BRSWGW01	BRSWGW02	BRSWRB03	Trip Blank 07 (aq)

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results

* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

The original VOA form 1 identified sample BRSWRB03 as BRSWGW03. Stone & Webster notified the laboratory and corrected forms were submitted.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 11/30/99 and received at the laboratory 3.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved, however the pH's of the VOA vials were not recorded. The laboratory should record and report these sample pHs.

Trip Blanks, Field Blanks, and Method Blanks

All VOA results for the aqueous method blank, the rinsate blank sample BRSWRB03, and the Trip Blank 07 were reported as non-detected. No results are qualified based upon the VOA blank results.

Matrix Spike / Matrix Spike Duplicate Results

The aqueous MS/MSD sample was BRSWRB03 (9911041-03, collected 11/30/99). This sample is the rinsate blank sample. The laboratory should not use field rinsate blank samples for quality control samples.

Results not meeting the MS/MSD laboratory acceptance criteria are summarized below. The laboratory acceptance criteria, listed on the MS/MSD QC summary report, is 70-130%. The

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

QAPP surface water/groundwater MS/MSD recovery limits are 80-120% for 1,1-dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene. The validator used the acceptance recoveries specified in the QAPP for the specified compounds and the laboratory acceptance criteria for the remaining compounds. The laboratory %RPD acceptance criterion is $\leq$ 25%. Results not meeting the MS/MSD laboratory acceptance criteria are summarized below.

Compound	MS % Recovery	MSD % Recovery	% RPD	Action
Trichlorofluoromethane	56.2	72.6	25.4	Non-detects UJ; Detects J
Acetone	56	109	64.2	Non-detects UJ; Detects J

The trichlorofluoromethane and acetone results for sample BRSWRB03 (rinsate blank sample collected 11/30/99) are reported as non-detected estimated (UJ). False negative results are possible. Poor analytical precision is indicated by the MS/MSD relative percent difference results.

Laboratory Control Sample

The QAPP has listed the 8260B LCS acceptance recoveries for select compounds as 80-120% and the laboratory forms indicate that the laboratory acceptance criterion is 70-130%. The validator used the 80-120% QAPP criterion for specified compounds 1,1-Dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene and the laboratory specified 70-130% acceptance criterion for non-QAPP specified compounds. A list of compounds not meeting these criteria is summarized below.

Compound	% Recovery	Action
Trichlorofluoromethane	48.8	Non-detects UJ; Detects J

All trichlorofluoromethane results are reported as non-detected estimated (UJ). False negative results are possible.

Field Duplicate Results

No field duplicate samples were collected on 11/30/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911041.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended. Note that the QAPP specified acceptance range for VOA surrogates is 80-

120% and the laboratory form 1 surrogate recovery criteria is 70-130%. The validator used the QAPP specified 80-120% criteria for this validation.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

Based upon the low MS/MSD recoveries the acetone and the trichlorofluoromethane results are reported as non-detected estimated (UJ), and false negative results are possible.

Based upon the low LCS trichlorofluoromethane recovery, all trichlorofluoromethane results are reported as non-detected estimated (UJ), and false negative results are possible.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8260 VOC results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW01	A, J^1
BRSWGW02	A, J^1
BRSWRB03	A, J^1, J^2
Trip Blank 07	A, J^1

A Accept all data.

J^1 Trichlorofluoromethane results are reported as non-detected estimated (UJ). LCS recoveries were low and false negatives are possible.

J^2 The acetone and trichlorofluoromethane results are reported as non-detected estimated (UJ). MS/MSD recoveries were low and false negatives are possible.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW01	BRSWGW02	BRSWRB03	Trip Blank 07	
S&W Sample (cont)						
Lab Sample Number:		*9911041-01A*	*9911041-02A*	*9911041-03A*	*9911041-04A*	
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	Aq/Low	
Sample Type:				Rinsate Blank	Trip Blank	
Dilution Factor:						
Date Sampled:		11/30/99	11/30/99	11/30/99	11/30/99	
Date Extracted:						
Date Analyzed:		12/03/99	12/02/99	12/02/99	12/02/99	
Percent Moisture:		NA	NA	NA	NA	
	Report					
Target Compounds	Limit	ug/L	ug/L	ug/L	ug/L	
Dichlorodifluoromethane	5	5.0 U	5.0 U	5.0 U	5.0 U	
Chloromethane	5	5.0 U	5.0 U	5.0 U	5.0 U	
Vinyl Chloride	2	2.0 U	2.0U	2.0 U	2.0U	
Chloroethane	5	5.0 U	5.0 U	5.0 U	5.0 U	
Bromomethane	5	5.0 U	5.0 U	5.0 U	5.0 U	
Trichlorofluoromethane	2	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ	
Acetone	10	10.0U	10.0U	10.0UJ	10.0U	
1.1-Dichloroethene	1	1.0 U	1.0 U	1.0 U	1.0 U	
Carbon disulfide	2	2.0 U	2.0 U	2.0 U	2.0 U	
Methylene Chloride	5	5.0 U	5.0 U	5.0 U	5.0 U	
Methyl tert-butyl ether	2	2.0 U	2.0 U	2.0 U	2.0 U	
trans-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
2-Butanone	10	10.0 U	10.0 U	10.0 U	10.0 U	
2,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	
cis-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Chloroform	2	2.0 U	2.0 U	2.0 U	2.0 U	
Bromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1,1-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1-Dichloropropene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Carbon tetrachloride	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Benzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Trichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Bromodichloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Dibromomethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
4-Methyl-2-pentanone	10	10.0 U	10.0 U	10.0 U	10.0 U	
cis-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	
Toluene	2	2.0 U	2.0 U	2.0 U	2.0 U	
trans-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	
1,1,2-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dibromoethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
2-Hexanone	10	10.0 U	10.0 U	10.0 U	10.0 U	
1,3-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Tetrachloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW01	BRSWGW02	BRSWRB03	Trip Blank 07	
S&W Sample (cont)						
Lab Sample Number:		9911041-01A	9911041-02A	9911041-03A	9911041-04A	
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	Aq/Low	
Sample Type:				Rinsate Blank	Trip Blank	
Dilution Factor:						
Date Sampled:		11/30/99	11/30/99	11/30/99	11/30/99	
Date Extracted:						
Date Analyzed:		12/03/99	12/02/99	12/02/99	12/02/99	
Percent Moisture:		NA	NA	NA	NA	
Dibromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW01	BRSWGW02	BRSWRB03	Trip Blank 07	
S&W Sample (cont)						
Lab Sample Number:		9911041-01A	9911041-02A	9911041-03A	9911041-04A	
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	Aq/Low	
Sample Type:				Rinsate Blank	Trip Blank	
Dilution Factor:						
Date Sampled:		11/30/99	11/30/99	11/30/99	11/30/99	
Date Extracted:						
Date Analyzed:		12/03/99	12/02/99	12/02/99	12/02/99	
Percent Moisture:		NA	NA	NA	NA	
Chlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1,1,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Ethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
m,p-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	
o-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Styrene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Bromoform	2	2.0 U	2.0 U	2.0 U	2.0 U	
Isopropylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1,2,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2,3-Trichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Bromobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
n-Propylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
2-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	
4-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,3,5-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
tert-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2,4,-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
sec-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
4-isopropyltoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,3-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,4-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
n-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dibromo-3-chloropropane	5	5.0 U	5.0 U	5.0 U	5.0 U	
1,2,4-Trichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Hexachlorobutadiene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Naphthalene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2,3-Trichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Jan. 31, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/30/99
1 Aqueous Rinsate Blank
Lab Order: 9911041

Extractable Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWRB03		

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

* - chain of custody documents
* - sample log-in documents
* - rinsate blanks, and method blanks
* - MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

The laboratory reported only the aliphatic and aromatic range results. The individual target compound results were not reported. The COC did not specify whether the complete list or the ranges were requested.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 11/30/99 and received at the laboratory 3.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. Sample preservation information was provided and indicates that the EPH sample was properly preserved to a pH <2 with HCl.

Field Blanks, and Method Blanks

All method blank results were reported as non-detected. No results were qualified based upon the method blank results.

Matrix Spike / Matrix Spike Duplicate Results

Aqueous sample BRSWGW13 (9912007-01E, collected 12/03/99) was analyzed as the MS/MSD sample. The n-nonane and the n-tetradecane MS/MSD recoveries were low and did not meet the method specified 40-140% acceptance criteria. Typically MS/MSD results apply to only the non-spiked sample, therefore no results were qualified due to the MS/MSD recoveries. The n-nonane LCS recovery was 41.4% and the LCS recovery method acceptance range is 40-140%.

Laboratory Control Samples

All aqueous EPH LCS recoveries met the method acceptance criteria.

Field Duplicate Results

No field duplicate samples were collected on 11/30/99.

Laboratory Duplicate Results

The laboratory /laboratory duplicate pair were not from the Gordon Craig site. All EPH results are reported as non-detected (U). No results are qualified based upon the laboratory duplicate results.

Surrogate Results

All aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8270C method surrogates were reported along with specified EPH surrogates.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All aqueous EPH results are accepted without qualification.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous EPH results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table 1a EPH aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Extractable Petroleum Hydrocarbon
Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB03	A

A Accept all data.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

Sample Number:			BRSWRB03			
Sample Location:						
Sample Type:			Aqueous			
Lab Sample Number:			9911041-03E			
Percent Moisture:			N/A			
Dilution Factor:			1			
Dilution Factor:						
Date Sampled:			11/30/1999			
Date Extracted			12/07/99			
Date Analyzed Aliphatics:			12/08/99			
Date Analyzed PNA			12/08/99			
Notes:						
		Report				
EPH ANALYTES	Method	Limit	ug/L			
C9-C18 Aliphatic (1)	8270C	100	100 U			
C19-C36 Aliphatic (1)	8270C	100	100 U			
C11-C22 Aromatics(1,2)	8270C	100	100 U			
Targeted PAH Analytes						
Naphthalene	8270C	1	Not Reported			
2-Methylnaphthalene	8270C	1	Not Reported			
Acenaphthylene	8270C	1	Not Reported			
Acenaphthene	8270C	1	Not Reported			
Fluorene	8270C	1	Not Reported			
Phenanthrene	8270C	1	Not Reported			
Anthracene	8270C	1	Not Reported			
Fluoranthene	8270C	1	Not Reported			
Pyrene	8270C	1	Not Reported			
Benzo(a)anthracene	8270C	1	Not Reported			
Chrysene	8270C	1	Not Reported			
Benzo(b)fluoranthene	8270C	1	Not Reported			
Benzo(k)fluoranthene	8270C	1	Not Reported			
Benzo(a)pyrene	8270C	1	Not Reported			
Indeno(1,2,3-cd)pyrene	8270C	1	Not Reported			
Dibenzo(a,h)anthracene	8270C	1	Not Reported			
Benzo(g,h,i)perylene	8270C	1	Not Reported			

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

U - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 31, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/30/99
1 rinsate blank and 1 trip blank
Lab Order: 9911041

Volatile Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWRB03	Trip Blank 07		

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

*- chain of custody documents
* - sample log-in documents
*- trip blanks, rinsate blanks, and method blanks
*- MS/MSD results
*- LCS results
*- field duplicate results
*- laboratory duplicate results
*- surrogate recoveries
*- holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

The original VPH form 1 identified sample BRSWRB03 as BRSWRB02. Stone & Webster notified the laboratory and corrected forms were submitted.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 11/30/99 and received at the laboratory 3.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation

The sample receipt checklist indicates that samples were properly preserved. The form 1s indicate that the sample pHs were below 2. Preservation information was provided and indicates that all samples were properly preserved.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the VPH preparation blank, rinaste blank BRSWRB03 (11/30/99) and trip blank 07.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWRB03 (9911041-03) was analyzed as the aqueous MS/MSD VPH sample. All MS/MSD recovery acceptance criteria were met. The % RPD for the naphthalene results was 30.3% and the acceptance limit is 25%. Naphthalene was not detected in samples BRSWRB03 and Trip Blank 07. Since the naphthalene spike recoveries met the acceptance criteria and the sample result was non-detected (U) no results were qualified based upon the MS/MSD results.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

The laboratory used the rinsate blank sample as the MS/MSD sample. Typically real samples should be used as quality control samples. No field samples were submitted with laboratory order 9911041.

Laboratory Control Samples

Al l aqueous laboratory control sample recoveries met the method specified recovery criteria

Field Duplicate Results

No field duplicate samples were collected on 11/30/99.

Laboratory Duplicates

The laboratory duplicate samples were not from the Gordon Craig site. No validation actions were taken based upon the laboratory duplicate results.

Surrogate Results

All aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8260B method surrogates were reported along with VPH surrogate 2,5-Dibromotoluene.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

All VPH results are accepted without qualification.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous VPH results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table 1a VPH aqueous results

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Volatile Petroleum Hydrocarbon Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWRB03	A
Trip Blank 07 (aq)	A

A Accept all results without qualification

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

Sample Number:			BRSWRB03	Trip Blank 07		
Sample Location:						
Sample Type:			Aqueous	Aqueous		
Lab Sample Number:			9911041-03F	9911041-04A		
Percent moisture:						
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/30/1999	11/30/1999		
Date Analyzed:			12/02/1999	12/02/1999		
Notes:						
		Report				
VPH ANALYTES	Method	Limit*	ug/L	ug/L		
C5-C8 Aliphatic (1,2)	8260	100	100 U	100 U		
C9-C12 Aliphatic(1,3)	8260	25	25 U	25 U		
C9-C10 Aromatics(1)	8260	25	25 U	25 U		
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	2.0	2.0 U	2.0 U		
Benzene	8260	2.0	2.0 U	2.0 U		
Toluene	8260	2.0	2.0 U	2.0 U		
Ethylbenzene	8260	2.0	2.0 U	2.0 U		
m,p-Xylene	8260	2.0	2.0 U	2.0 U		
o-Xylene	8260	2.0	2.0 U	2.0 U		
Napthalene	8260	2.0	2.0 U	2.0 U		

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution

TABLE I

Calcium Magnesium Hardness Validated Results

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW01	BRSWGW02	BRSWRB03		
Sample Location:							
Sample Type:			Aqueous Low	Aqueous Low	Aqueous Low		
Lab Sample Number:			9911041-01D	9911041-02D	9911041-03D		
Percent moisture:			NA	NA	NA		
Dilution Factor:			1	1	1		
Dilution Factor:							
Date Sampled:			11/30/99	11/20/99	11/30/99		
Date Analyzed:			12/07/99	12/07/99	12/07/99		
Notes:					Rinsate Blank		
		Report					
ANALYTES	Method	Limit*	mg/L	mg/L	mg/L		
Ca-Mg Hardness	6010B	33	210	41	33 U		

Analytical Method:
Hardness determined by calculation using calcium and magnesium results obtained by ICP (method 6010B) analyses.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Feb. 01, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/30/99
2 Groundwater Samples 1 Aqueous Rinsate Blank
Lab Order: 9911041

Inorganic Analysis

BRSWGW01	*BRSWGW02F*	*BRSWRB03(rinsate)*

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Arsenic, barium, cadmium, silver, lead, antimony, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B (ICP). Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
* MS /MSD results
* LCS results
Field duplicate results
Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

The original elements form 1 identified sample BRSWRB03 as BRSWGW03. Stone & Webster notified the laboratory and corrected forms were submitted.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 11/30/99 and received at the laboratory 3.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. Element sample pH results were submitted and all sample pHs were <2.

Element sample BRSWGW02 was field filtered and the results are dissolved elements rather than total elements.

Field Blanks and Method Blanks

Selenium was detected in the rinsate blank sample at 9.4ug/L and the method blank at 15.4ug/L. The blank action level is 77ug/L and the laboratory method quantitation level is 80ug/L. All selenium results are reported as non-detected (U) at 80ug/L. Selenium was detected in sample BRSWGW01, however based upon the blank results this result was reported as non-detected (U). Selenium is not a common laboratory contaminant. The selenium method blank and rinsate blank results are indicative of an instrumental problem.

MS/MSD Results

Groundwater sample BRSWGW13 (9912007-01, collected 12/03/99) was analyzed as the batch MS/MSD sample. All acceptance criteria were met. No results are qualified based upon the MS/MSD results.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

LCS Results

All LCS criteria were met. No results are qualified based upon the LCS results.

Field Duplicates

No field duplicate samples were collected on 11/30/99.

Laboratory Duplicates

No aqueous laboratory duplicate sample results were submitted.

Holding Times

All sample analyses holding time requirements were met.

Summary

Selenium was detected in the rinsate blank BRSWRB03 at 9.4ug/L and the selenium method blank result was 15.4ug/L. The selenium action level is 77 ug/L. The selenium method quantitation limit is 80ug/L. All selenium results are reported as non-detected (U), at 80ug/L. Selenium is not a common trace element contaminant and these results indicate instrument problems.

Chromium is reported as estimated (J) in samples BRSWGW01 and BRSWGW02. The reported results are between the method detection limit and the method quantitation limit.

Sample BRSWGW02 was field filtered. BRSWGW02 results are reported as dissolved elements.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Aqueous Recommendation Summary

Antimony	A
Arsenic	A
Barium	A
Cadmium	A
Chromium	A, J[1]
Lead	A
Mercury	A
Selenium	A
Silver	A

A- Accept all data

J[1]- Chromium results for samples BRSWGW01 and BRSWGW02 are reported as estimated (J). These results are between the method detection limit and the method quantitation limit.

1

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

Inorganic Validated Results

Project No.: *05000.33*
Lab Order: 9911041
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW01	BRSWGW02	BRSWRB03	
Sample Location:						
Sample Type:			Aqueous	Aqueous	Aqueous	
Lab Sample Number:			9911041-01C	9911041-02C	9911041-03C	
Percent Solids:			NA	NA	NA	
Dilution Factor:			1	1	1	
Dilution Factor:						
Date Sampled:			11/30/1999	11/30/1999	11/30/1999	
Notes:				Filtered	Rinsate Blank	
		Report				
Inorganic Analysis	Method	Limit	ug/L	ug/L	ug/L	
Antimony	6010B	20	20 U	20 U	20 U	
Arsenic	6010B	25	25 U	25 U	25 U	
Barium	6010B	200	200 U	340	200 U	
Cadmium	6010B	5	5.0 U	5.0 U	5.0 U	
Chromium	6010B	10	2.5 J	2.5 J	10 U	
Lead	6010B	25	25 U	25 U	25 U	
Selenium	6010B	80	80 U	80 U	80 U	
Silver	6010B	7	7.0 U	7.0 U	7.0 U	
Mercury	7470	0.2	0.20 U	0.20 U	0.20 U	

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9911041
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW01	BRSWGW02	BRSWRB03	
Sample Location:						
Sample Type:			Aqueous	Aqueous	Aqueous	
Lab Sample Number:			9911041-01C	9911041-02C	9911041-03C	
Percent Solids:			NA	NA	NA	
Dilution Factor:			1	1	1	
Dilution Factor:						
Date Sampled:			11/30/1999	11/30/1999	11/30/1999	
Notes:				Filtered	Rinsate Blank	
		Report				
Inorganic Analysis	Method	Limit	ug/L	ug/L	ug/L	
Antimony	6010B	20	20 U	20 U	20 U	
Arsenic	6010B	25	25 U	25 U	25 U	
Barium	6010B	200	200 U	340	200 U	
Cadmium	6010B	5	5.0 U	5.0 U	5.0 U	
Chromium	6010B	10	2.5 J	2.5 J	10 U	
Lead	6010B	25	25 U	25 U	25 U	
Selenium	6010B	80	80 U	80 U	80 U	
Silver	6010B	7	7.0 U	7.0 U	7.0 U	
Mercury	7470	0.2	0.20 U	0.20 U	0.20 U	

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Date Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - Value is rejected.

Feb. 03, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/01/99
4 Groundwater samples
Lab Order: 9912002

Semivolatile Organics Analysis

Samples Collected:

BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
* - rinsate blanks, and method blanks
- MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
- surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/01/99 and received at the laboratory 2 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

Field Blanks and Method Blanks

All method preparation SVOA blank results were non-detected. No rinsate blank sample was submitted with sample collected on 12/01/99. The SVOA rinsate blank results for samples BRSWRB03 (collected 11/30/99) and BRSWRB04 (collected 12/02/99) were all non-detected. No results are qualified due to blank contamination.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWGW13 (9912007-01, collected 12/3/99) was analyzed as the MS/MSD sample pair. MS/MSD results are typically used to qualify results from the non-spiked sample. The MS/MSD recoveries for benzidine 0% and 4.5% respectively. The LCS benzidine recovery was 64%. No validation actions were taken based upon the MS/MSD results. Benzidine is not listed in the QAPP as a contaminant of concern.

Laboratory Control Sample

All LCS recovery criteria were met.

Field Duplicate Results

No field duplicate samples were collected on 12/01/99. Field duplicate samples were submitted for samples collected on 12/02/99 and 12/03/99. All field duplicate precision criteria were met.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9912002.

Surrogate Results

The SVOA surrogate recoveries not meeting the QAPP specified acceptance criteria are summarized below.

Sample	Surrogate	% Recovery	Action
BRSWGW07D	Phenol –d5	16	UJ Phenol
BRSWGW08	Phenol –d5	25.6	UJ Phenol
MB-314	Phenol –d5	25.5	

The phenol-d5 QAPP surrogate recovery acceptance range is 26-53%. The phenol-d5 surrogate recovery for the method blank indicates potential laboratory extraction problems. The phenol results for samples BRSWGW07D and BRSWGW08 are reported as non-detected estimated (UJ). A low bias is indicated and the possibility of false negatives exists.

All other surrogate recoveries met the QAPP specified acceptance criteria. Phenol is reported in samples BRSWGW03 and BRSWGW06 at 4.5ug/L and 6.8ug/L respectively. These reported results are below the method quantitation limit and are reported as estimated (J). The phenol-d5 surrogate recoveries for these samples were 32.2% and 28.9% respectively. These recoveries meet the QAPP surrogate acceptance criteria but these recoveries do indicate a low bias for phenol. The reported results should be regarded as a low estimate.

Holding Times

All analytical holding times were met.

Summary

The phenol results for samples BRSWGW03 and BRSWGW06 are reported as estimated (J). The results are below the method quantitation level. The phenol-d5 surrogate recoveries met the QAPP acceptance criteria but do indicate that these results may be biased low.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 🖳 Electronic Mail: tlewis1260@aol.com

The phenol-d5 surrogate recoveries for samples BRSWGW07D and BRSWGW08 were low and did not meet the QAPP acceptance criteria. Phenol results for samples BRSWGW07D and BRSWGW08 are reported as non-detected estimated (UJ). False negative results are possible. All other surrogate recoveries met the QAPP specified acceptance criteria.

Bis(2-ethylhexyl)phthalate is reported as estimated (J) for sample BRSWGW07D. The reported result is below the method quantitation limit.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8270C SVOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a SVOC aqueous

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW03	A, J^1
BRSWGW07D	A, J^2, J^3
BRSWGW06	A, J^1
BRSWGW08	A, J^2

A Accept all data.

J^1 Phenol results are reported as estimated (J). The reported results are below the method quantitation limit and may be low bias, as indicated by low phenol-d5 surrogate recoveries.

J^2 Phenol results are reported as non-detected estimated (UJ). The phenol-d5 recoveries were below the QAPP specified criteria. False negatives are possible.

J^3 The bis(2-ethylhexyl)phthalate result is reported as estimated (J). The reported result is below the method quantitation limit.

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912002
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08
Lab Sample Number:		9912002-01B	9912002-02B	9912002-03B	9912002-04B
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	Aqueous/Low
Sample Type:					
Dilution Factor:		1	1	1	1
Date Sampled:		12/01/99	12/01/99	12/01/99	12/01/99
Date Extracted:		12/06/99	12/06/99	12/06/99	12/06/99
Date Analyzed		12/07/99	12/07/99	12/07/99	12/07/99
Percent Moisture:		NA	NA	NA	NA
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
N-nitrosodimethylamine	20	20 U	20 U	20 U	20 U
Phenol	10	4.5 J	10 UJ	6.8 J	10 UJ
bis(2-Chloroethyl) ether	10	10 U	10 U	10 U	10 U
2-Chlorophenol	10	10 U	10 UJ	10 U	10 U
1,3-Dichlorobenzene	10	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10	10 U	10 U	10 U	10 U
Benzyl Alcohol	20	20 U	20 U	20 U	20 U
2-Methylphenol	10	10 U	10 UJ	10 U	10 U
1,2-Dichlorobenzene	10	10 U	10 U	10 U	10 U
Bis(2-chloroisopropyl)ether	10	10 U	10 U	10 U	10 U
4-Methylphenol	10	10 U	10 UJ	10 U	10 U
n-Nitroso-di-n-propylamine	10	10 U	10 U	10 U	10 U
Hexachloroethane	10	10 U	10 U	10 U	10 U
Nitrobenzene	10	10 U	10 U	10 U	10 U
Isophorone	10	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10	10 U	10 U	10 U	10 U
Benzoic Acid	20	20 U	20 U	20 U	20 U
2-Nitrophenol	10	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy) methane	10	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10	10 U	10 U	10 U	10 U
Naphthalene	10	10 U	10 U	10 U	10 U
4-Chloroaniline	10	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	20	20 U	20 U	20 U	20 U
2-Methylnaphthalene	10	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	10	10 U	10 U	10 U	10 U
2-Chloronaphthalene	10	10 U	10 U	10 U	10 U
2-Nitroaniline	20	20 U	20 U	20 U	20 U

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912002
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08
Lab Sample Number:		9912002-01B	9912002-02B	9912002-03B	9912002-04B
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	Aqueous/Low
Sample Type:					
Dilution Factor:		1	1	1	1
Date Sampled:		12/01/99	12/01/99	12/01/99	12/01/99
Date Extracted:		12/06/99	12/06/99	12/06/99	12/06/99
Date Analyzed		12/07/99	12/07/99	12/07/99	12/07/99
Percent Moisture:		NA	NA	NA	NA
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
Dimethyl phthalate	10	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10	10 U	10 U	10 U	10 U
Acenaphthylene	10	10 U	10 U	10 U	10 U
3-Nitroaniline	20	20 U	20 U	20 U	20 U
4-Nitrophenol	20	20 U	20 U	20 U	20 U
2,4-Dinitrophenol	20	10 U	10 U	10 U	10 U
Acenaphthene	10	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10	10 U	10 U	10 U	10 U
Dibenzofuran	10	10 U	10 U	10 U	10 U
Diethyl phthalate	10	10 U	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10	10 U	10 U	10 U	10 U
Fluorene	10	10 U	10 U	10 U	10 U
4-Nitroaniline	20	20 U	20 U	20 U	20 U
4,6-Dinitro-2-methylphenol	20	20 U	20 U	20 U	20 U
n-Nitrosodiphenylamine	10	10 U	10 U	10 U	10 U
1,2-Diphenylhydrazine	10	10 U	10 U	10 U	10 U
4-Bromophenyl phenylether	10	10 U	10 U	10 U	10 U
Hexachlorobenzene	10	10 U	10 U	10 U	10 U
Pentachlorophenol	20	20 U	20 U	20 U	20 U
Phenanthrene	10	10 U	10 U	10 U	10 U
Anthracene	10	10 U	10 U	10 U	10 U
Carbazole	10	10 U	10 U	10 U	10 U
Di-n-butyl phthalate	10	10 U	10 U	10 U	10 U
Fluoranthene	10	10 U	10 U	10 U	10 U
Benzidine	20	20 U	20 U	20 U	20 U
Pyrene	10	10 U	10 U	10 U	10 U
Butyl benzyl phthalate	10	10 U	10 U	10 U	10 U
bis(2-ethylhexyl) phthalate	10	10 U	1.8 J	10 U	10 U
3,3'-Dichlorobenzidine	10	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10	10 U	10 U	10 U	10 U
Chrysene	10	10 U	10 U	10 U	10 U

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912002
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08
Lab Sample Number:		9912002-01B	9912002-02B	9912002-03B	9912002-04B
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	Aqueous/Low
Sample Type:					
Dilution Factor:		1	1	1	1
Date Sampled:		12/01/99	12/01/99	12/01/99	12/01/99
Date Extracted:		12/06/99	12/06/99	12/06/99	12/06/99
Date Analyzed		12/07/99	12/07/99	12/07/99	12/07/99
Percent Moisture:		NA	NA	NA	NA
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
Di-n-octyl phthalate	10	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10	10 U	10 U	10 U	10 U

aqueous results ug/L solid results ug/Kg dry weight.
J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.

Feb. 02, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/01/99
4 Groundwater samples and 1 trip blank
Lab Order: 9912002

Volatile Organics Analysis

Samples Collected:

BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08
Trip Blank 08			

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results

* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/01/99 and received at the laboratory 2 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved, however the pH's of the VOA vials were not recorded. The laboratory should record and report these sample pHs.

Trip Blanks, Field Blanks, and Method Blanks

All VOA results for the aqueous method blanks and the Trip Blank 08 were reported as non-detected. No results are qualified based upon the VOA blank results.

Matrix Spike / Matrix Spike Duplicate Results

Two MS/MSD pairs were reported with laboratory order 9912002.

One aqueous MS/MSD sample was BRSWRB03 (9911041-03, collected 11/30/99). This sample is the rinsate blank sample. The laboratory should not use field rinsate blank samples for quality control samples.

Results not meeting the MS/MSD laboratory acceptance criteria are summarized below. The laboratory acceptance criteria, listed on the MS/MSD QC summary report, is 70-130%. The QAPP surface water/groundwater MS/MSD recovery limits are 80-120% for 1,1-dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene. The validator used the acceptance

recoveries specified in the QAPP for the specified compounds and the laboratory acceptance criteria for the remaining compounds. The laboratory %RPD acceptance criterion is ≤ 25%. Results not meeting the MS/MSD laboratory acceptance criteria are summarized below.

Compound	MS % Recovery	MSD % Recovery	% RPD	Action
Trichlorofluoromethane	56.2	72.6	25.4	Non-detects UJ; Detects J
Acetone	56	109	64.2	Non-detects UJ; Detects J

Aqueous MS/MSD sample BRSWGW12 (9912004-02, collected 12/02/99) was also analyzed as a MS/MSD pair in laboratory order 9912002. Results not meeting the MS/MSD laboratory acceptance criteria are summarized below.

Compound	MS % Recovery	MSD % Recovery	% RPD	Action
Acetone	65.9	75.7	13.9	Non-detects UJ; Detects J
2-Butanone	68	71.9	5.5	Non-detects UJ; Detects J
1,2-Dibromo-3-chloropropane	63.1	69.2	9.2	Non-detects UJ; Detects J
1,2,4-Trichlorobenzene	58.2	72.7	22.2	Non-detects UJ; Detects J
Naphthalene	43.5	64.3	38.7	Non-detects UJ; Detects J
1,2,3-Trichlorobenzene	60	87.6	37.5	Non-detects UJ; Detects J

These samples were not part of laboratory order 9912002. No results were qualified based upon the MS/MSD results. MS/MSD qualifications typically apply to only that sample.

Laboratory Control Sample

Two LCS samples were submitted with laboratory order 9912002; LCS 12/02/99 and LCS 12/08/99.

The QAPP has listed the 8260B LCS acceptance recoveries for select compounds as 80-120% and the laboratory forms indicate that the laboratory acceptance criterion is 70-130%. The validator used the 80-120% QAPP criterion for specified compounds 1,1-Dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene and the laboratory specified 70-130% acceptance criterion for non-QAPP specified compounds. A list of compounds not meeting these criteria is summarized below.

Compound	**% Recovery**	**Action**
Trichlorofluoromethane	48.8	Non-detects UJ; Detects J

All trichlorofluoromethane results are reported as non-detected estimated (UJ) for samples Trip Blank 08, BRSWGW07D, BRSWGW06, and BRSWGW08. False negative results are possible.

The 12/08/99 LCS applies to sample BRSWGW03. Compounds not meeting the acceptance criteria are summarized below.

Compound	% Recovery	Action
1,2-Dibromo-3-chloropropane	64.3	Non-detects UJ; Detects J

The 1,2-dibromo-3-chloropropane result for sample BRSWGW03 are reported as non-detected estimated (UJ). False negative results are possible.

Field Duplicate Results

No field duplicate samples were collected on 12/01/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9912002.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended. Note that the QAPP specified acceptance range for VOA surrogates is 80-120% and the laboratory form 1 surrogate recovery criteria is 70-130%. The validator used the QAPP specified 80-120% criteria for this validation.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

Toluene is reported as estimated (J) in samples BRSWGW03 and BRSWGW07D. These reported results are below the method quantitation limits. The results are estimated due to uncertainty near the method detection limit.

Trichlorofluoromethane results are reported as non-detected estimated (UJ) for samples BRSWGW07D, BRSWGW06, BRSWGW08, and Trip Blank 08. The LCS recovery was low (48.8%) and the possibility of false negative results exists.

The 1,2-dibromo-3-chloropropane result for sample BRSWGW03 is reported as non-detected estimated (UJ). The LCS recovery was low (64.38%) and the possibility of false negative results exists.

No MS/MSD VOA samples were submitted from laboratory order 9912002.
Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8260 VOC results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

_____
Timothy Lewis, Validator

Attachments: Table 1a 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW03	A, J^2, J^3
BRSWGW07D	A, J^1, J^3
BRSWGW06	A, J^1
BRSWGW08	A, J^1
Trip Blank 08	A, J^1

A Accept all data.

J^1 Trichlorofluoromethane results are reported as non-detected estimated (UJ). LCS recoveries were low and false negatives are possible.

J^2 1,2-Dibromo-3-chloropropane results are reported as non-detected estimated (UJ). LCS recoveries were low and false negatives are possible.

J^3 Toluene results are reported as estimated (J). The reported results are below the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912002
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08	Trip Blank 08
S&W Sample (cont)						
Lab Sample Number:		9912002-01A	9912002-02A	9912002-03A	9912002-04A	9912002-05A
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	Aq/Low
Sample Type:						Trip Blank
Dilution Factor:						
Date Sampled:		12/01/99	12/01/99	12/01/99	12/01/99	12/01/99
Date Extracted:						
Date Analyzed:		12/08/99	12/02/99	12/02/99	12/03/99	12/02/99
Percent Moisture:		NA	NA	NA	NA	NA
	Report					
Target Compounds	Limit	ug/L	ug/L	ug/L	ug/L	ug/L
Dichlorodifluoromethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloromethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Vinyl Chloride	2	2.0 U	2.0U	2.0 U	2.0 U	2.0U
Chloroethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bromomethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichlorofluoromethane	2	2.0 U	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ
Acetone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
1.1-Dichloroethene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Methylene Chloride	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methyl tert-butyl ether	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
trans-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Butanone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
2,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloropropene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon tetrachloride	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Benzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromodichloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dibromomethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Methyl-2-pentanone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
cis-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	2	0.54 J	1.3 J	3.8	4.7	2.0 U
trans-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Hexanone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
1,3-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912002
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08	Trip Blank 08
S&W Sample (cont)						
Lab Sample Number:		9912002-01A	9912002-02A	9912002-03A	9912002-04A	9912002-05A
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	Aq/Low
Sample Type:						Trip Blank

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912002

Dilution Factor:						
Date Sampled:		12/01/99	12/01/99	12/01/99	12/01/99	12/01/99
Date Extracted:						
Date Analyzed:		12/08/99	12/02/99	12/02/99	12/03/99	12/02/99
Percent Moisture:		NA	NA	NA	NA	NA
Dibromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912002
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08	Trip Blank 08
S&W Sample (cont)						
Lab Sample Number:		9912002-01A	9912002-02A	9912002-03A	9912002-04A	9912002-05A
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	Aq/Low
Sample Type:						Trip Blank
Dilution Factor:						
Date Sampled:		12/01/99	12/01/99	12/01/99	12/01/99	12/01/99
Date Extracted:						
Date Analyzed:		12/08/99	12/02/99	12/02/99	12/03/99	12/02/99
Percent Moisture:		NA	NA	NA	NA	NA
Chlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m,p-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Styrene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromoform	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isopropylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,2,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
n-Propylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3,5-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
tert-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4,-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
scc-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-isopropyltoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,4-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
n-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromo-3-chloropropane	5	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U
1,2,4-Trichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Hexachlorobutadiene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Naphthalene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Feb. 03, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/01/99
4 Groundwater Samples
Lab Order: 9912002

Inorganic Analysis

BRSWGW03F	*BRSWGW07DF*	*BRSWGW06F*
BRSWGW08F		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Arsenic, barium, cadmium, silver, lead, antimony, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B (ICP). Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
* MS /MSD results
* LCS results
Field duplicate results
Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/01/99 and received at the laboratory 2 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. Element sample pH results were submitted and all sample pHs were <2.

All trace element samples were field filtered prior to sample submittal.

Field Blanks and Method Blanks

Selenium was detected in the rinsate blank sample at 9.4ug/L and the method blank at 15.4ug/L. The blank action level is 77ug/L and the laboratory method quantitation level is 80ug/L. All selenium results are reported as non-detected (U) at 80ug/L. Selenium was detected in sample BRSWGW03F, however based upon the blank results this result was reported as non-detected (U). Selenium is not a common laboratory contaminant. The selenium method blank and rinsate blank results are indicative of an instrumental problem.

No rinsate blank sample was submitted for samples collected on 12/01/99. All rinsate blank results for BRSWRB03 (collected 11/30/99) were reported as non-detected (U), except for selenium. All rinsate blank results for BRSWRB04 (collected 12/02/99) are reported as non-detected (U), except for barium. Barium was detected in sample BRSWRB04 at 280ug/L. Barium was not detected in the preparation blank sample. The validator has estimated all barium results (J), due to the variability of the rinsate blank results. Barium may or may not be present in these samples at low concentrations.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

MS/MSD Results

Groundwater sample BRSWGW13 (9912007-01, collected 12/03/99) was analyzed as the batch MS/MSD sample. All acceptance criteria were met. No results are qualified based upon the MS/MSD results.

LCS Results

All LCS criteria were met. No results are qualified based upon the LCS results.

Field Duplicates

Field duplicate pairs were collected on 12/02/99 and 12/03/99. The barium results for samples BRSWGW12F and BRSWGW12FD (collected 12/02/99) are 56ug/L and 310ug/L respectively. Barium was reported as non-detected (U) in both field duplicate samples collected 12/03/99. Based upon the field duplicate precision, barium results are reported as estimated (J). The imprecision may be due to sample non-homogeneity or random barium contamination.

Laboratory Duplicates

No aqueous laboratory duplicate sample results were submitted.

Holding Times

All sample analyses holding time requirements were met.

Summary

Trace element samples were field filtered. The reported results are dissolved elements rather than total element results.

Selenium was detected in the rinsate blank BRSWRB03 at 9.4ug/L and the selenium method blank result was 15.4ug/L. The selenium action level is 77 ug/L. The selenium method quantitation limit is 80ug/L. Selenium was detected in sample BRSWGW03F at 8.8ug/L. Based upon the method blank result all selenium results are reported as non-detected (U), at 80ug/L. Selenium is not a common trace element contaminant and these results indicate instrument problems.

No rinsate blank was submitted with samples collected on 12/01/99. Barium was not detected in rinsate blank sample BRSWRB03 (collected 11/30/99) and was detected in rinsate blank sample BRSWRB04 (collected 12/02/99) at 280ug/L. The validator has reported all barium results as

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

estimated (J). Barium may or may not be present in these samples at low concentrations. The barium result for sample BRSWGW06F is 190ug/L. This result is below 200ug/L the method

quantitation limit. Based upon the rinsate blank results, indicating potential random contamination,

the barium results may be high estimates. The barium results for the field duplicates also indicates possibly a sample homogeneity problem, a random blank contamination problem, or an analytical problem. The instrument QC criteria were met and the sample matrix is groundwater so it is likely that the field duplicate imprecision was due to random low-level barium contamination. The MCP groundwater criterion for barium is 30,000ug/L. All reported barium results are below 1,000ug/L.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Aqueous Recommendation Summary

Antimony	A
Arsenic	A
Barium	J^1
Cadmium	A
Chromium	A
Lead	A
Mercury	A
Selenium	A
Silver	A

A- Accept all data

J^1- Barium results are estimated based upon field duplicate precision results and indicatde random low-level barium contamination.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9912002
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW03F	BRSWGW07DF	BRSWGW06F	BRSWGW08F
Sample Location:						
Sample Type:			Aqueous	Aqueous	Aqueous	Aqueous
Lab Sample Number:			9912002-01C	9912002-02C	9912002-03C	9912002-04C
Percent Solids:			NA	NA	NA	NA
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			12/01/99	12/01/99	12/01/99	12/01/99
Notes:			Filtered	Filtered	Filtered	Filtered
		Report				
Inorganic Analysis	Method	Limit	ug/L	ug/L	ug/L	ug/L
Antimony	6010B	20	20 U	20 U	20 U	20 U
Arsenic	6010B	25	25 U	25 U	25 U	25 U
Barium	6010B	200	290J	260 J	190 J	230 J
Cadmium	6010B	5	5.0 U	5.0 U	5.0 U	5.0 U
Chromium	6010B	10	10 U	10 U	10 U	10 U
Lead	6010B	25	25 U	25 U	25 U	25 U
Selenium	6010B	80	80 U	80 U	80 U	80 U
Silver	6010B	7	7.0 U	7.0 U	7.0 U	7.0 U
Mercury	7470	0.2	0.20 U	0.20 U	0.20 U	0.20 U

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Date Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - Value is rejected.

Feb. 02, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/01/99
4 Groundwater samples
Lab Order: 9912002

Calcium Magnesium Hardness Analysis

BRSWGW03	BRSWGW07D	BRSWGW06
BRSWGW08		

Dear Ms. Doherty:

A modified Tier II data validation was performed on calcium magnesium hardness analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Calcium and magnesium were determined by ICP method 6010B. Hardness was calculated from the calcium and magnesium results.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

* Chain of custody documents
* Sample log-in documents
* Field blanks, and method blanks
* MS /MSD results
* LCS results
* Field duplicate results
* Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/01/99 and received at the laboratory 2 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. The laboratory has noted that the hardness samples were preserved with HNO_3 and the sample PHs were <2.

Field Blanks and Method Blanks

The hardness method blank was reported as non-detected (U). No results are qualified based upon the blank results.

The hardness result for rinsate blank, BRSWRB03, (collected 11/30/99) was reported as non-detected (U).

MS/MSD Results

Sample BRSWGW13 (collected 12/03/99) was analyzed as the MS/MSD sample. All precision and recovery criteria were met. No results are qualified based upon the MS/MSD results.

LCS Results

The LCS acceptance criterion was met. No hardness results are qualified based upon the LCS result.

Field Duplicates

Field duplicate samples BRSWGW12 and BRSWGW12D were collected on 12/02/99 and field duplicate samples BRSWGW05A and BRSWGW05AD were collected on 12/03/99. All field

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

duplicate precision criteria were met. No hardness results were qualified based upon the field duplicate results.

Laboratory Duplicates

No laboratory duplicate samples were analyzed with laboratory order 9912002.

Holding Times

All sample analyses holding time requirements were met.

Summary

All hardness results are accepted without qualification.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Calcium Magnesium Hardness

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Aqueous Hardness Recommendation Summary

BRSWGW03	A
BRSWGW07D	A
BRSWGW06	A
BRSWGW08	A

A- Accept all data

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

TABLE I

Calcium Magnesium Hardness Validated Results

Project No.: 05000.33
Lab Order: 9912002
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW03	BRSWGW07D	BRSWGW06	BRSWGW08	
Sample Location:							
Sample Type:			Aqueous Low	Aqueous Low	Aqueous Low	Aqueous Low	
Lab Sample Number:			9912002-01D	9912002-02D	9912002-03D	9912002-04D	
Percent moisture:			NA	NA	NA	NA	
Dilution Factor:			1	1	1	1	
Dilution Factor:							
Date Sampled:			12/01/99	12/01/99	12/01/99	12/01/99	
Date Analyzed:			12/07/99	12/07/99	12/07/99	12/07/99	
Notes:							
		Report					
ANALYTES	Method	Limit*	mg/L	mg/L	mg/L	mg/L	
Ca-Mg Hardness	6010B	33	77	33 U	160	53	

Analytical Method:
Hardness determined by calculation using calcium and magnesium results obtained by ICP (method 6010B) analyses.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Feb. 07, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/03/99
3 Groundwater samples
Lab Order: 9912007

Semivolatile Organics Analysis

Samples Collected:

BRSWGW13	BRSWGW05A	BRSWGW05AD	

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
* - rinsate blanks, and method blanks
- MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
- surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 12° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/03/99 and received at the laboratory 4.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. The pH of the SVOA samples was recorded as 7.

Field Blanks and Method Blanks

All method preparation SVOA blank results were non-detected. No rinsate blank was submitted with samples collected on12/03/99. The SVOA rinsate blank results for BRSWRB04 (collected 12/02/99) were all non-detected. No results are qualified due to blank contamination.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWGW13 (9912007-01, collected 12/3/99) was analyzed as the MS/MSD sample pair. The MS/MSD recoveries for benzidine were 0% and 4.5% respectively. The benzidine result, for sample BRSWGW13, is rejected (R). MS/MSD results typically apply to the non-spiked sample only. The LCS benzidine recovery was 64%. The benzidine results for samples BRSWGW05A and BRSWGW05AD are reported without qualification. Benzidine is not listed in the QAPP as a contaminant of concern.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Laboratory Control Sample

All LCS recovery criteria were met. No SVOA results are qualified based upon the LCS results.

Field Duplicate Results

Samples BRSWGW05A and BRSWGW05AD were the field duplicate pair sampled on 12/03/99. All field duplicate precision criteria were met.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9912007.

Surrogate Results

The SVOA surrogate recoveries not meeting the QAPP specified acceptance criteria are summarized below.

Sample	Surrogate	% Recovery	Action
BRSWGW13	Nitrobenzene-d5	92.0	No action
MB-314	Phenol –d5	25.5	

The nitrobenzene-d5 recovery is high and exceeds the laboratory established acceptance criteria. All compound results associated with nitrobenzene-d5 in sample BRSWGW13 are reported as non-detected (U). The surrogate recoveries indicate a high bias so no results were qualified based upon high nitrobenzene-d5 surrogate recoveries.

The phenol-d5 QAPP surrogate recovery acceptance range is 26-53%. The phenol-d5 surrogate recovery for the method blank indicates potential laboratory extraction problems. The phenol-d5 acceptance criteria were met for the field samples. The phenol-d5 surrogate recoveries for samples BRSWGW13, BRSWGW05A, and BRSWGW05AD were 34.6%, 27.8%, and 30.9% respectively. Phenol was detected in these samples at 9.6ug/L, 34ug/L, and 43ug/L respectively. Based upon the low surrogate recoveries the validator has qualified these results as estimated (J). These results may be low biased.

Holding Times

All analytical holding times were met.

Summary

The phenol results for samples BRSWGW13, BRSWGW05A, and BRSWGW05AD are reported

as estimated (J). The phenol-d5 surrogate recoveries met the QAPP acceptance criteria but do indicate that these results may be biased low. The phenol-d5 recoveries were 34.6%, 27.8%, and 30.9% respectively and the acceptance range is 26-53%. The phenol-d5 surrogate recovery for the extraction preparation blank was low (25.5%) and did not meet the laboratory acceptance criteria indicating possible sample preparation problems.

Bis(2-ethylhexyl)phthalate results are reported as estimated (J) for sample BRSWGW05A and BRSWGW05AD. The reported results are below the method quantitation limit.

The benzidine result for sample BRSWGW13 is rejected. The MS/MSD benzidine recoveries are below 10%.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8270C SVOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a SVOC aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW13	A, J^1, R
BRSWGW05A	A, J^1, J^2
BRSWGW05AD	A, J^1, J^2

A Accept all data.

R Reject the benzidine results. The MS/MSD recoveries were below 10%.

J^1 Phenol results are reported as estimated (J). The reported results may be biased low, as indicated by low phenol-d5 surrogate recoveries.

J^2 Bis(2-ethylhexyl)phthalate results are reported as estimated (J). The results are below the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW13	BRSWGW05A	BRSWGW05AD	
Lab Sample Number:		9912007-01B	9912007-02B	9912007-03B	
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	
Sample Type:			Field Dup	Field Dup	
Dilution Factor:		1	1	1	
Date Sampled:		12/03/99	12/03/99	12/03/99	
Date Extracted:		12/06/99	12/06/99	12/06/99	
Date Analyzed		12/08/99	12/08/99	12/08/99	
Percent Moisture:		NA	NA	NA	
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	
N-nitrosodimethylamine	20	20 U	20 U	20 U	
Phenol	10	9.6 J	34 J	43 J	
bis(2-Chloroethyl) ether	10	10 U	10 U	10 U	
2-Chlorophenol	10	10 U	10 U	10 U	
1,3-Dichlorobenzene	10	10 U	10 U	10 U	
1,4-Dichlorobenzene	10	10 U	10 U	10 U	
Benzyl Alcohol	20	20 U	20 U	20 U	
2-Methylphenol	10	10 U	10 U	10 U	
1,2-Dichlorobenzene	10	10 U	10 U	10 U	
Bis(2-chloroisopropyl)ether	10	10 U	10 U	10 U	
4-Methylphenol	10	10 U	10 U	10 U	
n-Nitroso-di-n-propylamine	10	10 U	10 U	10 U	
Hexachloroethane	10	10 U	10 U	10 U	
Nitrobenzene	10	10 U	10 U	10 U	
Isophorone	10	10 U	10 U	10 U	
2,4-Dimethylphenol	10	10 U	10 U	10 U	
Benzoic Acid	20	20 U	20 U	20 U	
2-Nitrophenol	10	10 U	10 U	10 U	
bis(2-Chloroethoxy) methane	10	10 U	10 U	10 U	
2,4-Dichlorophenol	10	10 U	10 U	10 U	
1,2,4-Trichlorobenzene	10	10 U	10 U	10 U	
Naphthalene	10	10 U	10 U	10 U	
4-Chloroaniline	10	10 U	10 U	10 U	
Hexachlorobutadiene	10	10 U	10 U	10 U	
4-Chloro-3-methylphenol	20	20 U	20 U	20 U	
2-Methylnaphthalene	10	10 U	10 U	10 U	
Hexachlorocyclopentadiene	10	10 U	10 U	10 U	
2,4,6-Trichlorophenol	10	10 U	10 U	10 U	
2,4,5-Trichlorophenol	10	10 U	10 U	10 U	
2-Chloronaphthalene	10	10 U	10 U	10 U	
2-Nitroaniline	20	20 U	20 U	20 U	

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW13	BRSWGW05A	BRSWGW05AD	
Lab Sample Number:		9912007-01B	9912007-02B	9912007-03B	
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	
Sample Type:			Field Dup	Field Dup	
Dilution Factor:		1	1	1	
Date Sampled:		12/03/99	12/03/99	12/03/99	
Date Extracted:		12/06/99	12/06/99	12/06/99	
Date Analyzed		12/08/99	12/08/99	12/08/99	
Percent Moisture:		NA	NA	NA	
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	
Dimethyl phthalate	10	10 U	10 U	10 U	
2,6-Dinitrotoluene	10	10 U	10 U	10 U	
Acenaphthylene	10	10 U	10 U	10 U	
3-Nitroaniline	20	20 U	20 U	20 U	
4-Nitrophenol	20	20 U	20 U	20 U	
2,4-Dinitrophenol	20	10 U	10 U	10 U	
Acenaphthene	10	10 U	10 U	10 U	
2,4-Dinitrotoluene	10	10 U	10 U	10 U	
Dibenzofuran	10	10 U	10 U	10 U	
Diethyl phthalate	10	10 U	10 U	10 U	
4-Chlorophenyl phenyl ether	10	10 U	10 U	10 U	
Fluorene	10	10 U	10 U	10 U	
4-Nitroaniline	20	20 U	20 U	20 U	
4,6-Dinitro-2-methylphenol	20	20 U	20 U	20 U	
n-Nitrosodiphenylamine	10	10 U	10 U	10 U	
1,2-Diphenylhydrazine	10	10 U	10 U	10 U	
4-Bromophenyl phenylether	10	10 U	10 U	10 U	
Hexachlorobenzene	10	10 U	10 U	10 U	
Pentachlorophenol	20	20 U	20 U	20 U	
Phenanthrene	10	10 U	10 U	10 U	
Anthracene	10	10 U	10 U	10 U	
Carbazole	10	10 U	10 U	10 U	
Di-n-butyl phthalate	10	10 U	10 U	10 U	
Fluoranthene	10	10 U	10 U	10 U	
Benzidine	20	R	20 U	20 U	
Pyrene	10	10 U	10 U	10 U	
Butyl benzyl phthalate	10	10 U	10 U	10 U	
bis(2-ethylhexyl) phthalate	10	10 U	4.0 J	5.2 J	
3,3'-Dichlorobenzidine	10	10 U	10 U	10 U	
Benzo(a)anthracene	10	10 U	10 U	10 U	
Chrysene	10	10 U	10 U	10 U	

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW13	BRSWGW05A	BRSWGW05AD	
Lab Sample Number:		9912007-01B	9912007-02B	9912007-03B	
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	
Sample Type:			Field Dup	Field Dup	
Dilution Factor:		1	1	1	
Date Sampled:		12/03/99	12/03/99	12/03/99	
Date Extracted:		12/06/99	12/06/99	12/06/99	
Date Analyzed		12/08/99	12/08/99	12/08/99	
Percent Moisture:		NA	NA	NA	
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	
Di-n-octyl phthalate	10	10 U	10 U	10 U	
Benzo(b)fluoranthene	10	10 U	10 U	10 U	
Benzo(k)fluoranthene	10	10 U	10 U	10 U	
Benzo(a)pyrene	10	10 U	10 U	10 U	
Dibenz(a,h)anthracene	10	10 U	10 U	10 U	
Indeno(1,2,3-cd)pyrene	10	10 U	10 U	10 U	
Benzo(g,h,i)perylene	10	10 U	10 U	10 U	

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Feb. 07, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/03/99
3 Groundwater samples and 1 trip blank
Lab Order: 9912007

Volatile Organics Analysis

Samples Collected:

BRSWGW13	BRSWGW05A	BRSWGW05AD	Trip Blank 10

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results

* - field duplicate results
* - laboratory duplicate results

* - surrogate recoveries
* - holding times
* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

Sample BRSWGW13 was specified as the MS/MSD sample.

No rinsate blank sample was submitted with sample collected on 12/03/99. The last rinsate blank collected that specified VOA analysis was BRSWRB04 collected on 12/03/99. These results were used to evaluate possible blank contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 12° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/03/99 and received at the laboratory 4.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that VOA samples were properly preserved to a pH <2 with HCl. The VOA pH results were not recorded. The VPH sample pHs were reported and these pHs were <2. The VOA pH results should be recorded and reported.

Trip Blanks, Field Blanks, and Method Blanks

All VOA results for the rinsate blank BRSWRB04 were reported as non-detected. Methylene chloride was detected in the VOA method blank at 0.80ug/L. This result is below the method quantitation limit. Methylene chloride was not detected in any samples submitted on 12/03/99. Acetone was detected in Trip Blank 10 (submitted on 12/03/99) at the method quantitation limit, 10ug/L. Acetone was not detected in any field samples. No results are qualified based upon the

Trip Blank 10 and the method blank results.

Matrix Spike / Matrix Spike Duplicate Results

Aqueous MS/MSD sample BRSWGW13 (9912007-01, collected 12/03/99) was analyzed as a MS/MSD pair in laboratory order 9912007. Results not meeting the MS/MSD laboratory acceptance criteria are summarized below.

Compound	MS % Recovery	MSD % Recovery	% RPD	Action
Dichlorodifluoromethane	132	134	1.4	Non-detects U; Detects J

MS/MSD qualifications typically apply to only that sample. The dichlorodifluoromethane MS/MSD results indicate that a high bias. Dichlorodifluoromethane was not detected in sample BRSWGW13 and the high bias does not impact the data quality.

Laboratory Control Sample

The QAPP has listed the 8260B LCS acceptance recoveries for select compounds as 80-120% and the laboratory forms indicate that the laboratory acceptance criterion is 70-130%. The validator used the 80-120% QAPP criterion for specified compounds 1,1-Dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene and the laboratory specified 70-130% acceptance criterion for non-QAPP specified compounds. A list of compounds not meeting these criteria is summarized below.

Compound	**% Recovery**	**Action**
Dichlorodifluoromethane	155	Non-detects U; Detects J

The dichlorodifluoromethane LCS recovery indicates a high bias, as did the MS/MSD results. Dichlorodifluoromethane was not detected in any field samples and no results are qualified based upon the high LCS recovery.

Field Duplicate Results

Samples BRSWGW05 and BRSWGW05AD were the field duplicate pair collected on 12/05/99. All precision field duplicate criteria were met. No results were qualified based upon the field duplicate results. Positive results were reported for n-propylbenzene, 1,2,4-trimethylbenzene, sec-butylbenzene and 4-isopropyltoluene in both field duplicate samples. These results were below the method quantitation limits, in both samples, and these results are reported as estimated (J).

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9912007.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is
recommended. Note that the QAPP specified acceptance range for VOA surrogates is 80-120% and the laboratory form 1 surrogate recovery criteria is 70-130%. The validator used the QAPP specified 80-120% criteria for this validation.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

Dichlorodifluoromethane MS/MSD and LCS recoveries are high and exceed the method acceptance criteria. All dichlorodifluoromethane field sample results are reported as non-detected (U) and these results are not impacted by the high bias.

Methylene chloride was detected in the VOA preparation blank at 0.8ug/L and acetone was detected in Trip Blank 10 at 10ug/L. These compound were not detected in the field samples and no results are qualified based upon these blank results.

Toluene is reported in samples BRSWGW13, BRSWGW05A, and BRSWGW05AD. The toluene result, for sample BRSWGW13, is reported as estimated (J). The reported result is below the method quantitation limit. The toluene results for samples BRSWGW05A and BRSWGW05AD are reported without qualification. These results exceed the method quantitation limit.

N-propylbenzene, 1,2,4-trimethylbenzene, sec-butylbenzene and 4-isopropyltoluene results are reported as estimated (J) in field duplicate samples BRSWGW05A and BRSWGW05AD. These results are reported at concentrations below the method quantitation limit.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8260 VOC results. Validated result tables are appended to this submittal.

Sincerely,

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator
Attachments: Table 1a 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW13	A, J^1
BRSWGW05A	A, J^2
BRSWGW05AD	A, J^2
Trip Blank 10	A

A Accept all data.

J^1 Estimate the toluene result (J). The reported result is below the method quantitation limit.

J^2 Estimate the n-propylbenzene, 1,2,4-trimethylbenzene, 4-isopropyltoluene and sec-butylbenzene results (J). The reported results are below the method quantitation limit.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW13	BRSWGW05A	BRSWGW05AD	Trip Blank 10	
S&W Sample (cont)						
Lab Sample Number:		9912007-01A	9912007-02B	9912007-03A	9912004-04A	
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	
Sample Type:			Field Dup	Field Dup	Trip Blank	
Dilution Factor:						
Date Sampled:		12/03/99	12/03/99	12/03/99	12/03/99	
Date Extracted:						
Date Analyzed:		12/08/99	12/08/99	12/08/99	12/08/99	
Percent Moisture:		NA	NA	NA	NA	
Target Compounds	Report Limit	ug/L	ug/L	ug/L	ug/L	
Dichlorodifluoromethane	5	5.0 U	5.0 U	5.0 U	5.0 U	
Chloromethane	5	5.0 U	5.0 U	5.0 U	5.0 U	
Vinyl Chloride	2	2.0 U	2.0U	2.0 U	2.0 U	
Chloroethane	5	5.0 U	5.0 U	5.0 U	5.0 U	
Bromomethane	5	5.0 U	5.0 U	5.0 U	5.0 U	
Trichlorofluoromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Acetone	10	10.0 U	10.0 U	10.0 U	10.0	
1.1-Dichloroethene	1	1.0 U	1.0 U	1.0 U	1.0 U	
Carbon disulfide	2	2.0 U	2.0 U	2.0 U	2.0 U	
Methylene Chloride	5	5.0 U	5.0 U	5.0 U	5.0 U	
Methyl tert-butyl ether	2	2.0 U	2.0 U	2.0 U	2.0 U	
trans-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
2-Butanone	10	10.0 U	10.0 U	10.0 U	10.0 U	
2,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	
cis-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Chloroform	2	2.0 U	2.0 U	2.0 U	2.0 U	
Bromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1,1-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1-Dichloropropene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Carbon tetrachloride	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Benzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Trichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Bromodichloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Dibromomethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
4-Methyl-2-pentanone	10	10.0 U	10.0 U	10.0 U	10.0 U	
cis-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	
Toluene	2	0.94 J	4.2	4.4	2.0 U	
trans-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	
1,1,2-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dibromoethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
2-Hexanone	10	10.0 U	10.0 U	10.0 U	10.0 U	
1,3-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Tetrachloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW13	BRSWGW05A	BRSWGW05AD	Trip Blank 10	
S&W Sample (cont)						
Lab Sample Number:		9912007-01A	9912007-02B	9912007-03A	9912004-04A	
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	
Sample Type:			Field Dup	Field Dup	Trip Blank	
Dilution Factor:						
Date Sampled:		12/03/99	12/03/99	12/03/99	12/03/99	
Date Extracted:						
Date Analyzed:		12/08/99	12/08/99	12/08/99	12/08/99	
Percent Moisture:		NA	NA	NA	NA	
Dibromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW13	BRSWGW05A	BRSWGW05AD	Trip Blank 10	
S&W Sample (cont)						
Lab Sample Number:		9912007-01A	9912007-02B	9912007-03A	9912004-04A	
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	
Sample Type:			Field Dup	Field Dup	Trip Blank	
Dilution Factor:						
Date Sampled:		12/03/99	12/03/99	12/03/99	12/03/99	
Date Extracted:						
Date Analyzed:		12/08/99	12/08/99	12/08/99	12/08/99	
Percent Moisture:		NA	NA	NA	NA	
Chlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1,1,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Ethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
m,p-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	
o-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Styrene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Bromoform	2	2.0 U	2.0 U	2.0 U	2.0 U	
Isopropylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,1,2,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2,3-Trichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	
Bromobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
n-Propylbenzene	2	2.0 U	0.55 J	0.53 J	2.0 U	
2-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	
4-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,3,5-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
tert-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2,4,-Trimethylbenzene	2	2.0 U	0.63 J	0.64 J	2.0 U	
sec-Butylbenzene	2	2.0 U	0.80 J	0.87 J	2.0 U	
4-isopropyltoluene	2	2.0 U	0.92 J	0.92 J	2.0 U	
1,3-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,4-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
n-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2-Dibromo-3-chloroprop	5	5.0 U	5.0 U	5.0 U	5.0 U	
1,2,4-Trichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Hexachlorobutadiene	2	2.0 U	2.0 U	2.0 U	2.0 U	
Naphthalene	2	2.0 U	2.0 U	2.0 U	2.0 U	
1,2,3-Trichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Feb 06, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/03/99
3 Groundwater
Lab Order: 9912007

Extractable Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWGW13	BRSWGW05A	BRSWGW05AD

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

- chain of custody documents
- sample log-in documents
- rinsate blanks, and method blanks
- MS/MSD results
* - LCS results
- field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

The laboratory reported only the aliphatic and aromatic range results. The individual target compound results were not reported. The COC did not specify whether the complete list or the ranges were requested.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 12° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/03/99 and received at the laboratory 4.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. Sample preservation information was provided and indicates that the EPH sample was properly preserved to a pH <2 with HCl.

Field Blanks, and Method Blanks

No rinsate blank sample was submitted with samples collected on 12/03/99. Rinsate blank sample BRSWRB03 (collected 11/30/99) was evaluated as the rinsate blank sample. All method blank results and rinsate blank results were reported as non-detected. No results were qualified based upon the method blank results.

Matrix Spike / Matrix Spike Duplicate Results

Aqueous sample BRSWGW13 (9912007-01E, collected 12/03/99) was analyzed as the MS/MSD sample. The n-nonane and the n-tetradecane MS/MSD recoveries were low and did not meet the method specified 40-140% acceptance criteria. The C9-C18aliphatic hydrocarbon results are reported as non-detected estimated (UJ). A low bias is indicated. The n-nonane LCS recovery was 41.4% and the LCS recovery method acceptance range is 40-140% also indicating a possible low bias.

The C19-C36 aliphatic and the C11-C22 aromatic MS/MSD results met the method specified acceptance criteria. These method criteria are spike recoveries between 40-140% and duplicate RPDs <50%. The MS recoveries are typically low, between 53% and 40%, and the %RPDS are all greater than 30%. Based upon these results and the poor field duplicate precision results, for samples BRSWGW05A and BRSWGW05AD, the C19-C36 aliphatic and the C11-C22 aromatic results for sample BRSWGW13 are reported as estimated (J) and non-detected estimated (UJ) respectively. A low bias is indicated and false negative results are possible.

Laboratory Control Samples

All aqueous EPH LCS recoveries met the method acceptance criteria.

Field Duplicate Results

Samples BRSWGW05 and BRSWGW05AD were the field duplicate pair. The results are summarized below.

Range	BRSWGW05	BRSWGW05AD	% RPD	Action
C9-C18 aliphatic	870 ug/L	200 ug/L	189%	J positives, UJ non-detects
C19-C36 aliphatic	240 ug/L	ND	NC	J positives, UJ non-detects
C11-C22 aromatic	580 ug/L	130 ug/L	127%	J positives, UJ non-detects

ND- non-detected
NC-not calculated

Based upon the field duplicate results all non-detected results are reported as non-detected estimated (UJ), and positive results are reported as estimated (J).

Laboratory Duplicate Results

The laboratory /laboratory duplicate pair were not from the Gordon Craig site. All EPH results are reported as non-detected (U). No results are qualified based upon the laboratory duplicate results.

Surrogate Results

All aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8270C method surrogates were reported along with specified EPH surrogates.

Holding Times

All holding times were met. No data validation action is recommended.

duplicate samples BRSWGW05A and BRSWGW05AD were collected on 12/03/99. All field duplicate precision criteria were met. No hardness results were qualified based upon the field duplicate results.

Laboratory Duplicates

No laboratory duplicate samples were analyzed with laboratory order 9912004.

Holding Times

All sample analyses holding time requirements were met.

Summary

The calcium magnesium hardness result for rinsate blank sample BRSWRB04 is 52mg/L and the action level is 260mg/L. Hardness results for BRSWGW14, BRSWGW12 and BRSWGW12D are reported as non-detected (U) at elevated concentrations. The rinsate blank result is reported without qualification.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Calcium Magnesium Hardness

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table 1a- Extractable Petroleum Hydrocarbon
Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW13	J^1
BRSWGW05A	J^2
BRSWGW05AD	J^2

A Accept all data.

J^1 Estimate results as non-detected (UJ) for C9-C18 aliphatics and C11-C22 aromatics. Estimate C19-C36 aliphatic result (J). These results may be biased low.

J^2 Estimate results as non-detected (UJ) or estimated (J) due to poor field duplicate precision.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I **MA DEP EPH Method 98-1 Validated Results**

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW13	BRSWGW05A	BRSWGW05AD	
Sample Location:						
Sample Type:			Aqueous	Aqueous	Aqueous	
Lab Sample Number:			9912007-01E	9912007-02E	9912007-03E	
Percent Moisture:			N/A	N/A	N/A	
Dilution Factor:			1	1	1	
Dilution Factor:						
Date Sampled:			12/03/99	12/03/99	12/03/99	
Date Extracted			12/07/99	12/07/99	12/07/99	
Date Analyzed Aliphatics:			12/08/99	12/08/99	12/08/99	
Date Analyzed PNA			12/08/99	12/08/99	12/08/99	
Notes:				Field Dup	Field Dup	
		Report				
EPH ANALYTES	Method	Limit	ug/L	ug/L	ug/L	
C9-C18 Aliphatic (1)	8270C	100	100 UJ	870 J	200 J	
C19-C36 Aliphatic (1)	8270C	100	100 J	240 J	100 UJ	
C11-C22 Aromatics(1,2)	8270C	100	100 UJ	580 J	130 J	
Targeted PAH Analytes						
Naphthalene	8270C	1	Not Reported	Not Reported	Not Reported	
2-Methylnaphthalene	8270C	1	Not Reported	Not Reported	Not Reported	
Acenaphthylene	8270C	1	Not Reported	Not Reported	Not Reported	
Acenaphthene	8270C	1	Not Reported	Not Reported	Not Reported	
Fluorene	8270C	1	Not Reported	Not Reported	Not Reported	
Phenanthrene	8270C	1	Not Reported	Not Reported	Not Reported	
Anthracene	8270C	1	Not Reported	Not Reported	Not Reported	
Fluoranthene	8270C	1	Not Reported	Not Reported	Not Reported	
Pyrene	8270C	1	Not Reported	Not Reported	Not Reported	
Benzo(a)anthracene	8270C	1	Not Reported	Not Reported	Not Reported	
Chrysene	8270C	1	Not Reported	Not Reported	Not Reported	
Benzo(b)fluoranthene	8270C	1	Not Reported	Not Reported	Not Reported	
Benzo(k)fluoranthene	8270C	1	Not Reported	Not Reported	Not Reported	
Benzo(a)pyrene	8270C	1	Not Reported	Not Reported	Not Reported	
Indeno(1,2,3-cd)pyrene	8270C	1	Not Reported	Not Reported	Not Reported	
Dibenzo(a,h)anthracene	8270C	1	Not Reported	Not Reported	Not Reported	
Benzo(g,h,i)perylene	8270C	1	Not Reported	Not Reported	Not Reported	

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Feb. 06, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/03/99
3 Groundwater and 1 trip blank
Lab Order: 9912007

Volatile Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWGW13	BRSWGW05A	BRSWGW05AD	TRIP BLANK 10

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
*- MS/MSD results
*- LCS results
- field duplicate results
*- laboratory duplicate results
*- surrogate recoveries
*- holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact

Sample BRSWGW13 was specified as the MS/MSD sample.

No rinsate blank sample was submitted with sample collected on 12/03/99. The last rinsate blank collected that specified VPH analysis was BRSWRB03 collected on 11/30/99. These results were used to evaluate possible blank contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 12° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/03/99 and received at the laboratory 4.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. The form 1s indicate that the sample pHs were below 2. Preservation information was provided and indicates that all samples were properly preserved.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the VPH preparation blank, rinsate blank BRSWRB03 (11/30/99) and Trip Blank 10. No data were qualified based upon the blank results.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWGW13 was analyzed as the VPH MS/MSD sample. All method acceptance criteria were met for spike recoveries and duplicate precision. No results are qualified based upon the MS/MSD results.

Laboratory Control Samples

Al l aqueous laboratory control sample recoveries met the method specified recovery criteria.

Field Duplicate Results

Samples BRSWGW05A and BRSWGW05AD were submitted as the field duplicate pair. The % RPDS for the C9-C12 aliphatic range results and the C9-C10 aromatic results were 98% and 30.1% respectively. The % RPD acceptance criteria for aqueous field duplicates is $\leq$30%. The C9-C12 aliphatic range results and the C9-C10 aromatic results for samples BRSWGW05 and BRSWGW05AD were reported as estimated (J).

Laboratory Duplicates

The laboratory duplicate samples were not from the Gordon Craig site. No validation actions were taken based upon the laboratory duplicate results.

Surrogate Results

All aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8260B method surrogates were reported along with VPH surrogate 2,5-Dibromotoluene.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

Based upon the field duplicate results, the C9-C12 aliphatic results and the C9-C10 aromatic results for samples BRSWGW05A and BRSWGW05AD are reported as estimated (J).

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous VPH results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table 1a VPH aqueous results

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Volatile Petroleum Hydrocarbon Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW13	A
BRSWGW05A	A, J^{I}
BRSWGW05AD	A, J^{I}
Trip Blank 10	A

A Accept all results without qualification

J^{I} The C9-C12 aliphatic and the C9-C10 Aromatic results are reported as estimated (J). The field duplicate % RPD criteria were not met.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW13	BRSWGW05A	BRSWGW05AD	Trip Blank 10
Sample Location:						
Sample Type:			Aqueous	Aqueous	Aqueous	Aqueous
Lab Sample Number:			9912007-01F	9912007-02F	9912007-03F	9912007-04B
Percent moisture:						
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			12/03/99	12/03/99	12/03/99	12/03/99
Date Analyzed:			12/08/99	12/08/99	12/08/99	12/08/99
Notes:				Field Dup	Field Dup	Trip Blank
		Report				
VPH ANALYTES	Method	Limit*	ug/L	ug/L	ug/L	ug/L
C5-C8 Aliphatic (1,2)	8260	100	100 U	100 U	100 U	100 U
C9-C12 Aliphatic(1,3)	8260	25	25 U	72 J	210 J	25 U
C9-C10 Aromatics(1)	8260	25	25 U	45 J	61 J	25 U
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	2.0	2.0 U	2.0 U	2.0 U	2.0 U
Benzene	8260	2.0	2.0 U	2.0 U	2.0 U	2.0 U
Toluene	8260	2.0	2.0 U	4.2	4.4	2.0 U
Ethylbenzene	8260	2.0	2.0 U	2.0 U	2.0 U	2.0 U
m,p-Xylene	8260	2.0	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene	8260	2.0	2.0 U	2.0 U	2.0 U	2.0 U
Napthalene	8260	2.0	2.0 U	2.0 U	2.0 U	2.0 U

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution

Feb. 07, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/03/99
3 Groundwater Samples
Lab Order: 9912007

Inorganic Analysis

BRSWGW13F	BRSWGW05AF	BRSWGW05ADF

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Arsenic, barium, cadmium, silver, lead, antimony, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B (ICP). Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
* MS /MSD results
* LCS results
Field duplicate results
Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 12° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were packed in ice. The samples were collected on 12/03/99 and received at the laboratory 4.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that the trace element samples were properly preserved. The laboratory has noted that the samples were preserved with HNO_3 and the sample pHs were <2.

All trace element samples were field filtered prior to sample submittal. The rinsate blank sample BRSWRB04 (collected 12/02/99) was not field filtered.

Field Blanks and Method Blanks

Selenium was detected in the method blank at 15.4ug/L. The blank action level is 77ug/L and the laboratory method quantitation level is 80ug/L. All selenium results are reported as non-detected (U) at 80ug/L. Selenium was detected in sample BRSWGW13F at 24ug/L, however based upon the method blank results this result was reported as non-detected (U). Selenium is not a common laboratory contaminant. The selenium method blank result is indicative of an instrumental problem.

Barium was detected in sample BRSWRB04 (collected 12/02/99) at 280ug/L. Barium was not detected in the preparation blank sample. The barium action level is 1400ug/L. All barium results are reported as non-detected (U) in all the field samples. Barium was detected in sample BRSWGW13F at 80ug/L. This result is reported as non-detected at 200ug/L due to the rinsate blank contamination.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

MS/MSD Results

Groundwater sample BRSWGW13 (9912007-01, collected 12/03/99) was analyzed as the batch MS/MSD sample. All acceptance criteria were met. No results are qualified based upon the MS/MSD results.

LCS Results

All LCS criteria were met. No results are qualified based upon the LCS results.

Field Duplicates

Field duplicate pairs were collected on 12/02/99 and 12/03/99. The barium results for samples BRSWGW12F and BRSWGW12FD (collected 12/02/99) are 56ug/L and 310ug/L respectively. Due to the rinsate blank results barium is reported as non-detected in samples BRSWGW12F and BRSWGW12FD. The duplicate results differ by more than the 200ug/L. the method quantitation level. Based upon the field duplicate precision results, barium results are reported as non-detected estimated (UJ) for samples BRSWGW14F, BRSWGW12F, BRSWGW12FD and BRSWGW15F. The barium result for sample BRSWRB04 is reported as estimated (J).

Field duplicate pair BRSWGW05AF and BRSWGW05ADF was collected on 12/03/99. Barium was reported as non-detected (U) in both samples. No barium results are qualified based upon these field duplicate results.

Laboratory Duplicates

No aqueous laboratory duplicate sample results were submitted.

Holding Times

All sample analyses holding time requirements were met.

Summary

Trace element samples were field filtered. The reported results are dissolved elements rather than total element results. The field rinsate blank sample was not field filtered.

The selenium method blank result was 15.4ug/L. The selenium action level is 77 ug/L. The selenium method quantitation limit is 80ug/L. Selenium was detected in sample BRSWGW13F at 24ug/L. Based upon the method blank result all selenium results are reported as non-detected

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

(U), at 80ug/L. Selenium is not a common trace element contaminant and these results indicate instrument problems.

The chromium result for sample BRSWGW13F is reported as estimated 3.6ug/L(J). The result is below the method quantitation limit. The lead result for sample BRSWGW13F is reported as estimated 6.0ug/L(J). These results are below the method quantitation limit. The lead and chromium results maybe due the field filtering process.

Barium was detected in rinsate blank sample BRSWRB04 at 280ug/L and the blank action level is 1400ug/L. All barium field sample results were below the blank action level and these results are reported as non-detected (U) due to the blank results.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Aqueous Recommendation Summary

Antimony	A
Arsenic	A
Barium	A
Cadmium	A
Chromium	A, J^1
Lead	A, J^1
Mercury	A
Selenium	A
Silver	A

A- Accept all data

J^1- Chromium and lead results for sample BRSWGW13F is estimated (J). These results are below the method quantitation limit.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW13F	BRSWGW05AF	BRSWGW05ADF		
Sample Location:							
Sample Type:			Aqueous	Aqueous	Aqueous		
Lab Sample Number:			9912007-01C	9912007-02C	9912007-03C		
Percent Solids:			NA	NA	NA		
Dilution Factor:			1	1	1		
Dilution Factor:							
Date Sampled:			12/03/99	12/03/99	12/03/99		
Notes:			Filtered	Filtered	Filtered		
		Report		Field Dup	Field Dup		
Inorganic Analysis	Method	Limit	ug/L	ug/L	ug/L		
Antimony	6010B	20	20 U	20 U	20 U		
Arsenic	6010B	25	25 U	25 U	25 U		
Barium	6010B	200	200 U	200 U	200 U		
Cadmium	6010B	5	5.0 U	5.0 U	5.0 U		
Chromium	6010B	10	3.6 J	10 U	10 U		
Lead	6010B	25	6.0 J	25 U	25 U		
Selenium	6010B	80	80 U	80 U	80 U		
Silver	6010B	7	7.0 U	7.0 U	7.0 U		
Mercury	7470	0.2	0.20 U	0.20 U	0.20 U		

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Date Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - Value is rejected.

Feb. 05, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/03/99
3 Groundwater samples
Lab Order: 9912007

Calcium Magnesium Hardness Analysis

BRSWGW13	BRSWGW05A	BRSWGW05AD

Dear Ms. Doherty:

A modified Tier II data validation was performed on calcium magnesium hardness analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Calcium and magnesium were determined by ICP method 6010B. Hardness was calculated from the calcium and magnesium results.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
* MS /MSD results
* LCS results
* Field duplicate results
* Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 11° C. The cooler temperature range is 2-6° C. The sample receipt checklist does indicate that ice packs were present. The samples were collected on 12/03/99 and received at the laboratory 4.5 hours later. Samples may not have had sufficient time to cool while on ice. Results were not qualified based upon this deviation.

The sample receipt checklist indicates that samples were properly preserved. The laboratory has noted that the hardness samples were preserved with HNO_3 and the sample pHs were <2.

Field Blanks and Method Blanks

The hardness method blank was reported as non-detected (U). No results are qualified based upon the method blank results.

The hardness result for rinsate blank, BRSWRB04, (collected 12/02/99) was reported at 52mg/L. The method quantitation limit is 33mg/L. The blank action level for calcium magnesium hardness is 260mg/L. Hardness results for samples BRSWGW13, BRSWGW05A, and BRSWGW05AD are reported as non-detected at elevated quantitation limits due to potential field sampling contamination.

MS/MSD Results

Sample BRSWGW13 (collected 12/03/99) was analyzed as the MS/MSD sample. All precision and recovery criteria were met. No results are qualified based upon the MS/MSD results.

LCS Results

The LCS acceptance criterion was met. No hardness results are qualified based upon the LCS result.

Field Duplicates

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Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Field duplicate samples BRSWGW05A and BRSWGW05AD were collected on 12/03/99. All field duplicate precision criteria were met. No hardness results were qualified based upon the field duplicate results.

Laboratory Duplicates

No laboratory duplicate samples were analyzed with laboratory order 9912007.

Holding Times

All sample analyses holding time requirements were met.

Summary

The calcium magnesium hardness result for rinsate blank sample BRSWRB04 (collected 12/02/99) is 52mg/L and the action level is 260mg/L. Hardness results for BRSWGW13, BRSWGW05 and BRSWGW05AD are reported as non-detected (U) at elevated concentrations. Note that the field duplicate and MS/MSD precision criteria were met indicating that the rinsate blank contamination was random and isolated to the rinsate blank sample or the blank contamination was reproducible. In the latter case the hardness results may be high biased.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Calcium Magnesium Hardness

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Aqueous Hardness Recommendation Summary

BRSWGW13	A^1
BRSWGW05	A^1
BRSWGW05AD	A^1

A- Accept all data

A^1- Accept these results as non-detected (U) at the reported concentrations due to rinsate blank contamination. The hardness action level is 260mg/L. Results below the action level are reported as non-detected (U).

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

Calcium Magnesium Hardness Validated Results

Project No.: 05000.33
Lab Order: 9912007
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW13	BRSWGW05A	BRSWGW05AD		
Sample Location:							
Sample Type:			Aqueous Low	Aqueous Low	Aqueous Low		
Lab Sample Number:			9912007-01D	9912007-02D	9912007-03D		
Percent moisture:			NA	NA	NA		
Dilution Factor:			1	1	1		
Dilution Factor:							
Date Sampled:			12/03/99	12/03/99	12/03/99		
Date Analyzed:			12/07/99	12/07/99	12/07/99		
Notes:				Field Dup	Field Dup		
		Report					
ANALYTES	Method	Limit*	mg/L	mg/L	mg/L		
Ca-Mg Hardness	6010B	33	210 U	160 U	150 U		

Analytical Method:
Hardness determined by calculation using calcium and magnesium results obtained by ICP (method 6010B) analyses.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Feb. 04, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/02/99
4 Groundwater samples and 1 rinsate blank
Lab Order: 9912004

Semivolatile Organics Analysis

Samples Collected:

BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15
BRSWRB04			

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
* - sample log-in documents
* - rinsate blanks, and method blanks
- MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
- surrogate recoveries

* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 5° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that the samples were properly preserved.

Field Blanks and Method Blanks

All method preparation SVOA blank results were non-detected. The SVOA rinsate blank results for BRSWRB04 (collected 12/02/99) were all non-detected. No results are qualified due to blank contamination.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWGW13 (9912007-01, collected 12/3/99) was analyzed as the MS/MSD sample pair. MS/MSD results are typically used to qualify results from the non-spiked sample. The MS/MSD recoveries for benzidine 0% and 4.5% respectively. The LCS benzidine recovery was 64%. No validation actions were taken based upon the MS/MSD results. Benzidine is not listed in the QAPP as a contaminant of concern.

Laboratory Control Sample

All LCS recovery criteria were met.

Field Duplicate Results

Samples BRSWGW12 and BRSWGW12D were the field duplicate pair sampled on 12/02/99. All field duplicate precision criteria were met.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9912004.

Surrogate Results

The SVOA surrogate recoveries not meeting the QAPP specified acceptance criteria are summarized below.

Sample	Surrogate	% Recovery	Action
BRSWGW14	2-Fluorobiphenyl	92.2	No action
BRSWGW14	Nitrobenzene-d5	93.2	No action
MB-314	Phenol –d5	25.5	

The 2-fluorobiphenyl and nitrobenzene-d5 recoveries are high and exceed the laboratory established acceptance criteria. All SVOA results for sample BRSWGW14 are reported as non-detected (U). The surrogate recoveries indicate a high bias so no results were qualified based upon high surrogate recoveries.

The phenol-d5 QAPP surrogate recovery acceptance range is 26-53%. The phenol-d5 surrogate recovery for the method blank indicates potential laboratory extraction problems. The phenol-d5 acceptance criteria were met for the field samples. The phenol-d5 recoveries for samples BRSWGW12 and BRSWGW12D were 27.3% and 27.4% respectively. Phenol was detected in these samples at 16ug/L and 17ug/L respectively. The validator has qualified these results as estimated (J). These results may be low biased.

Holding Times

All analytical holding times were met.

Summary

The phenol results for samples BRSWGW12 and BRSWGW12D are reported as estimated (J). The phenol-d5 surrogate recoveries met the QAPP acceptance criteria but do indicate that these results may be biased low. The phenol-d5 recoveries were 27.3% and 27.4% respectively and the acceptance range is 26-53%. The phenol-d5 surrogate recovery for the extraction preparation blank was low and did not meet the laboratory acceptance criteria indicating possible sample preparation problems.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8270C SVOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a SVOC aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW14	A
BRSWGW12	A, J^1
BRSWGW12D	A, J^1
BRSWGW15	A
BRSWRB04	A

A Accept all data.

J^1 Phenol results are reported as estimated (J). The reported results may be biased low, as indicated by low phenol-d5 surrogate recoveries.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15
Lab Sample Number:		9912004-01B	9912004-02B	9912004-03B	9912004-04B
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	Aqueous/Low
Sample Type:			Field Dup	Field Dup	
Dilution Factor:		1	1	1	1
Date Sampled:		12/02/99	12/02/99	12/02/99	12/02/99
Date Extracted:		12/06/99	12/06/99	12/06/99	12/06/99
Date Analyzed		12/07/99	12/07/99	12/07/99	12/07/99
Percent Moisture:		NA	NA	NA	NA
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
N-nitrosodimethylamine	20	20 U	20 U	20 U	20 U
Phenol	10	10 U	17 J	16 J	10 U
bis(2-Chloroethyl) ether	10	10 U	10 U	10 U	10 U
2-Chlorophenol	10	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10	10 U	10 U	10 U	10 U
Benzyl Alcohol	20	20 U	20 U	20 U	20 U
2-Methylphenol	10	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10	10 U	10 U	10 U	10 U
Bis(2-chloroisopropyl)ether	10	10 U	10 U	10 U	10 U
4-Methylphenol	10	10 U	10 U	10 U	10 U
n-Nitroso-di-n-propylamine	10	10 U	10 U	10 U	10 U
Hexachloroethane	10	10 U	10 U	10 U	10 U
Nitrobenzene	10	10 U	10 U	10 U	10 U
Isophorone	10	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10	10 U	10 U	10 U	10 U
Benzoic Acid	20	20 U	20 U	20 U	20 U
2-Nitrophenol	10	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy) methane	10	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10	10 U	10 U	10 U	10 U
Naphthalene	10	10 U	10 U	10 U	10 U
4-Chloroaniline	10	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	20	20 U	20 U	20 U	20 U
2-Methylnaphthalene	10	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	10	10 U	10 U	10 U	10 U
2-Chloronaphthalene	10	10 U	10 U	10 U	10 U
2-Nitroaniline	20	20 U	20 U	20 U	20 U

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15
Lab Sample Number:		9912004-01B	9912004-02B	9912004-03B	9912004-04B
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	Aqueous/Low
Sample Type:			Field Dup	Field Dup	
Dilution Factor:		1	1	1	1
Date Sampled:		12/02/99	12/02/99	12/02/99	12/02/99
Date Extracted:		12/06/99	12/06/99	12/06/99	12/06/99
Date Analyzed		12/07/99	12/07/99	12/07/99	12/07/99
Percent Moisture:		NA	NA	NA	NA
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
Dimethyl phthalate	10	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10	10 U	10 U	10 U	10 U
Acenaphthylene	10	10 U	10 U	10 U	10 U
3-Nitroaniline	20	20 U	20 U	20 U	20 U
4-Nitrophenol	20	20 U	20 U	20 U	20 U
2,4-Dinitrophenol	20	10 U	10 U	10 U	10 U
Acenaphthene	10	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10	10 U	10 U	10 U	10 U
Dibenzofuran	10	10 U	10 U	10 U	10 U
Diethyl phthalate	10	10 U	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10	10 U	10 U	10 U	10 U
Fluorene	10	10 U	10 U	10 U	10 U
4-Nitroaniline	20	20 U	20 U	20 U	20 U
4,6-Dinitro-2-methylphenol	20	20 U	20 U	20 U	20 U
n-Nitrosodiphenylamine	10	10 U	10 U	10 U	10 U
1,2-Diphenylhydrazine	10	10 U	10 U	10 U	10 U
4-Bromophenyl phenylether	10	10 U	10 U	10 U	10 U
Hexachlorobenzene	10	10 U	10 U	10 U	10 U
Pentachlorophenol	20	20 U	20 U	20 U	20 U
Phenanthrene	10	10 U	10 U	10 U	10 U
Anthracene	10	10 U	10 U	10 U	10 U
Carbazole	10	10 U	10 U	10 U	10 U
Di-n-butyl phthalate	10	10 U	10 U	10 U	10 U
Fluoranthene	10	10 U	10 U	10 U	10 U
Benzidine	20	20 U	20 U	20 U	20 U
Pyrene	10	10 U	10 U	10 U	10 U
Butyl benzyl phthalate	10	10 U	10 U	10 U	10 U
bis(2-ethylhexyl) phthalate	10	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	10	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10	10 U	10 U	10 U	10 U
Chrysene	10	10 U	10 U	10 U	10 U

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15
Lab Sample Number:		9912004-01B	9912004-02B	9912004-03B	9912004-04B
Matrix/Analysis:		Aqueous/Low	Aqueous/Low	Aqueous/Low	Aqueous/Low
Sample Type:			Field Dup	Field Dup	
Dilution Factor:		1	1	1	1
Date Sampled:		12/02/99	12/02/99	12/02/99	12/02/99
Date Extracted:		12/06/99	12/06/99	12/06/99	12/06/99
Date Analyzed		12/07/99	12/07/99	12/07/99	12/07/99
Percent Moisture:		NA	NA	NA	NA
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
Di-n-octyl phthalate	10	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10	10 U	10 U	10 U	10 U

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB04			
Lab Sample Number:		9912004-05B			
Matrix/Analysis:		Aqueous/Low			
Sample Type:		Rinsate Blank			
Dilution Factor:		1			
Date Sampled:		12/02/99			
Date Extracted:		12/06/99			
Date Analyzed		12/07/99			
Percent Moisture:		NA			
	Reporting				
Compounds	Limit	ug/L			
N-nitrosodimethylamine	20	20 U			
Phenol	10	10 U			
bis(2-Chloroethyl) ether	10	10 U			
2-Chlorophenol	10	10 U			
1,3-Dichlorobenzene	10	10 U			
1,4-Dichlorobenzene	10	10 U			
Benzyl Alcohol	20	20 U			
2-Methylphenol	10	10 U			
1,2-Dichlorobenzene	10	10 U			
Bis(2-chloroisopropyl)ether	10	10 U			
4-Methylphenol	10	10 U			
n-Nitroso-di-n-propylamine	10	10 U			
Hexachloroethane	10	10 U			
Nitrobenzene	10	10 U			
Isophorone	10	10 U			
2,4-Dimethylphenol	10	10 U			
Benzoic Acid	20	20 U			
2-Nitrophenol	10	10 U			
bis(2-Chloroethoxy) methane	10	10 U			
2,4-Dichlorophenol	10	10 U			
1,2,4-Trichlorobenzene	10	10 U			
Naphthalene	10	10 U			
4-Chloroaniline	10	10 U			
Hexachlorobutadiene	10	10 U			
4-Chloro-3-methylphenol	20	20 U			
2-Methylnaphthalene	10	10 U			
Hexachlorocyclopentadiene	10	10 U			
2,4,6-Trichlorophenol	10	10 U			
2,4,5-Trichlorophenol	10	10 U			
2-Chloronaphthalene	10	10 U			
2-Nitroaniline	20	20 U			

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB04			
Lab Sample Number:		9912004-05B			
Matrix/Analysis:		Aqueous/Low			
Sample Type:		Rinsate Blank			
Dilution Factor:		1			
Date Sampled:		12/02/99			
Date Extracted:		12/06/99			
Date Analyzed		12/07/99			
Percent Moisture:		NA			
	Reporting				
Compounds	Limit	ug/L			
Dimethyl phthalate	10	10 U			
2,6-Dinitrotoluene	10	10 U			
Acenaphthylene	10	10 U			
3-Nitroaniline	20	20 U			
4-Nitrophenol	20	20 U			
2,4-Dinitrophenol	20	10 U			
Acenaphthene	10	10 U			
2,4-Dinitrotoluene	10	10 U			
Dibenzofuran	10	10 U			
Diethyl phthalate	10	10 U			
4-Chlorophenyl phenyl ether	10	10 U			
Fluorene	10	10 U			
4-Nitroaniline	20	20 U			
4,6-Dinitro-2-methylphenol	20	20 U			
n-Nitrosodiphenylamine	10	10 U			
1,2-Diphenylhydrazine	10	10 U			
4-Bromophenyl phenylether	10	10 U			
Hexachlorobenzene	10	10 U			
Pentachlorophenol	20	20 U			
Phenanthrene	10	10 U			
Anthracene	10	10 U			
Carbazole	10	10 U			
Di-n-butyl phthalate	10	10 U			
Fluoranthene	10	10 U			
Benzidine	20	20 U			
Pyrene	10	10 U			
Butyl benzyl phthalate	10	10 U			
bis(2-ethylhexyl) phthalate	10	10 U			
3,3'-Dichlorobenzidine	10	10 U			
Benzo(a)anthracene	10	10 U			
Chrysene	10	10 U			

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWRB04			
Lab Sample Number:		9912004-05B			
Matrix/Analysis:		Aqueous/Low			
Sample Type:		Rinsate Blank			
Dilution Factor:		1			
Date Sampled:		12/02/99			
Date Extracted:		12/06/99			
Date Analyzed		12/07/99			
Percent Moisture:		NA			
	Reporting				
Compounds	Limit	ug/L			
Di-n-octyl phthalate	10	10 U			
Benzo(b)fluoranthene	10	10 U			
Benzo(k)fluoranthene	10	10 U			
Benzo(a)pyrene	10	10 U			
Dibenz(a,h)anthracene	10	10 U			
Indeno(1,2,3-cd)pyrene	10	10 U			
Benzo(g,h,i)perylene	10	10 U			

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Feb. 04, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/02/99
4 Groundwater samples 1 rinsate blank sample and 1 trip blank
Lab Order: 9912004

Volatile Organics Analysis

Samples Collected:

BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15
BRSWRB04	Trip Blank 09		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 5° C. The cooler temperature range is 2-6° C. The sample receipt checklist indicates that samples were properly preserved, however the pH's of the VOA vials were not recorded. The laboratory should record and report these sample pHs.

Trip Blanks, Field Blanks, and Method Blanks

All VOA results for the rinsate blank BRSWRB04 and the Trip Blank 09 were reported as non-detected. Methylene chloride was detected in the VOA method blank at 0.91ug/L. This result is below the method quantitation limit. Methylene chloride was not detected in any samples submitted on 12/02/99. No results are qualified based upon the VOA blank results.

Matrix Spike / Matrix Spike Duplicate Results

Aqueous MS/MSD sample BRSWGW12 (9912004-02, collected 12/02/99) was analyzed as a MS/MSD pair in laboratory order 9912004. Results not meeting the MS/MSD laboratory acceptance criteria are summarized below.

Compound	MS % Recovery	MSD % Recovery	% RPD	Action
Acetone	65.9	75.7	13.9	Non-detects UJ; Detects J
2-Butanone	68	71.9	5.5	Non-detects UJ; Detects J
1,2-Dibromo-3-chloropropane	63.1	69.2	9.2	Non-detects UJ; Detects J
1,2,4-Trichlorobenzene	58.2	72.7	22.2	Non-detects UJ; Detects J
Naphthalene	43.5	64.3	38.7	Non-detects UJ; Detects J

1,2,3-Trichlorobenzene	60	87.6	37.5	Non-detects UJ; Detects J

MS/MSD qualifications typically apply to only that sample. The acetone, 2-butanone, naphthalene, 1,2-dibromo-3-chloropropane, 1,2,4-trichlorobenzene and 1,2,3-trichlorobenzene results for samples BRSWGW12 and field duplicate sample BRSWGW12D are reported as non-detected estimated (UJ). False negative results are possible.

Laboratory Control Sample

The QAPP has listed the 8260B LCS acceptance recoveries for select compounds as 80-120% and the laboratory forms indicate that the laboratory acceptance criterion is 70-130%. The validator used the 80-120% QAPP criterion for specified compounds 1,1-Dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene and the laboratory specified 70-130% acceptance criterion for non-QAPP specified compounds. A list of compounds not meeting these criteria is summarized below.

Compound	% Recovery	Action
1,2-Dibromo-3-chloropropane	64.3	Non-detects UJ; Detects J

The 1,2-dibromo-3-chloropropane result for all samples submitted on 12/02/99 are reported as non-detected estimated (UJ). False negative results are possible.

Field Duplicate Results

Samples BRSWGW12 and BRSWGW12D were the field duplicate pair collected on 12/02/99. All precision field duplicate criteria were met. No results were qualified based upon the field duplicate results.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9912004.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended. Note that the QAPP specified acceptance range for VOA surrogates is 80-120% and the laboratory form 1 surrogate recovery criteria is 70-130%. The validator used the QAPP specified 80-120% criteria for this validation.

Holding Times

All holding times were met. No data validation action is recommended.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Summary

Toluene is reported in samples BRSWGW14, BRSWGW12, BRSWGW12D and BRSWGW15 without qualification. These results exceed the method quantitation limit. Methyl-tert butyl ether is reported in samples BRSWGW12 and BRSWGW12D without qualification. These results exceed the method quantitation limit.

Sample BRSWGW12 was analyzed as the MS/MSD sample. The acetone, 2-butanone, naphthalene, 1,2-dibromo-3-chloropropane, 1,2,4-trichlorobenzene and 1,2,3-trichlorobenzene recoveries for the MS/MSD samples were below the acceptance criteria. The acetone, 2-butanone, naphthalene, 1,2-dibromo-3-chloropropane, 1,2,4-trichlorobenzene and 1,2,3-trichlorobenzene results for samples BRSWGW12 and field duplicate sample BRSWGW12D are reported as non-detected estimated (UJ). False negative results are possible.

The 1,2-dibromo-3-chloropropane results for all samples are reported as non-detected estimated (UJ). The LCS recovery was below the laboratory acceptance criteria, at 64.4%, and the possibility of false negative results exists.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the aqueous 8260 VOC results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWGW14	A, J^2
BRSWGW12	A, J^2, J^1
BRSWGW12D	A, J^2, J^1
BRSWGW15	A, J^2
BRSWRB04	A, J^2
Trip Blank 09	A, J^2

A Accept all data.

J^1 Acetone, 2-butanone, 1,2-dibromo-3-chloropropane, 1,2,4-trichlorobenzene, naphthalene, 1,2,3-trichlorobenzene results are reported as non-detected estimated (UJ). False negatives are possible.

J^2 1,2-Dibromo-3-chloropropane results are reported as non-detected estimated (UJ). LCS recoveries were low and false negatives are possible.

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15	BRSWRB04
S&W Sample (cont)						
Lab Sample Number:		9912004-01A	9912004-02A	9912004-03A	9912004-04A	9912004-05A
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	Aq/Low
Sample Type:			Field Dup	Field Dup		Rinsate Blank
Dilution Factor:						
Date Sampled:		12/02/99	12/02/99	12/02/99	12/02/99	12/02/99
Date Extracted:						
Date Analyzed:		12/08/99	12/08/99	12/08/99	12/08/99	12/08/99
Percent Moisture:		NA	NA	NA	NA	NA
	Report					
Target Compounds	Limit	ug/L	ug/L	ug/L	ug/L	ug/L
Dichlorodifluoromethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloromethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Vinyl Chloride	2	2.0 U	2.0U	2.0 U	2.0 U	2.0U
Chloroethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bromomethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichlorofluoromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Acetone	10	10.0 U	10.0 UJ	10.0 UJ	10.0 U	10.0 U
1.1-Dichloroethene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Methylene Chloride	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methyl tert-butyl ether	2	2.0 U	3.7	3.8	2.0 U	2.0 U
trans-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Butanone	10	10.0 U	10.0 UJ	10.0 UJ	10.0 U	10.0 U
2,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
cis-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloropropene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon tetrachloride	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Benzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromodichloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dibromomethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Methyl-2-pentanone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
cis-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	2	2.7	6.4	7.7	3.8	2.0 U
trans-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Hexanone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
1,3-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15	BRSWRB04
S&W Sample (cont)						
Lab Sample Number:		9912004-01A	9912004-02A	9912004-03A	9912004-04A	9912004-05A
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	Aq/Low
Sample Type:			Field Dup	Field Dup		Rinsate Blank
Dilution Factor:						
Date Sampled:		12/02/99	12/02/99	12/02/99	12/02/99	12/02/99
Date Extracted:						
Date Analyzed:		12/08/99	12/08/99	12/08/99	12/08/99	12/08/99
Percent Moisture:		NA	NA	NA	NA	NA
Dibromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15	BRSWRB04
S&W Sample (cont)						
Lab Sample Number:		9912004-01A	9912004-02A	9912004-03A	9912004-04A	9912004-05A
Matrix/Analysis:		AQ/Low	AQ/Low	AQ/Low	AQ/Low	Aq/Low
Sample Type:			Field Dup	Field Dup		Rinsate Blank
Dilution Factor:						
Date Sampled:		12/02/99	12/02/99	12/02/99	12/02/99	12/02/99
Date Extracted:						
Date Analyzed:		12/08/99	12/08/99	12/08/99	12/08/99	12/08/99
Percent Moisture:		NA	NA	NA	NA	NA
Chlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m,p-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Styrene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromoform	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isopropylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,2,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
n-Propylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3,5-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
tert-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4,-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
sec-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-isopropyltoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,4-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
n-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromo-3-chloropropane	5	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ
1,2,4-Trichlorobenzene	2	2.0 U	2.0 UJ	2.0 UJ	2.0 U	2.0 U
Hexachlorobutadiene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Naphthalene	2	2.0 U	2.0 UJ	2.0 UJ	2.0 U	2.0 U
1,2,3-Trichlorobenzene	2	2.0 U	2.0 UJ	2.0 UJ	2.0 U	2.0 U

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 09				
S&W Sample (cont)						
Lab Sample Number:		9912004-06A				
Matrix/Analysis:		AQ/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		12/02/99				
Date Extracted:						
Date Analyzed:		12/08/99				
Percent Moisture:		NA				
Target Compounds	Report Limit	ug/L				
Dichlorodifluoromethane	5	5.0 U				
Chloromethane	5	5.0 U				
Vinyl Chloride	2	2.0 U				
Chloroethane	5	5.0 U				
Bromomethane	5	5.0 U				
Trichlorofluoromethane	2	2.0 U				
Acetone	10	10.0 U				
1.1-Dichloroethene	1	1.0 U				
Carbon disulfide	2	2.0 U				
Methylene Chloride	5	5.0 U				
Methyl tert-butyl ether	2	2.0 U				
trans-1,2-Dichloroethene	2	2.0 U				
1,1-Dichloroethane	2	2.0 U				
2-Butanone	10	10.0 U				
2,2-Dichloropropane	2	2.0 U				
cis-1,2-Dichloroethene	2	2.0 U				
Chloroform	2	2.0 U				
Bromochloromethane	2	2.0 U				
1,1,1-Trichloroethane	2	2.0 U				
1,1-Dichloropropene	2	2.0 U				
Carbon tetrachloride	2	2.0 U				
1,2-Dichloroethane	2	2.0 U				
Benzene	2	2.0 U				
Trichloroethene	2	2.0 U				
1,2-Dichloropropane	2	2.0 U				
Bromodichloromethane	2	2.0 U				
Dibromomethane	2	2.0 U				
4-Methyl-2-pentanone	10	10.0 U				
cis-1,3-Dichloropropene	1	1.0 U				
Toluene	2	2.0 U				
trans-1,3-Dichloropropene	1	1.0 U				
1,1,2-Trichloroethane	2	2.0 U				
1,2-Dibromoethane	2	2.0 U				
2-Hexanone	10	10.0 U				
1,3-Dichloropropane	2	2.0 U				
Tetrachloroethene	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 09				
S&W Sample (cont)						
Lab Sample Number:		9912004-06A				
Matrix/Analysis:		AQ/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		12/02/99				
Date Extracted:						
Date Analyzed:		12/08/99				
Percent Moisture:		NA				
Dibromochloromethane	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 09				
S&W Sample (cont)						
Lab Sample Number:		9912004-06A				
Matrix/Analysis:		AQ/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		12/02/99				
Date Extracted:						
Date Analyzed:		12/08/99				
Percent Moisture:		NA				
Chlorobenzene	2	2.0 U				
1,1,1,2-Tetrachloroethane	2	2.0 U				
Ethylbenzene	2	2.0 U				
m,p-Xylene	2	2.0 U				
o-Xylene	2	2.0 U				
Styrene	2	2.0 U				
Bromoform	2	2.0 U				
Isopropylbenzene	2	2.0 U				
1,1,2,2-Tetrachloroethane	2	2.0 U				
1,2,3-Trichloropropane	2	2.0 U				
Bromobenzene	2	2.0 U				
n-Propylbenzene	2	2.0 U				
2-Chlorotoluene	2	2.0 U				
4-Chlorotoluene	2	2.0 U				
1,3,5-Trimethylbenzene	2	2.0 U				
tert-Butylbenzene	2	2.0 U				
1,2,4,-Trimethylbenzene	2	2.0 U				
sec-Butylbenzene	2	2.0 U				
4-isopropyltoluene	2	2.0 U				
1,3-dichlorobenzene	2	2.0 U				
1,4-dichlorobenzene	2	2.0 U				
n-Butylbenzene	2	2.0 U				
1,2-Dichlorobenzene	2	2.0 U				
1,2-Dibromo-3-chloropropa	5	5.0 UJ				
1,2,4-Trichlorobenzene	2	2.0 U				
Hexachlorobutadiene	2	2.0 U				
Naphthalene	2	2.0 U				
1,2,3-Trichlorobenzene	2	2.0 U				

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Feb. 04, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/02/99
4 Groundwater Samples and 1 rinsate blank
Lab Order: 9912004

Inorganic Analysis

BRSWGW14F	*BRSWGW12F*	*BRSWGW12DF*
BRSWGW15F	*BRSWRB04*	

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Arsenic, barium, cadmium, silver, lead, antimony, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B (ICP). Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
* MS /MSD results
* LCS results
Field duplicate results
Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 5° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved. The laboratory has noted that the hardness samples were preserved with HNO_3 and the sample pHs were <2.

All trace element samples were field filtered prior to sample submittal. The rinsate blank sample BRSWRB04 was not field filtered.

Field Blanks and Method Blanks

Selenium was detected in the method blank at 15.4ug/L. The blank action level is 77ug/L and the laboratory method quantitation level is 80ug/L. All selenium results are reported as non-detected (U) at 80ug/L. Selenium was detected in sample BRSWGW12DF at 23ug/L, however based upon the method blank results this result was reported as non-detected (U). Selenium was not detected in sample BRSWGW12, the laboratory duplicate. Selenium is not a common laboratory contaminant. The selenium method blank result is indicative of an instrumental problem.

Barium was detected in sample BRSWRB04 (collected 12/02/99) at 280ug/L. Barium was not detected in the preparation blank sample. The barium action level is 1400ug/L. All barium results are reported as non-detected (U). Barium results for samples BRSWGW12DF and BRSWGW14F are reported as non-detected at elevated reporting limits. Barium may or may not be present in these samples at low concentrations.

MS/MSD Results

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Groundwater sample BRSWGW13 (9912007-01, collected 12/03/99) was analyzed as the batch MS/MSD sample. All acceptance criteria were met. No results are qualified based upon the MS/MSD results.

LCS Results

All LCS criteria were met. No results are qualified based upon the LCS results.

Field Duplicates

Field duplicate pairs were collected on 12/02/99 and 12/03/99. The barium results for samples BRSWGW12F and BRSWGW12FD (collected 12/02/99) are 56ug/L and 310ug/L respectively. Due to the rinsate blank results barium is reported as non-detected in samples BRSWGW12F and BRSWGW12FD. The duplicate results differ by more than the 200ug/L. the method quantitation level. Based upon the field duplicate precision results, barium results are reported as non-detected estimated (UJ) for samples BRSWGW14F, BRSWGW12F, BRSWGW12FD and BRSWGW15F. The barium result for sample BRSWRB04 is reported as estimated (J).

Laboratory Duplicates

No aqueous laboratory duplicate sample results were submitted.

Holding Times

All sample analyses holding time requirements were met.

Summary

Trace element samples were field filtered. The reported results are dissolved elements rather than total element results. The field rinsate blank sample was not field filtered.

The selenium method blank result was 15.4ug/L. The selenium action level is 77 ug/L. The selenium method quantitation limit is 80ug/L. Selenium was detected in sample BRSWGW12DF at 23ug/L. Based upon the method blank result all selenium results are reported as non-detected (U), at 80ug/L. Selenium is not a common trace element contaminant and these results indicate instrument problems.

The chromium result for sample BRSWGW15F is reported as estimated (J). The result is below the method quantitation limit.

Barium was detected in rinsate blank sample BRSWRB04 at 280ug/L and the blank action level is 1400ug/L. All barium field sample results were below the blank action level and these results are reported as non-detected (U) due to the blank results. The barium field duplicate sample results were 56ug/L and 310ug/L. Based upon these results the barium BRSWRB04 result is

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

reported as estimated (J), and the other barium results are reported as non-detected estimated (UJ). The field duplicate precision results may be due to analytical problems, sample non-homogeneity, and
low-level, random barium contamination.

The MCP groundwater criterion for barium is 30,000ug/L. All reported barium results are below 1,000ug/L.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Aqueous Recommendation Summary

Antimony	A
Arsenic	A
Barium	J^1
Cadmium	A
Chromium	A, J^2
Lead	A
Mercury	A
Selenium	A
Silver	A

A- Accept all data

J^1- Barium results are estimated (J) or non-detected estimated (UJ) based upon field duplicate precision results and indicated random, low-level barium contamination.

J^2- Chromium result for sample BRSWGW15F is estimated (J). The result is below the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

TABLE 1

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW14F	BRSWGW12F	BRSWGW12DF	BRSWGW15F	BRSWRB04
Sample Location:							
Sample Type:			Aqueous	Aqueous	Aqueous	Aqueous	Aqueous
Lab Sample Number:			9912004-01C	9912004-02C	9912004-03C	9912004-04C	9912004-05C
Percent Solids:			NA	NA	NA	NA	NA
Dilution Factor:			1	1	1	1	1
Dilution Factor:							
Date Sampled:			12/02/99	12/02/99	12/02/99	12/02/99	12/02/99
Notes:			Filtered	Filtered	Filtered	Filtered	
		Report		Field Dup	Field Dup		Rinsate Blank
Inorganic Analysis	Method	Limit	ug/L	ug/L	ug/L	ug/L	ug/L
Antimony	6010B	20	20 U	20 U	20 U	20 U	20 U
Arsenic	6010B	25	25 U	25 U	25 U	25 U	25 U
Barium	6010B	200	290 UJ	200 UJ	310 UJ	200 UJ	280 J
Cadmium	6010B	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chromium	6010B	10	10 U	10 U	10 U	2.8 J	10 U
Lead	6010B	25	25 U	25 U	25 U	25 U	25 U
Selenium	6010B	80	80 U	80 U	80 U	80 U	80 U
Silver	6010B	7	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U
Mercury	7470	0.2	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Date Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - Value is rejected.

Feb. 03, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/02/99
4 Groundwater samples and 1 Rinsate blank sample
Lab Order: 9912004

Calcium Magnesium Hardness Analysis

BRSWGW14	BRSWGW12	BRSWGW12D
BRSWGW15	BRSWRB04	

Dear Ms. Doherty:

A modified Tier II data validation was performed on calcium magnesium hardness analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Calcium and magnesium were determined by ICP method 6010B. Hardness was calculated from the calcium and magnesium results.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

* Chain of custody documents
* Sample log-in documents
  Field blanks, and method blanks
* MS /MSD results
* LCS results
* Field duplicate results
* Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 5° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved. The laboratory has noted that the hardness samples were preserved with HNO_3 and the sample pHs were <2.

Field Blanks and Method Blanks

The hardness method blank was reported as non-detected (U). No results are qualified based upon the method blank results.

The hardness result for rinsate blank, BRSWRB04, (collected 12/02/99) was reported at 52mg/L. The method quantitation limit is 33mg/L. The blank action level for calcium magnesium hardness is 260mg/L. The hardness result for BRSWRB04 is reported without qualification. Hardness results for samples BRSWGW14, BRSWGW12, and BRSWGW12D are reported as non-detected at elevated quantitation limits due to potential field sampling contamination.

MS/MSD Results

Sample BRSWGW13 (collected 12/03/99) was analyzed as the MS/MSD sample. All precision and recovery criteria were met. No results are qualified based upon the MS/MSD results.

LCS Results

The LCS acceptance criterion was met. No hardness results are qualified based upon the LCS result.

Field Duplicates

Field duplicate samples BRSWGW12 and BRSWGW12D were collected on 12/02/99 and field

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

duplicate samples BRSWGW05A and BRSWGW05AD were collected on 12/03/99. All field duplicate precision criteria were met. No hardness results were qualified based upon the field duplicate results.

Laboratory Duplicates

No laboratory duplicate samples were analyzed with laboratory order 9912004.

Holding Times

All sample analyses holding time requirements were met.

Summary

The calcium magnesium hardness result for rinsate blank sample BRSWRB04 is 52mg/L and the action level is 260mg/L. Hardness results for BRSWGW14, BRSWGW12 and BRSWGW12D are reported as non-detected (U) at elevated concentrations. The rinsate blank result is reported without qualification.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Calcium Magnesium Hardness

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Aqueous Hardness Recommendation Summary

BRSWGW14	A^1
BRSWGW12	A^1
BRSWGW12D	A^1
BRSWGW15	A
BRSWRB04	A

A- Accept all data

A^1- Accept these results as non-detected (U) at the reported concentrations due to rinsate blank contamination. The hardness action level is 260mg/L. Results below the action level are reported as non-detected (U).

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

Calcium Magnesium Hardness Validated Results

Project No.: 05000.33
Lab Order: 9912004
Site: Gordon Craig Army Reserve

Sample Number:			BRSWGW14	BRSWGW12	BRSWGW12D	BRSWGW15	BRSWRB04
Sample Location:							
Sample Type:			Aqueous Low	Aqueous Low	Aqueous Low	Aqueous Low	Aqueous Low
Lab Sample Number:			9912004-01D	9912004-02D	9912004-03D	9912004-04D	9912004-05D
Percent moisture:			NA	NA	NA	NA	NA
Dilution Factor:			1	1	1	1	1
Dilution Factor:							
Date Sampled:			12/02/99	12/02/99	12/02/99	12/02/99	12/02/99
Date Analyzed:			12/07/99	12/07/99	12/07/99	12/07/99	12/07/99
Notes:				Field Dup	Field Dup		Rinsate Blank
		Report					
ANALYTES	Method	Limit*	mg/L	mg/L	mg/L	mg/L	mg/L
Ca-Mg Hardness	6010B	33	93 U	70 U	71 U	33 U	52

Analytical Method:
Hardness determined by calculation using calcium and magnesium results obtained by ICP (method 6010B) analyses.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 27, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/23/99
5 Sediment samples
5 Surface water samples
Lab Order: 9911033

Semivolatile Organics Analysis

Samples Collected:

BRSWSD01	BRSWSD02	BRSWSD04
BRSWSD03	BRSWSD03D	BRSWSW01
BRSWSW02	BRSWSW04	BRSWSW03
BRSWSW03D		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- rinsate blanks, and method blanks
- MS/MSD results
- LCS results

- field duplicate results
* - laboratory duplicate results
- surrogate recoveries
- holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No rinsate blank was submitted with the samples collected on 11/23/99. The rinsate blank sample BRSWRB02 (collected 11/24/9) was used to evaluate equipment blank contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA samples.

Field Blanks and Method Blanks

All semivolatile compounds were reported as non-detected in field rinsate blank sample BRSWRB02.

All semivolatile compounds were reported as non-detected in the aqueous and sediment preparation blank samples.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Matrix Spike / Matrix Spike Duplicate Results

Due to laboratory error the entire compound list was not spiked into the aqueous and sediment MS/MSD samples. The entire compound list was used for the aqueous and sediment LCS samples.

Sample BRSWSW03 was analyzed as the aqueous MS/MSD sample. All compound recovery criteria and duplicate precision criteria were met. No validation actions were taken based upon aqueous MS/MSD results.

Sample BRSWSD03 was analyzed as the sediment MS/MSD sample. Compounds not meeting the laboratory acceptance criteria are summarized below.

Compound	MS % Recovery	MSD % Recovery	Acceptance Criteria	Actions
1,2,4-trichlorobenzene	43.6	40.7	44-96	UJ nons, J pos
1,4-Dichlorobenzene	38.7	33.7	38-88	UJ nons, J pos

Based upon these results the 1,2,4-trichlorobenzene and 1,4-dichlorobenzene results are reported as non-detected estimated (UJ) for samples BRSWSD03 and BRSWSD03D. The possibility of false negatives exists.

Laboratory Control Sample

The aqueous benzidine LCS % recovery was 0%. All aqueous benzidine results are rejected. All other compounds met the laboratory acceptance criteria.

A list of compounds not meeting the sediment LCS recoveries is summarized below.

Compound	LCS % Recovery	Acceptance Criteria	Actions
1,3-Dichlorobenzene	48.6	53-147	UJ nons, J pos
1,4-Dichlorobenzene	51.4	55-145	UJ nons, J pos
1,2-Dichlorobenzene	51.8	54-146	UJ nons, J pos
2,4-Dimethylphenol	49.7	54-146	UJ nons, J pos
3,3'-Dichlorobenzidine	55.1	57-143	UJ nons, J pos

These compound results are reported as non-detected estimated (UJ) in all soil samples. The recoveries indicate a low bias and false negatives may be possible.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Field Duplicate Results

Samples BRSWSD03 and BRSWSD03D were field duplicate samples. Many low level polyaromatic hydrocarbons were detected in both samples at concentrations below the method quantitation limits. Phenanthrene and fluoranthene were reported as non-detected (U) in sample BRSWSD03 and detected in the field duplicate sample BRSWSD03D. The phenanthrene and fluoranthene results for sample BRSWSD03 are reported as non-detected estimated (UJ). Benzo(k)fluoranthene was detected in sample BRSWSD03D at a concentration below the method quantitation limit and not in sample BRSWSD03. Benzo(k)fluoranthene is reported in sample BRSWSD03 as non-detected estimated (UJ).

These discrepancies may be due to field sampling variability and may reflect analytical uncertainty at concentrations near the method detection limits.

Laboratory Duplicate Results

No laboratory duplicates were analyzed with laboratory order 9911033.

Surrogate Results

The acid surrogate recoveries for aqueous sample BRSWSW02 did not meet the laboratory acceptance criteria. The recoveries are summarized below.

Surrogate	% Recovery	Acceptance criteria
2,4,6-Tribromophenol	15.2	49-98
2-Fluorophenol	8.27	34-68
Phenol-d5	14.2	26-53

Based upon the poor recoveries, particularly the 2-fluorphenol recovery < 10%, all acid compound results for sample BRSWSW02 are rejected (R). The results do not confirm the presence or absence of these compounds. The laboratory narrative did note that sampleBRSWSW02 did form an emulsion during the sample extraction. The low acid surrogate recoveries may be due to sample matrix.

All surrogate recoveries for sediment sample BRSWSD04 were outside the laboratory acceptance criteria. These results are summarized below.

Surrogate	% Recovery	Acceptance criteria
2-Fluorobiphenyl	113	44-94
4-Terphenyl-d14	123	47-101
Nitrobenzene-d5	117	39-90
2,4,6-Tribromophenol	124	40-103

2-Fluorophenol	117	37-85
Phenol-d5	117	42-92

All surrogate recoveries indicate a potential high bias for the results. The positive results reported for sample BRSWSD04 are below the method quantitation level and are reported as estimated (J), due to uncertainty near the detection limit. These results may be biased high based upon the surrogate recoveries and false positive results may exist.

Holding Times

All analytical holding times were met.

Summary

Reject aqueous benzidine results for all aqueous samples. The benzidine LCS recovery was 0%. Benzidine is not listed in the QAPP as a contaminant of concern.

The acid surrogate recoveries for sample BRSWSW02 did not meet the laboratory acceptance criteria. The 2-fluorophenol recovery was <10%. All acid compound results for sample BRSWSW02 are rejected (R). The laboratory narrative indicated that the sample extraction formed an emulsion, indicating possible matrix interferences.

All surrogate recoveries for sediment sample BRSWSD04 were above the laboratory acceptance limits. All positive results are reported as estimated (J) due to analytical uncertainty near the detection limit. Reported results may be biased high and the chance of false positive results exists.

1,3-Dichlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dimethylphenol, and 3,3'-dichlorobenzidine LCS sediment results were low and did not meet the laboratory acceptance criteria. Results for these compounds are reported as non-detected estimated (UJ), for all sediment samples. A low bias is indicated and false negatives are possible.

The MS/MSD sediment recoveries for 1,2,4-trichlorbenzene and 1,4-dichlorobenzene were low and did not meet the laboratory method acceptance criteria. These results were reported as non-detected estimated (UJ) for samples BRSWSD03 and BRSWSD03D. A low bias is indicated and false negatives are possible.

Phenanthrene, benzo(ghi)perylene, benz(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene and bis(2-ethylhexyl)phthalate results are reported as estimated (J) for sample BRSWSD01. These results are reported at concentrations below the method quantitation limit.

Fluoranthene, chrysene and benzo(b)fluoranthene results are reported as estimated (J) for sample BRSWSD02. These results are reported at concentrations below the method quantitation limit.

Pyrene, chrysene, benz(a)anthracene, benzo(a)pyrene, benzo(ghi)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene results are reported as estimated (J) for sample BRSWSD03. These results are reported at concentrations below the method quantitation limit.

Phenanthrene, fluoranthene, chrysene, benz(a)anthracene, benzo(a)pyrene, benzo(ghi)perylene, benzo(b)fluoranthene, pyrene and indeno(1,2,3-cd)pyrene results are reported as estimated (J) for sample BRSWSD03D. These results are reported at concentrations below the method quantitation limit.

Fluoranthene, pyrene, chrysene, benzo(ghi)perylene, benzo(b)fluoranthene, benzo(a)pyrene and indeno(1,2,3-cd)pyrene results are reported as estimated (J) for sample BRSWSD04. These results are reported at concentrations below the method quantitation limit.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous 8270C SVOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia SVOC soils
Table Ib SVOC aqueous

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSD01	A, J^2, J^3
BRSWSD02	A, J^2, J^4
BRSWSD04	A, J^2, J^7
BRSWSD03	A, J^1, J^2, J^5
BRSWSD03D	A, J^1, J^2, J^6

A Accept all data.

J^1 The 1,2,4-trichlorobenzene and the 1,4-dichlorobenzene results for samples BRSWSD03 and BRSWSD03D are reported as non-detected estimated (UJ) based upon the MS/MSD results . False negative results are possible.

J^2 The LCS recoveries for 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene, 2,4-dimethylphenol and 3,3'-dichlorobenzidine results for all sediment samples are reported as non-detected estimated (UJ). False negative results are possible.

J^3 Phenanthrene, benzo(ghi)perylene, benz(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene and bis(2-ethylhexyl)phthalate results are reported as estimated (J). These results are reported at concentrations below the method quantitation limit.

J^4 Fluoranthene, chrysene and benzo(b)fluoranthene results are reported as estimated (J). Results are reported at concentrations below the method quantitation limit.

J^5 Chrysene, benz(a)anthracene, benzo(a)pyrene, benzo(ghi)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, pyrene, and indeno(1,2,3-cd)pyrene results are reported as estimated (J). Results are reported at concentrations below the method quantitation limit.

J^6 Phenanthrene, fluoranthene, pyrene chrysene, benz(a)anthracene, benzo(a)pyrene, benzo(ghi)perylene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene results are reported as estimated (J). Results are reported at concentrations below the method quantitation limit.

J^7 Fluoranthene, indeno(1,2,3-cd)pyrene, chrysene, benzo(ghi)perylene, benzo(b)fluoranthene, benzo(a)pyrene, and pyrene results are reported as estimated (J). Results are reported at concentrations below the method quantitation limit.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1b- Semivolatile 8270C Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSW01	A, R
BRSWSW02	A, R^1, R^2
BRSWSW04	A, R
BRSWSW03	A, R
BRSWSW03D	A, R

A Accept all data.

R^1 Benzidine results are rejected. The benzidine LCS recovery was 0%.

R^2 All acid compound results are rejected (R). The acid surrogate recoveries were low and the 2-fluorophenol was <10%.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03
Lab Sample Number:		9911033-01B	9911033-02B	9911033-03B	9911033-04B
Matrix/Analysis:		Sediment/Low	Sediment/Low	Sediment/Low	Sediment/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/23/99	11/23/99	11/23/99	11/23/99
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/03/1999	12/03/1999	12/09/1999	12/03/1999
Percent Moisture:		7.7	17.6	45	22.3
					Field Dup
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
N-nitrosodimethylamine	500	530 U	600 U	900 U	640 U
Phenol	250	270 U	300 U	450 U	320 U
bis(2-Chloroethyl) ether	250	270 U	300 U	450 U	320 U
2-Chlorophenol	250	270 U	300 U	450 U	320 U
1,3-Dichlorobenzene	250	270 UJ	300 UJ	450 UJ	320 UJ
1,4-Dichlorobenzene	250	270 UJ	300 UJ	450 UJ	320 UJ
Benzyl Alcohol	500	540 U	600 U	900 U	640 U
2-Methylphenol	250	270 U	300 U	450 U	320 U
1,2-Dichlorobenzene	250	270 UJ	300 UJ	450 UJ	320 UJ
Bis(2-chloroisopropyl)ether	250	270 U	300 U	450 U	320 U
4-Methylphenol	250	270 U	300 U	450 U	320 U
n-Nitroso-di-n-propylamine	250	270 U	300 U	450 U	320 U
Hexachloroethane	250	270 U	300 U	450 U	320 U
Nitrobenzene	250	270 U	300 U	450 U	320 U
Isophorone	250	270 U	300 U	450 U	320 U
2,4-Dimethylphenol	250	270 UJ	300 UJ	450 UJ	320 UJ
Benzoic Acid	500	540 U	600 U	900 U	640 U
2-Nitrophenol	250	270 U	300 U	450 U	320 U
bis(2-Chloroethoxy) methane	250	270 U	300 U	450 U	320 U
2,4-Dichlorophenol	250	270 U	300 U	450 U	320 U
1,2,4-Trichlorobenzene	250	270 U	300 U	450 U	320 UJ
Naphthalene	250	270 U	300 U	450 U	320 U
4-Chloroaniline	250	270 U	300 U	450 U	320 U
Hexachlorobutadiene	250	270 U	300 U	450 U	320 U
4-Chloro-3-methylphenol	500	540 U	600 U	900 U	640 U
2-Methylnaphthalene	250	270 U	300 U	450 U	320 U
Hexachlorocyclopentadiene	250	270 U	300 U	450 U	320 U
2,4,6-Trichlorophenol	250	270 U	300 U	450 U	320 U
2,4,5-Trichlorophenol	250	270 U	300 U	450 U	320 U
2-Chloronaphthalene	250	270 U	300 U	450 U	320 U
2-Nitroaniline	500	540 U	600 U	900 U	640 U

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03
Lab Sample Number:		9911033-01B	9911033-02B	9911033-03B	9911033-04B
Matrix/Analysis:		Sediment/Low	Sediment/Low	Sediment/Low	Sediment/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/23/99	11/23/99	11/23/99	11/23/99
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/03/1999	12/03/1999	12/09/1999	12/03/1999
Percent Moisture:		7.7	17.6	45	22.3
					Field Dup
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Dimethyl phthalate	250	270 U	300 U	450 U	320 U
2,6-Dinitrotoluene	250	270 U	300 U	450 U	320 U
Acenaphthylene	250	270 U	300 U	450 U	320 U
3-Nitroaniline	500	540 U	600 U	900 U	640 U
4-Nitrophenol	500	540 U	600 U	900 U	640 U
2,4-Dinitrophenol	500	540 U	600 U	900 U	640 U
Acenaphthene	250	270 U	300 U	450 U	320 U
2,4-Dinitrotoluene	250	270 U	300 U	450 U	320 U
Dibenzofuran	250	270 U	300 U	450 U	320 U
Diethyl phthalate	250	270 U	300 U	450 U	320 U
4-Chlorophenyl phenyl ether	250	270 U	300 U	450 U	320 U
Fluorene	250	270 U	300 U	450 U	320 U
4-Nitroaniline	500	540 U	600 U	900 U	640 U
4,6-Dinitro-2-methylphenol	500	540 U	600 U	900 U	640 U
n-Nitrosodiphenylamine	250	270 U	300 U	450 U	320 U
1,2-Diphenylhydrazine	250	270 U	300 U	450 U	320 U
4-Bromophenyl phenylether	250	270 U	300 U	450 U	320 U
Hexachlorobenzene	250	270 U	300 U	450 U	320 U
Pentachlorophenol	500	540 U	600 U	900 U	640 U
Phenanthrene	250	260 J	300 U	450 U	320 UJ
Anthracene	250	270 U	300 U	450 U	320 U
Carbazole	250	270 U	300 U	450 U	320 U
Di-n-butylphthalate	250	270 U	300 U	450 U	320 U
Fluoranthene	250	570	60 J	190 J	320 UJ
Benzidine	250	270 U	300 U	450 U	320 U
Pyrene	250	480	300 U	180 J	150 J
Butyl benzyl phthalate	250	270 U	300 U	450 U	320 U
bis(2-ethylhexyl)phthalate	250	250 J	300 U	450 U	380
3,3'-Dichlorobenzidine	250	270 UJ	300 UJ	450 UJ	320 UJ
Benzo(a)anthracene	250	190 J	300 U	450 U	88 J
Chrysene	250	310	60 J	160 J	120 J

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03
Lab Sample Number:		9911033-01B	9911033-02B	9911033-03B	9911033-04B
Matrix/Analysis:		Sediment/Low	Sediment/Low	Sediment/Low	Sediment/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/23/99	11/23/99	11/23/99	11/23/99
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/03/1999	12/03/1999	12/09/1999	12/03/1999
Percent Moisture:		7.7	17.6	45	22.3
					Field Dup
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Di-n-octylphthalate	250	270 U	300 U	450 U	320 U
Benzo(b)fluoranthene	250	430	89 J	210 J	130 J
Benzo(k)fluoranthene	250	120 J	300 U	450 U	70 J
Benzo(a)pyrene	250	270 J	300 U	99 J	120 J
Dibenz(a,h)anthracene	250	270 U	300 U	450 U	320 U
Indeno(1,2,3-cd)pyrene	250	280	300 U	110 J	88 J
Benzo(g,h,i)perylene	250	260 J	300 U	110 J	100 J

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD03D			
Lab Sample Number:		9911033-04B			
Matrix/Analysis:		*Sediment/Low*			
Sample Type:		ROUTINE			
Dilution Factor:		1			
Date Sampled:		11/23/99			
Date Extracted:		11/29/1999			
Date Analyzed		12/03/1999			
Percent Moisture:		23.1			
	Reporting	Field Dup			
Compounds	Limit	ug/Kg			
N-nitrosodimethylamine	500	640 U			
Phenol	250	320 U			
bis(2-Chloroethyl) ether	250	320 U			
2-Chlorophenol	250	320 U			
1,3-Dichlorobenzene	250	320 UJ			
1,4-Dichlorobenzene	250	320 UJ			
Benzyl Alcohol	500	640 U			
2-Methylphenol	250	320 U			
1,2-Dichlorobenzene	250	320 UJ			
Bis(2-chloroisopropyl)ether	250	320 U			
4-Methylphenol	250	320 U			
n-Nitroso-di-n-propylamine	250	320 U			
Hexachloroethane	250	320 U			
Nitrobenzene	250	320 U			
Isophorone	250	320 U			
2,4-Dimethylphenol	250	320 UJ			
Benzoic Acid	500	640 U			
2-Nitrophenol	250	320 U			
bis(2-Chloroethoxy) methane	250	320 U			
2,4-Dichlorophenol	250	320 U			
1,2,4-Trichlorobenzene	250	320 UJ			
Naphthalene	250	320 U			
4-Chloroaniline	250	320 U			
Hexachlorobutadiene	250	320 U			
4-Chloro-3-methylphenol	500	640 U			
2-Methylnaphthalene	250	320 U			
Hexachlorocyclopentadiene	250	320 U			
2,4,6-Trichlorophenol	250	320 U			
2,4,5-Trichlorophenol	250	320 U			
2-Chloronaphthalene	250	320 U			
2-Nitroaniline	500	640 U			

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD03D			
Lab Sample Number:		9911033-04B			
Matrix/Analysis:		Sediment/Low			
Sample Type:		ROUTINE			
Dilution Factor:		1			
Date Sampled:		11/23/99			
Date Extracted:		11/29/1999			
Date Analyzed		12/03/1999			
Percent Moisture:		23.1			
	Reporting	Field Dup			
Compounds	Limit	ug/Kg			
Dimethyl phthalate	250	320 U			
2,6-Dinitrotoluene	250	320 U			
Acenaphthylene	250	320 U			
3-Nitroaniline	500	640 U			
4-Nitrophenol	500	640 U			
2,4-Dinitrophenol	500	640 U			
Acenaphthene	250	320 U			
2,4-Dinitrotoluene	250	320 U			
Dibenzofuran	250	320 U			
Diethyl phthalate	250	320 U			
4-Chlorophenyl phenyl ether	250	320 U			
Fluorene	250	320 U			
4-Nitroaniline	500	640 U			
4,6-Dinitro-2-methylphenol	500	640 U			
n-Nitrosodiphenylamine	250	320 U			
1,2-Diphenylhydrazine	250	320 U			
4-Bromophenyl phenylether	250	320 U			
Hexachlorobenzene	250	320 U			
Pentachlorophenol	500	640 U			
Phenanthrene	250	100 J			
Anthracene	250	320 U			
Carbazole	250	320 U			
Di-n-butyl phthalate	250	320 U			
Fluoranthene	250	140 J			
Benzidine	250	320 U			
Pyrene	250	160 J			
Butyl benzyl phthalate	250	320 U			
bis(2-ethylhexyl) phthalate	250	580			
3,3'-Dichlorobenzidine	250	320 UJ			
Benzo(a)anthracene	250	88 J			
Chrysene	250	94 J			

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD03D			
Lab Sample Number:		9911033-04B			
Matrix/Analysis:		Sediment/Low			
Sample Type:		ROUTINE			
Dilution Factor:		1			
Date Sampled:		11/23/99			
Date Extracted:		11/29/1999			
Date Analyzed		12/03/1999			
Percent Moisture:		23.1			
	Reporting	Field Dup			
Compounds	Limit	ug/Kg			
Di-n-octyl phthalate	250	320 U			
Benzo(b)fluoranthene	250	98 J			
Benzo(k)fluoranthene	250	320 UJ			
Benzo(a)pyrene	250	84 J			
Dibenz(a,h)anthracene	250	320 U			
Indeno(1,2,3-cd)pyrene	250	64 J			
Benzo(g,h,i)perylene	250	72 J			

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSW01	BRSWSW02	BRSWSW04	BRSWSW03
Lab Sample Number:		9911033-06B	9911033-07B	9911033-08B	9911033-09B
Matrix/Analysis:		Aqueous Low	Aqueous Low	Aqueous Low	Aqueous Low
Sample Type:		Routine	Routine	Routine	Routine
Dilution Factor:		Low	Low	Low	Low
Date Sampled:		11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/01/1999	12/01/1999	12/01/1999	12/01/1999
Percent Moisture:					Field Dup
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
N-nitrosodimethylamine	20	21 U	24 U	20 U	20 U
Phenol	10	10 U	R	10 U	10 U
bis(2-Chloroethyl) ether	10	10 U	12 U	10 U	10 U
2-Chlorophenol	10	10 U	R	10 U	10 U
1,3-Dichlorobenzene	10	10 U	12 U	10 U	10 U
1,4-Dichlorobenzene	10	10 U	12 U	10 U	10 U
Benzyl Alcohol	20	21 U	24 U	20 U	20 U
2-Methylphenol	10	10 U	R	10 U	10 U
1,2-Dichlorobenzene	10	10 U	12 U	10 U	10 U
Bis(2-chloroisopropyl)ether	10	10 U	12 U	10 U	10 U
4-Methylphenol	10	10 U	R	10 U	10 U
n-Nitroso-di-n-propylamine	10	10 U	12 U	10 U	10 U
Hexachloroethane	10	10 U	12 U	10 U	10 U
Nitrobenzene	10	10 U	12 U	10 U	10 U
Isophorone	10	10 U	12 U	10 U	10 U
2,4-Dimethylphenol	10	10 U	R	10 U	10 U
Benzoic Acid	20	21 U	R	20 U	20 U
2-Nitrophenol	10	10 U	R	10 U	10 U
bis(2-Chloroethoxy) methane	10	10 U	12 U	10 U	10 U
2,4-Dichlorophenol	10	10 U	R	10 U	10 U
1,2,4-Trichlorobenzene	10	10 U	12 U	10 U	10 U
Naphthalene	10	10 U	12 U	10 U	10 U
4-Chloroaniline	10	10 U	12 U	10 U	10 U
Hexachlorobutadiene	10	10 U	12 U	10 U	10 U
4-Chloro-3-methylphenol	20	21U	R	20 U	20 U
2-Methylnaphthalene	10	10 U	12 U	10 U	10 U
Hexachlorocyclopentadiene	10	10 U	12 U	10 U	10 U
2,4,6-Trichlorophenol	10	10 U	R	10 U	10 U
2,4,5-Trichlorophenol	10	10 U	R	10 U	10 U
2-Chloronaphthalene	10	10 U	12 U	10 U	10 U
2-Nitroaniline	20	21 U	24 U	20 U	20 U

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSW01	BRSWSW02	BRSWSW04	BRSWSW03
Lab Sample Number:		9911033-06B	9911033-07B	9911033-08B	9911033-09B
Matrix/Analysis:		Aqueous Low	Aqueous Low	Aqueous Low	Aqueous Low
Sample Type:		Routine	Routine	Routine	Routine
Dilution Factor:		Low	Low	Low	Low
Date Sampled:		11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/01/1999	12/01/1999	12/01/1999	12/01/1999
Percent Moisture:					Field Dup
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
Dimethyl phthalate	10	10 U	12 U	10 U	10 U
2,6-Dinitrotoluene	10	10 U	12 U	10 U	10 U
Acenaphthylene	10	10 U	12 U	10 U	10 U
3-Nitroaniline	20	21 U	24 U	20 U	20 U
4-Nitrophenol	20	21 U	R	20 U	20 U
2,4-Dinitrophenol	20	21 U	R	20 U	20 U
Acenaphthene	10	10 U	12 U	10 U	10 U
2,4-Dinitrotoluene	10	10 U	12 U	10 U	10 U
Dibenzofuran	10	10 U	12 U	10 U	10 U
Diethyl phthalate	10	10 U	12 U	10 U	10 U
4-Chlorophenyl phenyl ether	10	10 U	12 U	10 U	10 U
Fluorene	10	10 U	12 U	10 U	10 U
4-Nitroaniline	20	21 U	24 U	20 U	20 U
4,6-Dinitro-2-methylphenol	20	21 U	R	20 U	20 U
n-Nitrosodiphenylamine	10	10 U	12 U	10 U	10 U
1,2-Diphenylhydrazine	10	10 U	12 U	10 U	10 U
4-Bromophenyl phenylether	10	10 U	12 U	10 U	10 U
Hexachlorobenzene	10	10 U	12 U	10 U	10 U
Pentachlorophenol	20	21 U	R	20 U	20 U
Phenanthrene	10	10 U	12 U	10 U	10 U
Anthracene	10	10 U	12 U	10 U	10 U
Carbazole	10	10 U	12 U	10 U	10 U
Di-n-butylphthalate	10	10 U	12 U	10 U	10 U
Fluoranthene	10	10 U	12 U	10 U	10 U
Benzidine	20	R	R	R	R
Pyrene	10	10 U	12 U	10 U	10 U
Butyl benzyl phthalate	10	10 U	12 U	10 U	10 U
bis(2-ethylhexyl)phthalate	10	10 U	12 U	10 U	1.3 J
3,3'-Dichlorobenzidine	10	10 U	12 U	10 U	10 U
Benzo(a)anthracene	10	10 U	12 U	10 U	10 U
Chrysene	10	10 U	12 U	10 U	10 U

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSW01	BRSWSW02	BRSWSW04	BRSWSW03
Lab Sample Number:		9911033-06B	9911033-07B	9911033-08B	9911033-09B
Matrix/Analysis:		Aqueous Low	Aqueous Low	Aqueous Low	Aqueous Low
Sample Type:		Routine	Routine	Routine	Routine
Dilution Factor:		Low	Low	Low	Low
Date Sampled:		11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/01/1999	12/01/1999	12/01/1999	12/01/1999
Percent Moisture:					Field Dup
	Reporting				
Compounds	Limit	ug/L	ug/L	ug/L	ug/L
Di-n-octylphthalate	10	10 U	12 U	10 U	10 U
Benzo(b)fluoranthene	10	10 U	12 U	10 U	10 U
Benzo(k)fluoranthene	10	10 U	12 U	10 U	10 U
Benzo(a)pyrene	10	10 U	12 U	10 U	10 U
Dibenz(a,h)anthracene	10	10 U	12 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10	10 U	12 U	10 U	10 U
Benzo(g,h,i)perylene	10	10 U	12 U	10 U	10 U

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Table I **Semivolatile Validated Results**
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSW03D			
Lab Sample Number:		9911033-09B			
Matrix/Analysis:		Aqueous Low			
Sample Type:		Routine			
Dilution Factor:		Low			
Date Sampled:		11/23/1999			
Date Extracted:		11/29/1999			
Date Analyzed		12/01/1999			
Percent Moisture:		Field Dup			
	Reporting				
Compounds	Limit	ug/L			
N-nitrosodimethylamine	20	20 U			
Phenol	10	10 U			
bis(2-Chloroethyl) ether	10	10 U			
2-Chlorophenol	10	10 U			
1,3-Dichlorobenzene	10	10 U			
1,4-Dichlorobenzene	10	10 U			
Benzyl Alcohol	20	20 U			
2-Methylphenol	10	10 U			
1,2-Dichlorobenzene	10	10 U			
Bis(2-chloroisopropyl)ether	10	10 U			
4-Methylphenol	10	10 U			
n-Nitroso-di-n-propylamine	10	10 U			
Hexachloroethane	10	10 U			
Nitrobenzene	10	10 U			
Isophorone	10	10 U			
2,4-Dimethylphenol	10	10 U			
Benzoic Acid	20	20 U			
2-Nitrophenol	10	10 U			
bis(2-Chloroethoxy) methane	10	10 U			
2,4-Dichlorophenol	10	10 U			
1,2,4-Trichlorobenzene	10	10 U			
Naphthalene	10	10 U			
4-Chloroaniline	10	10 U			
Hexachlorobutadiene	10	10 U			
4-Chloro-3-methylphenol	20	20 U			
2-Methylnaphthalene	10	10 U			
Hexachlorocyclopentadiene	10	10 U			
2,4,6-Trichlorophenol	10	10 U			
2,4,5-Trichlorophenol	10	10 U			
2-Chloronaphthalene	10	10 U			
2-Nitroaniline	20	20 U			

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSW03D			
Lab Sample Number:		9911033-09B			
Matrix/Analysis:		Aqueous Low			
Sample Type:		Routine			
Dilution Factor:		Low			
Date Sampled:		11/23/1999			
Date Extracted:		11/29/1999			
Date Analyzed		12/01/1999			
Percent Moisture:		Field Dup			
	Reporting				
Compounds	Limit	ug/L			
Dimethyl phthalate	10	10 U			
2,6-Dinitrotoluene	10	10 U			
Acenaphthylene	10	10 U			
3-Nitroaniline	20	20 U			
4-Nitrophenol	20	20 U			
2,4-Dinitrophenol	20	20 U			
Acenaphthene	10	10 U			
2,4-Dinitrotoluene	10	10 U			
Dibenzofuran	10	10 U			
Diethyl phthalate	10	10 U			
4-Chlorophenyl phenyl ether	10	10 U			
Fluorene	10	10 U			
4-Nitroaniline	20	20 U			
4,6-Dinitro-2-methylphenol	20	20 U			
n-Nitrosodiphenylamine	10	10 U			
1,2-Diphenylhydrazine	10	10 U			
4-Bromophenyl phenylether	10	10 U			
Hexachlorobenzene	10	10 U			
Pentachlorophenol	20	20 U			
Phenanthrene	10	10 U			
Anthracene	10	10 U			
Carbazole	10	10 U			
Di-n-butylphthalate	10	10 U			
Fluoranthene	10	10 U			
Benzidine	20	R			
Pyrene	10	10 U			
Butyl benzyl phthalate	10	10 U			
bis(2-ethylhexyl)phthalate	10	1.3 J			
3,3'-Dichlorobenzidine	10	10 U			
Benzo(a)anthracene	10	10 U			
Chrysene	10	10 U			

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSW03D			
Lab Sample Number:		9911033-09B			
Matrix/Analysis:		Aqueous Low			
Sample Type:		Routine			
Dilution Factor:		Low			
Date Sampled:		11/23/1999			
Date Extracted:		11/29/1999			
Date Analyzed		12/01/1999			
Percent Moisture:		Field Dup			
	Reporting				
Compounds	Limit	ug/L			
Di-n-octylphthalate	10	10 U			
Benzo(b)fluoranthene	10	10 U			
Benzo(k)fluoranthene	10	10 U			
Benzo(a)pyrene	10	10 U			
Dibenz(a,h)anthracene	10	10 U			
Indeno(1,2,3-cd)pyrene	10	10 U			
Benzo(g,h,i)perylene	10	10 U			

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Feb. 09, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/23/99
5 Sediment samples
5 Surface Water samples and 1 trip blank
Lab Order: 9911033

Volatile Organics Analysis

Samples Collected:

BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03
BRSWSD03D	BRSWSW01	BRSWSW02	BRSWSW04
BRSWSW03	BRSWSW03D	Trip Blank VI	

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results
- field duplicate results

* - laboratory duplicate results

* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No rinsate blank was submitted with the samples collected on 11/23/99. The rinsate blank sample BRSWRB02 (collected 11/24/99) was used to evaluate equipment blank contamination.

Aqueous sample BRSWSW03 and sediment sample BRSWSD03 were specified as the MS/MSD samples.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA samples. The aqueous VPH sample preservation information was provided and the VPH sample pHs were less than 2.

Trip Blanks, Field Blanks, and Method Blanks

Methylene chloride was detected in the 11/23/99 soil preparation blank at 17.0ug/Kg and the action level is 170 ug/Kg. Methylene chloride was not detected in any sediment samples. No results are qualified based upon the sediment method blank results. Rinsate blank sample BRSWRB02 (collected 11/24/99) was evaluated as the rinsate blank sample. All VOA rinsate blank results were reported as non-detected, and no VOA results are qualified based upon the rinsate blank results.

All VOA aqueous method blank results were reported as non-detected (U). Methylene chloride was detected in aqueous trip blank sample Trip Blank VI at 1.1ug/L and the laboratory quantitation limit is 5ug/L.

Methylene chloride was not detected in the sediment and aqueous field samples. No aqueous and sediment field sample results are qualified based upon the method blank, rinsate blank, and trip blank results.

Matrix Spike / Matrix Spike Duplicate Results

The sediment MS/MSD sample was BRSWSD03 (9911033-04). All VOA results for sediment sample BRSWD03 and sediment field duplicate sample BRSWSD03D are reported as estimated (J) or non-detected estimated (UJ). Forty compounds for the MS sample and fifty compounds for the MSD sample did not meet the method acceptance criteria (70-130%). All recoveries were low, typically 40-60%. Severe matrix problems are indicated. All positive results are biased low and false negative results are possible for non-detected results. All MS/MSD surrogate recovery criteria were met. Typically, MS/MSD results apply to only the non-spiked sample results. The validator has also applied these qualifiers to the field duplicate sample results.

The aqueous MS/MSD sample was BRSWSW03 (9911033-09). Results not meeting the MS/MSD laboratory acceptance criteria are summarized below. The laboratory acceptance criteria, listed on the MS/MSD QC summary report, is 70-130%. The QAPP surface water/groundwater MS/MSD recovery limits are 80-120% for 1,1-dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene. The validator used the acceptance recoveries specified in the QAPP for the specified compounds and the laboratory acceptance criteria for the remaining compounds. The laboratory %RPD acceptance criterion is $\leq$ 25%. Results not meeting the MS/MSD laboratory acceptance criteria are summarized below.

Compound	MS % Recovery	MSD % Recovery	% RPD	Action
Dichlorodifluoromethane	65.6	72.6	10.2	Non-detects UJ; Detects J
Trichlorofluoromethane	55.0	51.2	7.2	Non-detects UJ; Detects J
Acetone	17.5	126	151	Non-detects UJ; Detects J
2,2-Dichloropropane	59	61	3.3	Non-detects UJ; Detects J
Naphthalene	70	87.1	21.8	Non-detects UJ; Detects J

These compound results are reported as non-detected estimated (UJ) for samples BRSWSW03 and BRSWSW03D. The acetone MS/MSD recoveries and the %RPD indicate possible acetone contamination. Acetone was reported as non-detected estimated (UJ) in samples BRSWSW03 and BRSWSW03D.

Laboratory Control Sample

Two LCSs were prepared with the VOA samples collected on 11/23/99. The laboratory soil LCS recovery acceptance criteria are 70-130%. A list of compounds not meeting this criterion is summarized below. These LCS results are applied to samples BRSWSD01 and BRSWSD02.

Compound	% Recovery	Action
Dichlorodifluoromethane	59.8	Non-detects UJ; Detects J
Chloroethane	65.9	Non-detects UJ; Detects J
Bromomethane	65.5	Non-detects UJ; Detects J
trans-1,2-Dichloroethene	132	Non-detects U; Detects J
1,1-Dichloroethane	132	Non-detects U; Detects J
2-Butanone	158	Non-detects U; Detects J
2,2-Dichloropropane	133	Non-detects U; Detects J
1,2-Dichloropropane	138	Non-detects U; Detects J
Chloroform	145	Non-detects U; Detects J

Based upon the soil LCS recoveries the dichlorodifluoromethane, chloroethane, and bromomethane, results for soil samples BRSWSD01 and BRSWSD02 are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists. The remaining compounds are all non-detects and are not qualified because a high bias is indicated.

The following LCS results are applied to samples BRSWSD04, BRSWSD03 and BRSWSD03D.

Compound	% Recovery	Action
Dichlorodifluoromethane	147	Non-detects U; Detects J
Vinyl Chloride	131	Non-detects U; Detects J
Chloroethane	60.6	Non-detects UJ; Detects J
Bromomethane	65.9	Non-detects UJ; Detects J
2-Butanone	158	Non-detects U; Detects J

The chloroethane and bromomethane results for samples BRSWSD04, BRSWSD03 and BRSWSD03D are reported as non-detected estimated (UJ). The remaining compounds are all non-detects and are not qualified because a high bias is indicated.

The QAPP has listed the 8260B LCS acceptance recoveries for select compounds as 80-120% and the laboratory forms indicate that the laboratory acceptance criterion is 70-130%. The validator used the 80-120% QAPP criterion for specified compounds 1,1-Dichloroethene,

benzene, trichloroethene, toluene, and chlorobenzene and the laboratory specified 70-130% acceptance criterion for non-QAPP specified compounds. A list of compounds not meeting these criteria is summarized below.

Compound	% Recovery	Action
Dichlorodifluoromethane	52.4	Non-detects UJ; Detects J
Chloromethane	65.9	Non-detects UJ; Detects J
Chloroethane	44.7	Non-detects UJ; Detects J

The dichlorodifluoromethane, chloromethane, and chloroethane results for all aqueous samples are reported as non-detected estimated (UJ) and the results may be biased low.

Field Duplicate Results

Sediment samples BRSWSD03 and BRSWSD03D were a field sample duplicate pair. Based upon the poor MS/MSD recoveries all VOA results are estimated (J) or non-detected estimated (UJ) for these samples. Acetone was the only VOA compound detected in these samples. The acetone results were reported as estimated (J). The field duplicate % RPD for acetone is 99%. Based upon the acetone field duplicate precision results the acetone results for sediment samples BRSWSD01, BRSWSD04, BRSWSD03, and BRSWSD03D are reported as estimated (J). The variability may be due to sample non-homogeneity or laboratory contamination. The acetone result for sample BRSWSD01 is below the method quantitation limit and is estimated (J) also due to imprecision below the method quantitation limit.

Aqueous samples BRSWSW03 and BRSWSW03D were a field duplicate pair. All results are reported as non-detected (U) or non-detected estimated (UJ) and all field duplicate precision criteria were met. No aqueous results were qualified based upon the field duplicate results.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 99110033.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended based upon surrogate recoveries.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

Carbon disulfide was reported in sample BRSWSW02 at 0.81ug/L. The method quantitation limit is 2.0ug/L and the result is reported as estimated (J).

Method blank BRSWRB02, collected 11/24/99, was evaluated for potential field sampling contamination. All VOA rinsate blank results were reported as non-detected or non-detected estimated. No field sample results are qualified based upon the rinsate blank results.

Methylene chloride is reported as estimated (J) in aqueous sample Trip Blank VI at 1.1ug/L. This reported result is below the method quantitation level, (5ug/L). Methylene chloride was not detected in any aqueous field samples.

Methylene chloride was detected in the 11/23/99 preparation blank at 17ug/Kg. The action level is 170ug/Kg. Methylene chloride was not detected in any sediment field samples.

The QAPP LCS acceptance criteria for the aqueous 8260B results were 80-120%, for 1,1-Dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene. Laboratory LCS forms indicate that the laboratory used 70-130% acceptance criteria for all compounds. The validator used the QAPP specified criteria (80-120) for the specified compounds and the laboratory specified acceptance criteria (70-130) for the remaining compounds.

Based upon the aqueous LCS recoveries the dichlorodifluoromethane, chloromethane, and trichloromethane results for all aqueous samples are reported as non-detected estimated (UJ) and these results may be biased low.

Based upon the soil LCS recoveries the dichlorodifluoromethane, chloroethane, and bromomethane, results for soil samples BRSWSD01, and BRSWSD02 are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists.

Based upon the soil LCS recoveries the chloroethane and bromomethane results for samples BRSWSD04, BRSWSD03 and BRSWSD03D are reported as non-detected estimated (UJ). The remaining compounds are all non-detects and are not qualified because a high bias is indicated.

All the results for sediment VOA samples BRSWSD03 and BRSWSD03D are reported as estimated (J) or non-detected estimated (UJ). The MS/MSD recoveries for sediment sample BRSWSD03 indicate a significant low bias. Forty MS recoveries and 50 MSD recoveries were below the 70-130% acceptance range. The validator has qualified all VOA results for samples BRSWSD03 and field duplicate sample BRSWSD03D due to the indicated matrix problems. All results should be regarded as low estimates.

The dichlorodifluoromethane, trichlorofluoromethane, acetone, 2,2-dichloropropane, and napthalene MS/MSD recoveries were low for aqueous VOA sample BRSWSW03. These compound results are reported as non-detected estimated (UJ) for samples BRSWSW03 and field duplicate sample BRSWSW03D. The MS/MSD recoveries for acetone were 17.5% and 126%, and the %RPD was 151%. The poor precision may be due to laboratory contamination.

Based upon the field duplicate precision, the positive sediment acetone results for samples BRSWSD01, BRSWSD04, and BRSWSD03 and BRSWSD03D are reported as estimated (J). The poor precision may be due to sample non-homogeneity or laboratory contamination.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the sediment and aqueous 8260B VOA results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia 8260B sediment
Table Ib 8260B aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Sediment
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSD01	A, J[2], J[3]
BRSWSD02	A, J[3]
BRSWSD04	A, J[2], J[4]
BRSWSD03	J[1]
BRSWSD03D	J[1]

A Accept all data.

J[1] All sediment VOA results are reported as estimated (J) or non-detected estimated (UJ) due to poor MS/MSD recoveries. The MS/MSD recoveries indicate a low bias and a matrix problem. False negative results are possible.

J[2] Acetone is reported as estimated (J) due to poor field duplicate precision.

J[3] The dichlorodiluoromethane, chloroethane, and bromomethane results are reported as non-detected estimated (UJ) due to LCS recoveries. A low bias is indicated and false negatives are possible.

J[4] The choroethane and bromomethane results are reported as non-detected estimated (UJ) due to LCS recoveries. A low bias is indicated and false negatives are possible.

Table 1b- Volatiles-8260B Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSW01	A, J^1
BRSWSW02	A, J^1, J^4
BRSWSW04	A, J^1
BRSWSW03	A, J^1, J^2
BRSWSW03D	A, J^1, J^2
TRIP BLANK VI	A, J^1, J^3

A Accept all data.

J^1 Dichlorodifluoromethane, chloromethane, and trichlorofluoromethane results are reported as non-detected estimated (UJ). LCS recoveries were low and false negatives are possible.

J^2 The trichlorofluoromethane, dichlorodifluormethane, acetone, 2,2-dichloropropane, and naphthalene results are reported as non-detected estimated (UJ). The MS/MSD recoveries were low and false negatives are possible.

J^3 Methylene chloride is reported as estimated 1.1ug/L (J). The result is below the method quantitation level (5.0ug/L).

J^4 Carbon disulfide is reported as estimated 0.81ug/L (J). The result is below the method quantitation level (2.0ug/L).

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03	BRSWSD03D
S&W Sample (cont)					Field Dup	Field Dup
Lab Sample Number:		9911033-01A	9911033-02A	9911033-03A	9911333-04A	9911333-05A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1	1
Date Sampled:		11/23/99	11/23/99	11/23/99	11/23/99	11/23/99
Date Extracted:		11/24/1999	11/24/1999	11/24/1999	11/24/1999	11/24/1999
Date Analyzed:		12/01/99	12/01/99	12/02/99	12/02/99	12/02/99
Percent Moisture:		7.7	17.6	45.0	22.3	23.1
Target Compounds	Report Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Dichlorodifluoromethane	4	4.7 UJ	5.6 UJ	9.4 U	5.8 UJ	5.8 UJ
Chloromethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Vinyl Chloride	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Chloroethane	4	4.7 UJ	5.6 UJ	9.4 UJ	5.8 UJ	5.8 UJ
Bromomethane	4	4.7 UJ	5.6 UJ	9.4 UJ	5.8 UJ	5.8 UJ
Trichlorofluoromethane	4	4.3 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Acetone	20	18 J	28 U	89 J	160 J	54 J
1,1-Dichloroethene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Carbon disulfide	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Methylene Chloride	20	23 U	21 U	47 U	29 UJ	29 UJ
Methyl tert-butyl ether	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
trans-1,2-Dichloroethene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,1-Dichloroethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
2-Butanone	20	23 U	21 U	47 U	29 UJ	29 UJ
2,2-Dichloropropane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
cis-1,2-Dichloroethene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Chloroform	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Bromochloromethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,1,1-Trichloroethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,1-Dichloropropene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Carbon tetrachloride	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2-Dichloroethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Benzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Trichloroethene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2-Dichloropropane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Bromodichloromethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Dibromomethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
4-Methyl-2-pentanone	20	23 U	28 U	47 U	29 UJ	29 UJ
cis-1,3-Dichloropropene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Toluene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
trans-1,3-Dichloropropene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,1,2-Trichloroethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2-Dibromoethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
2-Hexanone	20	23 U	28 U	47 U	29 UJ	29 UJ
1,3-Dichloropropane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Tetrachloroethene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03	BRSWSD03D
S&W Sample (cont)					Field Dup	Field Dup
Lab Sample Number:		9911033-01A	9911033-02A	9911033-03A	9911333-04A	9911333-05A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1	1
Date Sampled:		11/23/99	11/23/99	11/23/99	11/23/99	11/23/99
Date Extracted:		11/24/1999	11/24/1999	11/24/1999	11/24/1999	11/24/1999
Date Analyzed:		12/01/99	12/01/99	12/02/99	12/02/99	12/02/99
Percent Moisture:		7.7	17.6	45.0	22.3	23.1
Dibromochloromethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03	BRSWSD03D
S&W Sample (cont)					Field Dup	Field Dup
Lab Sample Number:		9911033-01A	9911033-02A	9911033-03A	9911333-04A	9911333-05A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1	1
Date Sampled:		11/23/99	11/23/99	11/23/99	11/23/99	11/23/99
Date Extracted:		11/24/1999	11/24/1999	11/24/1999	11/24/1999	11/24/1999
Date Analyzed:		12/01/99	12/01/99	12/02/99	12/02/99	12/02/99
Percent Moisture:		7.7	17.6	45.0	22.3	23.1
Chlorobenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,1,1,2-Tetrachloroethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Ethylbenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
m,p-Xylene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
o-Xylene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Styrene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Bromoform	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Isopropylbenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,1,2,2-Tetrachloroethane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2,3-Trichloropropane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Bromobenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
n-Propylbenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
2-Chlorotoluene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
4-Chlorotoluene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,3,5-Trimethylbenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
tert-Butylbenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2,4,-Trimethylbenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
sec-Butylbenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
4-isopropyltoluene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,3-dichlorobenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,4-dichlorobenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
n-Butylbenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2-Dichlorobenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2-Dibromo-3-chloropropane	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2,4-Trichlorobenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Hexachlorobutadiene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
Naphthalene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ
1,2,3-Trichlorobenzene	4	4.7 U	5.6 U	9.4 U	5.8 UJ	5.8 UJ

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Soil units ug/Kg based upon 100% total solids

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSW01	BRSWSW02	BRSWSW04	BRSWSW03	BRSWSW03D
S&W Sample (cont)					Field Dup	Field Dup
Lab Sample Number:		9911033-06A	9911033-07A	9911033-08A	9911033-09A	9911033-10A
Matrix/Analysis:		AQ/Low	Aq/Low	Aq/Low	Aq/Low	Aq/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1	1
Date Sampled:		11/23/1999	11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Extracted:		11/30/1999	11/30/1999	11/30/1999	11/30/1999	11/30/1999
Date Analyzed:		11/30/1999	11/30/1999	11/30/1999	11/30/1999	11/30/1999
Percent Moisture:		NA	NA	NA	NA	NA
Target Compounds	Report Limit	ug/L	ug/L	ug/L	ug/L	ug/L
Dichlorodifluoromethane	5	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ
Chloromethane	5	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ
Vinyl Chloride	2	2.0 U	2.0U	2.0 U	2.0 U	2.0 U
Chloroethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Bromomethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichlorofluoromethane	2	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ	2.0 UJ
Acetone	10	10.0 U	10.0 U	10.0 U	10.0 UJ	10.0 UJ
1,1-Dichloroethene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	2	2.0 U	0.81 J	2.0 U	2.0 U	2.0 U
Methylene Chloride	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methyl tert-butyl ether	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
trans-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Butanone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
2,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 UJ
cis-1,2-Dichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloropropene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon tetrachloride	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Benzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromodichloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dibromomethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Methyl-2-pentanone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
cis-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
trans-1,3-Dichloropropene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromoethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Hexanone	10	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
1,3-Dichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSW01	BRSWSW02	BRSWSW04	BRSWSW03	BRSWSW03D
S&W Sample (cont)					Field Dup	Field Dup
Lab Sample Number:		9911033-06A	9911033-07A	9911033-08A	9911033-09A	9911033-10A
Matrix/Analysis:		AQ/Low	Aq/Low	Aq/Low	Aq/Low	Aq/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1	1
Date Sampled:		11/23/1999	11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Extracted:		11/30/1999	11/30/1999	11/30/1999	11/30/1999	11/30/1999
Date Analyzed:		11/30/1999	11/30/1999	11/30/1999	11/30/1999	11/30/1999
Percent Moisture:		NA	NA	NA	NA	NA
Dibromochloromethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSW01	BRSWSW02	BRSWSW04	BRSWSW03	BRSWSW03D
S&W Sample (cont)					Field Dup	Field Dup
Lab Sample Number:		9911033-06A	9911033-07A	9911033-08A	9911033-09A	9911033-10A
Matrix/Analysis:		AQ/Low	Aq/Low	Aq/Low	Aq/Low	Aq/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1	1
Date Sampled:		11/23/1999	11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Extracted:		11/30/1999	11/30/1999	11/30/1999	11/30/1999	11/30/1999
Date Analyzed:		11/30/1999	11/30/1999	11/30/1999	11/30/1999	11/30/1999
Percent Moisture:		NA	NA	NA	NA	NA
Chlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m,p-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Styrene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromoform	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isopropylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,2,2-Tetrachloroethane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichloropropane	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
n-Propylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chlorotoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3,5-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
tert-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4,-Trimethylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
sec-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-isopropyltoluene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,4-dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
n-Butylbenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromo-3-chloropropane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2,4-Trichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Hexachlorobutadiene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Naphthalene	2	2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 UJ
1,2,3-Trichlorobenzene	2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank VI				
S&W Sample (cont)						
Lab Sample Number:		9911033-11A				
Matrix/Analysis:		AQ/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/23/1999				
Date Extracted:		11/30/1999				
Date Analyzed:		11/30/1999				
Percent Moisture:		NA				
Target Compounds	Report Limit	ug/L				
Dichlorodifluoromethane	5	5.0 UJ				
Chloromethane	5	5.0 UJ				
Vinyl Chloride	2	2.0 U				
Chloroethane	5	5.0 U				
Bromomethane	5	5.0 U				
Trichlorofluoromethane	2	2.0 UJ				
Acetone	10	10.0 U				
1.1-Dichloroethene	1	1.0 U				
Carbon disulfide	2	2.0 U				
Methylene Chloride	5	1.1 J				
Methyl tert-butyl ether	2	2.0 U				
trans-1,2-Dichloroethene	2	2.0 U				
1,1-Dichloroethane	2	2.0 U				
2-Butanone	10	10.0 U				
2,2-Dichloropropane	2	2.0 U				
cis-1,2-Dichloroethene	2	2.0 U				
Chloroform	2	2.0 U				
Bromochloromethane	2	2.0 U				
1,1,1-Trichloroethane	2	2.0 U				
1,1-Dichloropropene	2	2.0 U				
Carbon tetrachloride	2	2.0 U				
1,2-Dichloroethane	2	2.0 U				
Benzene	2	2.0 U				
Trichloroethene	2	2.0 U				
1,2-Dichloropropane	2	2.0 U				
Bromodichloromethane	2	2.0 U				
Dibromomethane	2	2.0 U				
4-Methyl-2-pentanone	10	10.0 U				
cis-1,3-Dichloropropene	1	1.0 U				
Toluene	2	2.0 U				
trans-1,3-Dichloropropene	1	1.0 U				
1,1,2-Trichloroethane	2	2.0 U				
1,2-Dibromoethane	2	2.0 U				
2-Hexanone	10	10.0 U				
1,3-Dichloropropane	2	2.0 U				
Tetrachloroethene	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank VI				
S&W Sample (cont)						
Lab Sample Number:		9911033-11A				
Matrix/Analysis:		AQ/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/23/1999				
Date Extracted:		11/30/1999				
Date Analyzed:		11/30/1999				
Percent Moisture:		NA				
Dibromochloromethane	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank VI				
S&W Sample (cont)						
Lab Sample Number:		9911033-11A				
Matrix/Analysis:		AQ/Low				
Sample Type:		ROUTINE				
Dilution Factor:		1				
Date Sampled:		11/23/1999				
Date Extracted:		11/30/1999				
Date Analyzed:		11/30/1999				
Percent Moisture:		NA				
Chlorobenzene	2	2.0 U				
1,1,1,2-Tetrachloroethane	2	2.0 U				
Ethylbenzene	2	2.0 U				
m,p-Xylene	2	2.0 U				
o-Xylene	2	2.0 U				
Styrene	2	2.0 U				
Bromoform	2	2.0 U				
Isopropylbenzene	2	2.0 U				
1,1,2,2-Tetrachloroethane	2	2.0 U				
1,2,3-Trichloropropane	2	2.0 U				
Bromobenzene	2	2.0 U				
n-Propylbenzene	2	2.0 U				
2-Chlorotoluene	2	2.0 U				
4-Chlorotoluene	2	2.0 U				
1,3,5-Trimethylbenzene	2	2.0 U				
tert-Butylbenzene	2	2.0 U				
1,2,4,-Trimethylbenzene	2	2.0 U				
sec-Butylbenzene	2	2.0 U				
4-isopropyltoluene	2	2.0 U				
1,3-dichlorobenzene	2	2.0 U				
1,4-dichlorobenzene	2	2.0 U				
n-Butylbenzene	2	2.0 U				
1,2-Dichlorobenzene	2	2.0 U				
1,2-Dibromo-3-chloropropane	5	5.0 U				
1,2,4-Trichlorobenzene	2	2.0 U				
Hexachlorobutadiene	2	2.0 U				
Naphthalene	2	2.0 U				
1,2,3-Trichlorobenzene	2	2.0 U				

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Jan. 28, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/23/99
4 Sediment samples including the trip blank
2 Aqueous samples and 1 trip blank
Lab Order: 9911033

Volatile Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSD043	BRSWSD03D	Trip Blank VI (SED)	BRSWSDO7
BRSWSW03	BRSWSW03D	TRIP BLANK VI (AQ)	

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

- chain of custody documents
- sample log-in documents
*- trip blanks, rinsate blanks, and method blanks
*- MS/MSD results
* - LCS results
* - field duplicate results
* - laboratory duplicate results
- surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No rinsate blank was submitted with the samples collected on 11/23/99. The rinsate blank sample BRSWRB02 (collected 11/24/99) was used to evaluate equipment blank contamination.

VPH results were reported for sediment samples BRSWSD03 and BRSWSD03D. These analyses were not requested on the chain of custodies. The validator did include these validated results on the summary tables.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA samples. The aqueous VPH sample preservation was provided. Sample pHs were less than 2.

Trip Blanks, Field Blanks, and Method Blanks

No target compounds were detected in the VPH soil preparation blank, rinaste blank BRSWRB02 (11/24/99) and the soil trip blank VI. No target compounds were detected in the VPH aqueous preparation blanks and the trip blank VI.

Matrix Spike / Matrix Spike Duplicate Results

Sediment sample BRSWSD03 (9911033-04B) was analyzed as the MS/MSD VPH sample. All method analyte recovery and duplicate precision criteria were met.

Aqueous sample BRSWSW03 (9911033-09D) was analyzed as the MS/MSD VPH sample. All method analyte recovery and duplicate precision criteria were met.

Laboratory Control Samples

All soil laboratory control sample recoveries met the method specified recovery criteria.

Al l aqueous laboratory control sample recoveries met the method specified recovery criteria

Field Duplicate Results

Aqueous samples BRSWSW03 and BRSWSW03D were submitted as the field duplicate samples. All VPH results were reported as non-detected (U). No results were qualified based upon the field duplicate results.

Sediment samples BRSWSD03 and BRSWSD03D were submitted as the field duplicate samples. All VPH results were reported as non-detected (U). No results were qualified based upon the field duplicate results.

Laboratory Duplicates

Soil sample BRSWSB19 was analyzed as the sample/sample duplicate. All method precision acceptance criteria were met.

The laboratory did not analyze an aqueous VPH laboratory duplicate. No results are qualified due to this omission.

Surrogate Results

The 2,5-dibromotoluene result for sediment sample BRSWSD07 was 69.0%. The method specified acceptance criterion is 70-130%. All VPH results for sediment sample BRSWSD07 are reported as non-detected estimated (UJ). False negative results are possible.

The surrogate recoveries for all other sediment and aqueous samples met the method specified acceptance criterion.

Specified 8260B method surrogates were reported along with VPH surrogate 2,5-Dibromotoluene.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The 2,5-dibromotoluene surrogate recovery for sample BRSWSD07 was 69.0%. This recovery is low and outside the method acceptance criterion. All VPH results for sample BRSWSD07 are reported as non-detected estimated (UJ).

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the sediment and aqueous VPH results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

Attachments: Table 1a VPH sediment
Table 1b VPH aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1a- Volatile Petroleum Hydrocarbon
Sediment Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSD03	A
BRSWSD03D	A
BRSWSD07	J^1
Trip Blank VI (soil)	A

A Accept all results without qualification

J^1 All VPH results reported as non-detected estimated (UJ). The 2,5-dibromotoluene surrogate recovery was low (69%). False negative results are possible.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1b- Volatile Petroleum Hydrocarbon Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSW03	A
BRSWSW03D	A
Trip Blank VI (aq)	A

A Accept all results without qualification

TABLE 1

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSD03	BRSWSD03D	Trip Blank VI	BRSWSD07
Sample Location:						
Sample Type:			SOIL	SOIL		SOIL
Lab Sample Number:			9911033-04B	9911033-05B	9911033-11A	9911033-12B
Percent moisture:			22.3	23.1	NA	32.0
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Date Analyzed:			12/05/1999	12/05/1999	12/04/1999	12/05/1999
Notes:			FIELD DUP	FIELD DUP		
		Report				
VPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	mg/Kg
C5-C8 Aliphatic (1,2)	8260	2.5	3.2 U	3.4 U	2.5 U	4.0 UJ
C9-C12 Aliphatic(1,3)	8260	0.62	0.81 U	0.84 U	0.62 U	1.0 U
C9-C10 Aromatics(1)	8260	0.62	0.81 U	0.84 U	0.62 U	1.0 UJ
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	0.050	0.065U	0.067 U	0.050 U	0.081 UJ
Benzene	8260	0.050	0.065U	0.067 U	0.050 U	0.081 UJ
Toluene	8260	0.050	0.065U	0.067 U	0.050 U	0.081 UJ
Ethylbenzene	8260	0.050	0.065U	0.067 U	0.050 U	0.081 UJ
m,p-Xylene	8260	0.050	0.065U	0.067 U	0.050 U	0.081 UJ
o-Xylene	8260	0.050	0.065U	0.067 U	0.050 U	0.081 UJ
Napthalene	8260	0.050	0.065U	0.067 U	0.050 U	0.081 UJ

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution
* Reporting limit is based upon 100% total solids and a 1:1 methanol to soil ratio.

TABLE I

MA DEP VPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSW03	BRSWSW03D	Trip-Blank VI	
Sample Location:						
Sample Type:			Aqueous	Aqueous	Aqueous	
Lab Sample Number:			9911033-09D	9911033-10D	9911033-11A	
Percent moisture:			NA	NA	NA	
Dilution Factor:			1	1	1	
Dilution Factor:						
Date Sampled:			11/23/1999	11/23/1999	11/23/1999	
Date Analyzed:			11/30/1999	11/30/1999	11/30/1999	
Notes:			FIELD DUP	FIELD DUP		
		Report				
VPH ANALYTES	Method	Limit*	ug/L	ug/L	ug/L	
C5-C8 Aliphatic (1,2)	8260	100	100 U	100 U	100 U	
C9-C12 Aliphatic(1,3)	8260	25	25 U	25 U	25 U	
C9-C10 Aromatics(1)	8260	25	25 U	25 U	25 U	
Targeted VPH Analytes						
Methyl tert-Butyl Ether	8260	2.0	2.0 U	2.0 U	2.0 U	
Benzene	8260	2.0	2.0 U	2.0 U	2.0 U	
Toluene	8260	2.0	2.0 U	2.0 U	2.0 U	
Ethylbenzene	8260	2.0	2.0 U	2.0 U	2.0 U	
m,p-Xylene	8260	2.0	2.0 U	2.0 U	2.0 U	
o-Xylene	8260	2.0	2.0 U	2.0 U	2.0 U	
Napthalene	8260	2.0	2.0 U	2.0 U	2.0 U	

Analytical Method:
The laboratory used EPA method 8260, VOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C5-C8 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.
(3) C9-C12 Aliphatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range and concentration of C9-C10 Aromatic Hydrocarbons.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

D - Dilution

Jan. 28, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/23/99
3 Sediment samples
2 Aqueous Samples
Lab Order: 9911033

Extractable Petroleum Hydrocarbon Analysis

Samples Collected:

BRSWSD043	BRSWSD03D	BRSWSDO7
BRSWSW03	BRSWSW03D	

Dear Ms. Doherty:

This data validation was performed on the organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve. The laboratory, AMRO Environmental Laboratories Corp. (Merrimack N.H.), prepared the samples in accordance with Massachusetts Department of Environmental Protection Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), January 1998. Samples were analyzed using GC-MS rather than the method specified analytical method. The Massachusetts DEP has approved this method modification since this laboratory was able to demonstrate comparability. The data were evaluated according to the Quality Control requirements as specified in the methods, based upon the following parameters, in accordance with project specific guidelines and standard USEPA Region 1 data validation guidelines:

- chain of custody documents
- sample log-in documents
* - rinsate blanks, and method blanks
* - MS/MSD results
* - LCS results
- field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No rinsate blank was submitted with the samples collected on 11/23/99. The rinsate blank sample BRSWRB02 (collected 11/24/99) was used to evaluate equipment blank contamination.

EPH results were reported for sediment samples BRSWSD03 and BRSWSD03D. These analyses were not requested on the chain of custodies. The validator did include these validated results on the summary tables.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous VOA samples.

Field Blanks and Method Blanks

The rinsate blank sample BRSWRB02 (collected 11/24/99) was used to evaluate equipment blank contamination. No EPH contaminants were detected.

No EPH contaminants were detected in the aqueous and the sediment preparation blanks.

No EPH results were qualified based upon the rinsate and the preparation blank results.

Matrix Spike / Matrix Spike Duplicate Results

Sediment sample BRSWSD03 (9911033-04D) was analyzed as the MS/MSD EPH sample. All method analyte recovery and duplicate precision criteria were met.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Aqueous sample BRSWSW03 (9911033-09E) was analyzed as the MS/MSD EPH sample. All method analyte recovery and duplicate precision criteria were met.

Laboratory Control Samples

All soil EPH LCS recoveries met the method acceptance criteria.

All aqueous EPH LCS recoveries met the method acceptance criteria.

Field Duplicate Results

Aqueous samples BRSWSW03 and BRSWSW03D were submitted as the field duplicate samples. The C19-C36 results were 330ug/L and 170ug/L respectively. The duplicate result % RPD is 64%. The C19-C36 results are reported as estimated (J). The C11-C22 aromatic result for sample BRSWSW03 is 130ug/L and the C11-C22 aromatic result for sample BRSWSW03D is non-detected (U) at 100ug/L. These results are reported as estimated (J) and non-detected estimated (UJ) respectively.

Sediment samples BRSWSD03 and BRSWSD03D were submitted as the field duplicate samples.
The C19-C36 results were 630mg/Kg and 110mg/Kg respectively. The duplicate result %RPD is 140%. The C19-C36 results are reported as estimated (J). The C11-C22 aromatic result for sample BRSWSD03 is 130mg/Kg and the C11-C22 aromatic result for sample BRSWSD03D is non-detected (U) at 64mg/Kg. These results are reported as estimated (J) and non-detected estimated (UJ) respectively.

Pyrene and chrysene were reported at concentrations below the method quantitation limit in sample BRSWSD03 and as non-detected in the field duplicate sample BRSWSD03D. The positive pyrene and chrysene results are reported as estimated (J) and the non-detects are reported as non-detected estimated (UJ).

Laboratory Duplicate Results

Sediment sample BRSWSD07 was analyzed as the laboratory duplicate sample. All field duplicate precision criteria were met. No validation actions were taken based upon the soil laboratory duplicate results.

The EPH aqueous duplicate sample was the rinsate blank sample BRSWRB02 (collected 11/24/99). Method blanks should not be used as the laboratory duplicate samples. No validation actions were taken based upon the aqueous laboratory duplicate results.

Surrogate Results

All soil and aqueous sample surrogate recoveries met the method specified acceptance criteria. Specified 8270C method surrogates were reported along with specified EPH surrogates.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The C19-C36 aliphatic results for aqueous samples BRSWSW03 and BRSWSW03D are reported as estimated (J) based upon poor field duplicate precision. The duplicate RPD is 64%.

The C11-C22 aromatic hydrocarbon results for aqueous samples BRSWSW03 and BRSWSW03D are reported as estimated (J) and non-detected estimated (UJ) respectively. Low level concentrations of C11-C22 aromatic hydrocarbons, near the method quantitation limit, may be present in these samples.

The C19-C36 aliphatic hydrocarbon results for sediment samples BRSWSD03 and BRSWSD03D are reported as estimated (J) due to poor field duplicate precision. The duplicate RPD is 140%.

The C11-C22 aromatic hydrocarbon results for aqueous samples BRSWSD03 and BRSWSD03D are reported as estimated (J) and non-detected estimated (UJ) respectively. Low level concentrations of C11-C22 aromatic hydrocarbons, near the method quantitation limit, may be present in these samples.

Pyrene and chrysene are reported at concentrations below the method quantitation limit in sample BRSWSD03 and as non-detected in field duplicate sample BRSWSD03D. The positive pyrene and chrysene results are reported as estimated (J) and the non-detected results are reported as non-detected estimated (UJ). Low level concentrations of pyrene and chrysene may be present in these samples.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the sediment and aqueous EPH results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Data Validator

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Attachments: Table Ia EPH soils
Table Ib EPH aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table 1a- Extractable Petroleum Hydrocarbon Sediment Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSD03	A, J^1
BRSWSD03D	A, J^1
BRSWSD07D	A

A Accept all data.

J^1 Estimate positive C19-C36 aliphatic results, C11-C22 aromatic results, pyrene, and chrysene results (J) and non-detected results for these analytes (UJ) based upon field duplicate precision.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1b- Extractable Petroleum Hydrocarbon
Aqueous Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSW03	A, J^1
BRSWSW03D	A, J^1

A Accept all data.

J^1 Estimate positive C19-C36 aliphatic results and C11-C22 aromatic results (J) and non-detected results for these analytes (UJ) based upon field duplicate precision.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

TABLE I

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSD03	BRSWSD03D	BRSWSD07	
Sample Location:						
Sample Type:			SOIL	SOIL	SOIL	
Lab Sample Number:			9911033-04	9911033-05	9911033-12	
Percent Moisture:			22.3	23.1	32.0	
Dilution Factor:			1	1	1	
Dilution Factor:						
Date Sampled:			11/23/1999	11/23/1999	11/23/1999	
Date Extracted			11/29/1999	11/29/1999	11/29/1999	
Date Analyzed Aliphatics:			12/01/1999	12/01/1999	12/01/1999	
Date Analyzed PNA			12/01/1999	12/01/1999	12/01/1999	
Notes:			Field Dup	Field Dup		
		Report				
EPH ANALYTES	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	
C9-C18 Aliphatic (1)	8270C	50	63 U	64 U	73 U	
C19-C36 Aliphatic (1)	8270C	50	630 J	110 J	73 U	
C11-C22 Aromatics(1,2)	8270C	50	130 UJ	64 UJ	73 U	
Targeted PAH Analytes						
Naphthalene	8270C	0.25	0.32 U	0.32 U	0.36 U	
2-Methylnaphthalene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Acenaphthylene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Acenaphthene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Fluorene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Phenanthrene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Anthracene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Fluoranthene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Pyrene	8270C	0.25	0.24 J	0.32 UJ	0.36 U	
Benzo(a)anthracene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Chrysene	8270C	0.25	0.23 J	0.32 UJ	0.36 U	
Benzo(b)fluoranthene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Benzo(k)fluoranthene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Benzo(a)pyrene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Indeno(1,2,3-cd)pyrene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Dibenzo(a,h)anthracene	8270C	0.25	0.32 U	0.32 U	0.36 U	
Benzo(g,h,i)perylene	8270C	0.25	0.32 U	0.32 U	0.36 U	

Analytical Method:

The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

* Based upon 100% total solids

(1) Hydrocarbon Range data exclude concentrations of any surrogates.

(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Data Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

MA DEP EPH Method 98-1 Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSW03	BRSWSW03D		
Sample Location:						
Sample Type:			Aqueous	Aqueous		
Lab Sample Number:			9911033-09	9911033-10		
Percent Moisture:			N/A	N/A		
Dilution Factor:			1	1		
Dilution Factor:						
Date Sampled:			11/23/1999	11/23/1999		
Date Extracted			11/29/1999	11/29/1999		
Date Analyzed Aliphatics:			11/30/1999	11/30/1999		
Date Analyzed PNA			11/30/1999	12/01/1999		
Notes:			Field Dup	Field Dup		
		Report				
EPH ANALYTES	Method	Limit	ug/L	ug/L		
C9-C18 Aliphatic (1)	8270C	100	100 U	100 U		
C19-C36 Aliphatic (1)	8270C	100	330 J	170 J		
C11-C22 Aromatics(1,2)	8270C	100	130 J	100 U J		
Targeted PAH Analytes						
Naphthalene	8270C	1	1.0 U	1.0 U		
2-Methylnaphthalene	8270C	1	1.0 U	1.0 U		
Acenaphthylene	8270C	1	1.0 U	1.0 U		
Acenaphthene	8270C	1	1.0 U	1.0 U		
Fluorene	8270C	1	1.0 U	1.0 U		
Phenanthrene	8270C	1	1.0 U	1.0 U		
Anthracene	8270C	1	1.0 U	1.0 U		
Fluoranthene	8270C	1	1.0 U	1.0 U		
Pyrene	8270C	1	1.0 U	1.0 U		
Benzo(a)anthracene	8270C	1	1.0 U	1.0 U		
Chrysene	8270C	1	1.0 U	1.0 U		
Benzo(b)fluoranthene	8270C	1	1.0 U	1.0 U		
Benzo(k)fluoranthene	8270C	1	1.0 U	1.0 U		
Benzo(a)pyrene	8270C	1	1.0 U	1.0 U		
Indeno(1,2,3-cd)pyrene	8270C	1	1.0 U	1.0 U		
Dibenzo(a,h)anthracene	8270C	1	1.0 U	1.0 U		
Benzo(g,h,i)perylene	8270C	1	1.0 U	1.0 U		

Analytical Method:
The laboratory used EPA method 8270, SVOCs by GC-MS, rather than the specified GC-FID and GC-PID techniques. Mass. DEP has approved this modification.

(1) Hydrocarbon Range data exclude concentrations of any surrogates.
(2) C9-C22 Aromatic Hydrocarbons exclude the concentration of Target Analytes eluting in that range.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.

TABLE I

U - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Feb 11, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/23/99
5 Sediment samples
5 Aqueous Samples
Lab Order: 9911033

Inorganic Analysis

BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03
BRSWSD03D	BRSWSW01	BRSWSW02	BRSWSW04
BRSWSW03	BRSWSW03D		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Soil samples were analyzed according to SW-846 EPA Method 6010B, mercury was analyzed by SW-846 Method 7471 and antimony was analyzed by EPA method 7041. Arsenic, barium, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B and silver, cadmium, lead, and antimony were analyzed in the aqueous samples according to SW-846 EPA Methods 7761, 7131, 7421, and 7041 respectively. Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks

MS /MSD results

* LCS results
Field duplicate results
* Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Tables 1a and 1b summarize the validation recommendations which are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No rinsate blank was submitted with the samples collected on 11/23/99. The rinsate blank sample BRSWRB02 (collected 11/24/99) was used to evaluate equipment blank contamination.

Aqueous sample BRSWSW03 and sediment sample BRSWSD03 were specified as the MS/MSD samples.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved however, pH information is not provided for the aqueous element samples.

Field Blanks and Method Blanks

Chromium and selenium were detected in the soil preparation blanks at 0.77mg/Kg and 1.43 mg/Kg respectively. The resulting action levels were 3.85mg/Kg and 7.14mg/Kg respectively. Chromium sample results were above the action level and no chromium results were qualified based upon the method blank results.

All sediment selenium results were below the blank action level and all results are reported as non-detected at the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

All aqueous method blank results were reported as non-detected. No aqueous results were qualified based upon these blank results.

Rinsate blank sample BRSWRB02 (9911036-01, collected 11/24/99) was evaluated for potential field sampling contamination. All results were reported as non-detected (U), and no results are qualified based upon the field rinsate blank results.

MS/MSD Results

Sediment sample BRSWSD03 was prepared as the batch MS/MSD sample. All laboratory MS/MSD laboratory acceptance criteria were met.

Aqueous sample BRSWSW03 (Lab order 9911033) was prepared as the batch MS/MSD samples. Silver and cadmium MS/MSD recoveries did not meet the laboratory acceptance criteria of 75-125%. These recoveries were low typically 60-74%, and sample matrix problems are indicated. The sample MS/MSD digestates were diluted and reanalyzed for silver and cadmium. The recoveries were still outside the acceptance limits. The silver results for all aqueous samples are reported as non-detected estimated (UJ). A low bias is indicated and false negatives are possible. The cadmium results for aqueous samples BRSWSW01, BRSWSW02, and BRSWSWW04 are reported as non-detected estimated (UJ). A low bias is indicated and false negatives are possible. The cadmium results for samples BRSWSW03 and BRSWSW03D were 1.9ug/L and 2.6ug/L respectively. These results are reported as estimated (J). Based upon the MS/MSD cadmium recoveries, 74% and 73% respectively, a low bias is indicated. The cadmium surface water DQO, as listed in the QAPP is 2.2ug/L.

LCS Results

Sediment and aqueous LCS recoveries met the specified acceptance criteria. No results are qualified based upon the LCS results.

Field Duplicates

Aqueous samples BRSWSW03 and BRSWSW03D were a field duplicate pair. The cadmium field duplicate result % RPD was 31% and the Region 1 acceptance criterion is $\pm$ 30%. The BRSWSW03 sample digestate was diluted by 2 prior to analysis. These cadmium results are reported as estimated (J) due to field duplicate precision and the low MS/MSD recoveries.

Sediment samples BRSWSD03 and BRSWSD03D were a field duplicate pair. All field duplicate precision criteria were met and no sediment results were qualified based upon the field duplicate results.

Laboratory Duplicates

No laboratory duplicate sample results were submitted with laboratory work order 9911033.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Holding Times

All sample analyses holding time requirements were met.

Summary

Silver and cadmium are reported as non-detected estimated (UJ) or estimated (J) in all aqueous samples. MS/MSD recoveries for these elements were below 75%. The results are low biased and the possibility of false negatives exists. The cadmium results for samples BRSWSW03 and BRSWSW03D were 1.9ug/L and 2.6ug/L respectively. These results are reported as estimated (J). Based upon the MS/MSD cadmium recoveries, 74% and 73% respectively, a low bias is indicated. The cadmium surface water DQO, as listed in the QAPP is 2.2ug/L.

All aqueous silver sample digestates were diluted by 5 prior to analyses. The method quantitation limit was elevated to 2.5ug/L due to these dilutions. The silver surface water DQO as listed in the QAPP is 0.12 ug/L.

Cadmium aqueous sample digestate BRSWSW02 was diluted by 5 and cadmium sample BRSWSW03 was diluted by 2 prior to analysis. Cadmium is reported as non-detected estimated (J) at an elevated method quantitation limit due to the dilution. The method quantitation limit exceeds the DQO for cadmium.

Lead aqueous sample digestates BRSWSW03 and BRSWSW03D were diluted by 2 prior to analyses. The reported results exceed the method quantitation limit so the lead DQO is not impacted.

Antimony sediment sample digestates BRSWSD03 and BRSWSD03D were diluted by 2 prior to analyses. The reported results exceed the method quantitation limit so the antimony DQO is not impacted.

Aqueous lead results for samples BRSWSW04, BRSWSW03, and BRSWSW03D are 5.0 ug/L, 27 ug/L and 25 ug/L respectively. These reported concentrations exceed the lead surface water DQO as listed in the QAPP, 2.5ug/L. The laboratory method quantitation limit for lead is 5.0ug/L and the laboratory method detection limit is 1 ug/L.

Chromium and selenium were detected in the solid preparation blank at 0.77 mg/Kg and 1.43 mg/Kg respectively and the action levels were 3.85 mg/Kg and 7.1 mg/Kg respectively. Chromium results were above the action level so no chromium results required qualification. The selenium results for the sediment samples were reported as non-detected (U) at the method quantitation level due to the preparation blank contamination.

Antimony sediment results for samples BRSWSD01, BRSWSD02 and BRSWSD04 are reported as estimated (J). These reported results are below the method quantitation limit. The aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

antimony results, for samples BRSWSW02, BRSWSW04 and BRSWSW03D, are reported as estimated (J). These results are below the method quantitation limit, 5 ug/L.

Arsenic sediment results for samples BRSWSD01, BRSWSD04, and BRSWSD03D are reported as estimated (J). These reported results are below the method quantitation limit. All arsenic aqueous results are reported as non-detected (U).

Barium sediment results for samples BRSWSD01, BRSWSD02, BRSWSD03 and BRSWSD03D were reported as estimated (J). These reported results are below the method quantitation limit. The aqueous barium results for samples BRSWSW02 and BRSWSW04 are reported as estimated (J). These results are below the method quantitation limit, 200ug/L.

The cadmium sediment result for sample BRSWSD01 was reported as estimated (J). The reported result is below the method quantitation limit.

Chromium aqueous results for samples BRSWSW02, BRSWSW03, and BRSWSW03D are reported as estimated (J). These results are below the method quantitation limit, 10ug/L.

Selenium aqueous results for sample BRSWSW01 are reported as estimated (J). The result is below the method quantitation limit, 40ug/L.

The lead sediment result for sample BRSWSD02 was reported as estimated (J). The reported result is below the method quantitation limit.

The silver sediment result for sample BRSWSD04 was reported as estimated (J). The reported result is below the method quantitation limit.

The mercury sediment results for samples BRSWSD02, BRSWSD03, and BRSWSD03D were reported as estimated (J). The reported results are below the method quantitation limit.

Tables 1a and 1b summarize the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic sediments
Table 1b Inorganic aqueous

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Sediment Recommendation Summary

Antimony	A, J[1]
Arsenic	A, J[2]
Barium	A, J[3]
Cadmium	A, J[4]
Chromium	A
Lead	A, J[5]
Mercury	A, J[6]
Selenium	A
Silver	A, J[7]

A- Accept all data

J[1]- Antimony arsenic results are reported as estimated (J) for samples BRSWSD01, BRSWSD04 and BRSWSD02. These results are between the method detection limit and the method quantitation limit.

J[2]- Arsenic results are reported as estimated (J) for samples BRSWSD01, BRSWSD04 and BRSWSD03D. These results are between the method detection limit and the method quantitation limit.

J[3]- Barium results are reported as estimated (J) for samples BRSWSD01, BRSWSD02, BRSWSD03, and BRSWSD03D. These results are between the method detection limit and the method quantitation limit.

J[4]- Cadmium results are reported as estimated (J) for samples BRSWSD01. This result is between the method detection limit and the method quantitation limit.

J[5]- Lead result is reported as estimated (J) for sample BRSWSD02. This result is between the method detection limit and the method quantitation limit.

J[6]- Mercury results are reported as estimated (J) for samples BRSWSD02, BRSWSD03, and BRSWD03D. These results are between the method detection limit and the method quantitation limit.

J[7]- Silver result is reported as estimated (J) for sample BRSWSD04. This result is between the method detection limit and the method quantitation limit.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1b-Inorganic Water Recommendation Summary

Antimony	A, J[1]
Arsenic	A
Barium	A, J[2]
Cadmium	J[3]
Chromium	A, J[4]
Lead	A
Mercury	A
Selenium	A, J[5]
Silver	J[6]

A- Accept all results

J[1]- Estimate BRSWSW02, BSWSW04 and BRSWSW03D antimony results (J). The results are below the method quantitation limit.

J[2]- Estimate BRSWSW02 and BSWSW04 barium results (J). The results are below the method quantitation limit.

J[3]- Estimate positive cadmium results (J) and non-detected results (UJ). The low MS/MSD recoveries indicate potential matrix problems and a low bias.

J[4]- Estimate BRSWSW02, BRSWSW03, and BRSWSW03D chromium results (J). The results are below the method quantitation limit.

J[5]- Estimate BRSWSW01 selenium result (J). The result is below the method quantitation limit.

J[6]- Estimate all silver results as non-detected estimated (UJ). The low MS/MSD recoveries indicate potential matrix problems and a low bias. Results are reported as non-detected estimated at elevated quantitation limits due to dilution.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

TABLE I **Inorganic Validated Results**

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSD01	BRSWSD02	BRSWSD04	BRSWSD03
Sample Location:						
Sample Type:			Sediment/LOW	Sediment/LOW	Sediment/LOW	Sediment/LOW
Lab Sample Number:			9911033-01B	9911033-02B	9911033-03B	9911033-04B
Percent Solids:			92.3	82.4	55.0	77.7
Dilution Factor:			1	1	1	Sb-2
Dilution Factor:						
Date Sampled:			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Notes:						Field Duplicate
		Report				
Inorganic Analysis	Method	Limit*	mg/kg	mg/kg	mg/kg	mg/kg
Antimony	7041	0.5	0.55 J	0.57 J	1.1 J	4.9
Arsenic	6010B	5	2.3 J	7.4 U	7.5 J	7.8
Barium	6010B	20	13 J	15 J	84	30 J
Cadmium	6010B	0.5	0.22 J	0.74 U	1.4	3.3
Chromium	6010B	1	11	7.8	18	25
Lead	6010B	5	24	7.2 J	170	63
Selenium	6010B	8	10 U	12 U	18 U	12 U
Silver	6010B	1.4	1.8 U	2.1 U	3.1 J	2.1 U
Mercury	7471B	0.025	0.025 U	0.016 J	0.13	0.020 J

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSD03D			
Sample Location:						
Sample Type:			*Sediment/LOW*			
Lab Sample Number:			9911033-05B			
Percent Solids:			76.9			
Dilution Factor:			1			
Dilution Factor:						
Date Sampled:			11/23/1999			
Notes:			Field Duplicate			
		Report				
Inorganic Analysis	Method	Limit*	mg/kg			
Antimony	7041	0.5	5.7			
Arsenic	6010B	5	6.6 J			
Barium	6010B	20	28 J			
Cadmium	6010B	0.5	3.0			
Chromium	6010B	1	32			
Lead	6010B	5	50			
Selenium	6010B	8	12 U			
Silver	6010B	1.4	2.2 U			
Mercury	7471B	0.025	0.018 J			

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSW01	BRSWSW02	BRSWSW04	BRSWSW03
Sample Location:						
Sample Type:			Aqueous	Aqueous	Aqueous	Aqueous
Lab Sample Number:			9911033-06C	9911033-07C	9911033-08C	9911033-09C
Percent Solids:			0.0	0.0	0.0	0.0
Dilution Factor:			Ag-5	Ag-5	Ag-5	Ag-5
Dilution Factor:				Cd-5		Cd/Pb-2
Date Sampled:			11/23/1999	11/23/1999	11/23/1999	11/23/1999
Notes:						Field Dup
		Report				
Inorganic Analysis	Method	Limit	ug/L	ug/L	ug/L	ug/L
Antimony	7041	5	5 U	2.5 J	2.8 J	5 U
Arsenic	6010B	25	25 U	25 U	25 U	25 U
Barium	6010B	200	200 U	60 J	45 J	200 U
Cadmium	7131	0.5	0.5 UJ	2.5 UJ	0.5 UJ	1.9 J
Chromium	6010B	10	10 U	3.4 J	10 U	3.2 J
Lead	7421	5	5 U	5 U	5.0	27
Selenium	6010B	40	9.1 J	40 U	40 U	40 U
Silver	7761	0.5	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ
Mercury	7470	0.2	0.2 U	0.2 U	0.2 U	0.2 U

Note:

J - Quantition is approximate due to limitations identified in the quality control review (Date Review).

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - Value is rejected.

TABLE I **Inorganic Validated Results**

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSW03D			
Sample Location:						
Sample Type:			Aqueous			
Lab Sample Number:			9911033-10C			
Percent Solids:			0.0			
Dilution Factor:			Ag-5			
Dilution Factor:			Pb-2			
Date Sampled:			11/23/1999			
Notes:			Field Dup			
		Report				
Inorganic Analysis	Method	Limit	ug/L			
Antimony	7041	5	2.5 J			
Arsenic	6010B	25	25 U			
Barium	6010B	200	200 U			
Cadmium	7131	0.5	2.6 J			
Chromium	6010B	10	2.2 J			
Lead	7421	5	25			
Selenium	6010B	40	40 U			
Silver	7761	0.5	2.5 UJ			
Mercury	7470	0.2	0.2 U			

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 28, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/23/99
5 Surface Water samples
Lab Order: 9911033

Calcium Magnesium Hardness Analysis

BRSWSW01	BRSWSW02	BRSWSW04
BRSWSW03	BRSWSW03D	

Dear Ms. Doherty:

A modified Tier II data validation was performed on calcium magnesium hardness analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Calcium and magnesium were determined by ICP method 6010B. Hardness was calculated from the calcium and magnesium results.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

* Chain of custody documents
* Sample log-in documents
* Field blanks, and method blanks
* MS /MSD results
* LCS results
* Field duplicate results
* Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were present and intact on the coolers.

No rinsate blank was submitted with the samples collected on 11/23/99. The rinsate blank sample BRSWRB02 (collected 11/24/99) was used to evaluate equipment blank contamination.

Sample Log-in Documents

The sample receipt checklist indicates that the sample cooler temperature was 4° C. The cooler temperature range is 2-6° C.

The sample receipt checklist indicates that samples were properly preserved, however aqueous sample pHs were not included in the data package. No results were qualified based upon this omission.

Field Blanks and Method Blanks

The hardness method blank was reported as non-detected. No data are qualified based upon the blank results.

The hardness result for rinsate blank, BRSWRB02, (collected 11/24/99) was not reported. The analysis was requested, as indicated on the chain of custody accompanying laboratory work order 9911036.

MS/MSD Results

Sample BRSWSW03 was analyzed as the MS/MSD sample. All precision and recovery criteria were met. No results are qualified based upon the MS/MSD results.

LCS Results

The LCS acceptance criterion was met. No hardness results are qualified based upon the LCS result.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Field Duplicates

Aqueous samples BRSWSW03 and BRSWSW03D were the field duplicate samples. All field duplicate precision criteria were met.

Laboratory Duplicates

No laboratory duplicate samples were analyzed.

Holding Times

All sample analyses holding time requirements were met.

Summary

All hardness results are accepted without qualification.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Calcium Magnesium Hardness

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Aqueous Hardness Recommendation Summary

BRSWSW01	A
BRSWSW02	A
BRSWSW04	A
BRSWSW03	A
BRSWSW03D	A

A- Accept all data

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

TABLE I

Calcium Magnesium Hardness Validated Results

Project No.: 05000.33
Lab Order: 9911033
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSW01	BRSWSW02	BRSWSW04	BRSWSW03	BRSWSW03D
Sample Location:							
Sample Type:			Aqueous Low	Aqueous Low	Aqueous Low	Aqueous Low	Aqueous Low
Lab Sample Number:			9911033-06C	9911033-07C	9911033-08C	9911033-09C	9911033-10C
Percent moisture:			NA	NA	NA	NA	NA
Dilution Factor:			1	1	1	1	1
Dilution Factor:							
Date Sampled:			11/23/99	11/23/99	11/23/99	11/23/99	11/23/99
Date Analyzed:			12/01/99	12/01/99	12/01/99	12/01/99	12/01/99
Notes:						Field Dup	Field Dup
		Report					
ANALYTES	Method	Limit*	mg/L	mg/L	mg/L	mg/L	mg/L
Ca-Mg Hardness	6010B	33	35	39	37	75	76

Analytical Method:
Hardness determined by calculation using calcium and magnesium results obtained by ICP (method 6010B) analyses.

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Data Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 24, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/22/99
4 Sediment samples
Lab Order: 9911028

Semivolatile Organics Analysis

Samples Collected:

BRSWSD-05	BRSWSD-06	BRSWSD-07
BRSWSD-08		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the semi-volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8270C.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
* - rinsate blanks, and method blanks
- MS/MSD results
- LCS results
* - field duplicate results
* - laboratory duplicate results
* - surrogate recoveries
*- holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a summarizes the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were not present.

The COC indicates that no cooler temperature blank was included in the cooler.

No rinsate blank was submitted with the samples collected on 11/22/99. Rinsate blank BRSWRB02, submitted on 11/24/99, following all sediment sample collections was used to evaluate field potential field sample contamination.

Sample Log-in Documents

No cooler temperatures were recorded on the sample receipt checklist. The form does not indicate that the samples were received on ice. The samples were received on the same day as sampled. The laboratory provided a courier service and the time between sample release by the field crew and receipt at the laboratory was less than 4 hours. Mercury results may be impacted due to temperature deviations, however the validator did not qualify results due to this deviation. The field crew was asked to submit any additional information regarding this deviation. Discussions with the field crew indicated that the samples were packed in ice before transport to the laboratory. The field crew did not remember if temperature blanks were included in all coolers.

The sample receipt checklist indicates that samples were properly preserved however pH information is not provided for the aqueous VOA sample.

Field Blanks and Method Blanks

All sediment extraction preparation blank results are reported as non-detected.

Equipment blank sample BRSWRB02, collected 11/24/99, following all sediment sample collections was used to evaluate field potential field sample contamination. All semivolatile rinsate blank results were reported as non-detected.

Matrix Spike / Matrix Spike Duplicate Results

Sediment sample BRSWSD03, collected 11/23/99, was analyzed as the MS/MSD sample. Due to laboratory error the laboratory did not spike the MS/MSD samples with the entire compound list. The LCS was spiked with the entire compound list.

Laboratory Control Sample

The following compounds did not meet the laboratory derived semivolatile LCS recovery acceptance criteria.

Compound	% Recovery	Acceptance Criteria	Actions
1,3-Dichlorobenzene	48.6	53-147	UJ nons, J pos
1,4-Dichlorobenzene	51.4	55-145	UJ nons, J pos
1,2-Dichlorobenzene	51.8	54-146	UJ nons, J pos
2,4-Dimethylphenol	49.7	54-146	UJ nons, J pos
3,3-Dichlorobenzidine	55.1	57-143	UJ nons, J pos

These compounds are reported as non-detected (U) in the field samples. These results are reported as non-detected estimated (UJ) and the results may be low biased. The possibility of false negatives exists.

Field Duplicate Results

Sediment field duplicate samples BRSWSD03 and BRSWSD03D (collected 11/23/99) were the sediment field duplicate pair samples. No validation actions were taken based upon the field duplicate results.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911028.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

No laboratory duplicate sample was analyzed with laboratory work order 9911028.

Sediment sample BRSWSD03, collected 11/23/99, was analyzed as the MS/MSD sample. Due to laboratory error the laboratory did not spike the MS/MSD samples with the entire compound list. The LCS was spiked with the entire compound list.

All 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dimethylphenol and 3,3 –dichlorobenzidine results are reported as estimated (UJ) based upon low LCS recoveries. The possibility of false negatives exists.

Phenanthene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, and benzo(g,h,i)perylene results were reported as estimated (J) for sediment sample BRSWSD-05. The reported results are below the method quantitation limit.

Fluoranthene, pyrene, chrysene and benzo(b)fluoranthene results were reported as estimated (J) for sediment sample BRSWSD-06. The reported results are below the method quantitation limit.

Fluoranthene, pyrene and benzo(b)fluoranthene results were reported as estimated (J) for sediment sample BRSWSD-07. The reported results are below the method quantitation limit.

Phenanthene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and benzo(g,h,i)perylene results were reported as estimated (J) for sediment sample BRSWSD-08. The reported results are below the method quantitation limit.

Table 1a provides a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil 8270C SVOC results. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table Ia SVOC sediments

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table Ia- Semivolatiles 8270C Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSD-05	A, J[1], J[2]
BRSWSD-06	A, J[1], J[3]
BRSWSD-07	A, J[1], J[4]
BRSWSD-08	A, J[1], J[5]

A Accept all data.

J[1] 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dimethylphenol and 3,3 –dichlorobenzidine results are reported as estimated (UJ) based upon low LCS recoveries. The possibility of false negatives exists.

J[2] Phenanthene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, and benzo(g,h,i)perylene results were reported as estimated (J) for sediment sample BRSWSD-05. The reported results are below the method quantitation limit.

J[3] Fluoranthene, pyrene, chrysene, and benzo(b)fluoranthene results were reported as estimated (J) for sediment sample BRSWSD-06. The reported results are below the method quantitation limit.

J[4] Fluoranthene, pyrene and benzo(b)fluoranthene results were reported as estimated (J) for sediment sample BRSWSD-07. The reported results are below the method quantitation limit.

J[5] Phenanthene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and benzo(g,h,i)perylene results were reported as estimated (J) for sediment sample BRSWSD-05. The reported results are below the method quantitation limit.

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD-05	BRSWSD-06	BRSWSD-07	BRSWSD-08
Lab Sample Number:		9911028-01B	9911028-02B	9911028-03B	9911028-04B
Matrix/Analysis:		Sed/Low	Sed/Low	Sed/Low	Sed/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/22/99	11/22/99	11/22/99	11/22/99
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/03/1999	12/03/1999	12/03/1999	12/03/1999
Percent Moisture:		30.2	29.0	24.5	20.8
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
N-nitrosodimethylamine	500	700 U	690 U	660 U	630 U
Phenol	250	350 U	350 U	330 U	310 U
bis(2-Chloroethyl) ether	250	350 U	350 U	330 U	310 U
2-Chlorophenol	250	350 U	350 U	330 U	310 U
1,3-Dichlorobenzene	250	350 UJ	350 UJ	330 UJ	310 UJ
1,4-Dichlorobenzene	250	350 UJ	350 UJ	330 UJ	310 UJ
Benzyl Alcohol	500	700 U	690 U	660 U	630 U
2-Methylphenol	250	350 U	350 U	330 U	310 U
1,2-Dichlorobenzene	250	350 UJ	350 UJ	330 UJ	310 UJ
Bis(2-chloroisopropyl)ether	250	350 U	350 U	330 U	310 U
4-Methylphenol	250	350 U	350 U	330 U	310 U
n-Nitroso-di-n-propylamine	250	350 U	350 U	330 U	310 U
Hexachloroethane	250	350 U	350 U	330 U	310 U
Nitrobenzene	250	350 U	350 U	330 U	310 U
Isophorone	250	350 U	350 U	330 U	310 U
2,4-Dimethylphenol	250	350 UJ	350 UJ	330 UJ	310 UJ
Benzoic Acid	500	700 U	690 U	660 U	630 U
2-Nitrophenol	250	350 U	350 U	330 U	310 U
bis(2-Chloroethoxy) methane	250	350 U	350 U	330 U	310 U
2,4-Dichlorophenol	250	350 U	350 U	330 U	310 U
1,2,4-Trichlorobenzene	250	350 U	350 U	330 U	310 U
Naphthalene	250	350 U	350 U	330 U	310 U
4-Chloroaniline	250	350 U	350 U	330 U	310 U
Hexachlorobutadiene	250	350 U	350 U	330 U	310 U
4-Chloro-3-methylphenol	500	700 U	690 U	660 U	630 U
2-Methylnaphthalene	250	350 U	350 U	330 U	310 U
Hexachlorocyclopentadiene	250	350 U	350 U	330 U	310 U
2,4,6-Trichlorophenol	250	350 U	350 U	330 U	310 U
2,4,5-Trichlorophenol	250	350 U	350 U	330 U	310 U
2-Chloronaphthalene	250	350 U	350 U	330 U	310 U
2-Nitroaniline	500	700 U	690 U	660 U	630 U

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD-05	BRSWSD-06	BRSWSD-07	BRSWSD-08
Lab Sample Number:		9911028-01B	9911028-02B	9911028-03B	9911028-04B
Matrix/Analysis:		Sed/Low	Sed/Low	Sed/Low	Sed/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/22/99	11/22/99	11/22/99	11/22/99
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/03/1999	12/03/1999	12/03/1999	12/03/1999
Percent Moisture:		30.2	29.0	24.5	20.8
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Dimethyl phthalate	250	350 U	350 U	330 U	310 U
2,6-Dinitrotoluene	250	350 U	350 U	330 U	310 U
Acenaphthylene	250	350 U	350 U	330 U	310 U
3-Nitroaniline	500	700 U	690 U	660 U	630 U
4-Nitrophenol	500	700 U	690 U	660 U	630 U
2,4-Dinitrophenol	500	700 U	690 U	660 U	630 U
Acenaphthene	250	350 U	350 U	330 U	310 U
2,4-Dinitrotoluene	250	350 U	350 U	330 U	310 U
Dibenzofuran	250	350 U	350 U	330 U	310 U
Diethyl phthalate	250	350 U	350 U	330 U	310 U
4-Chlorophenyl phenyl ether	250	350 U	350 U	330 U	310 U
Fluorene	250	350 U	350 U	330 U	310 U
4-Nitroaniline	500	700 U	690 U	660 U	630 U
4,6-Dinitro-2-methylphenol	500	700 U	690 U	660 U	630 U
n-Nitrosodiphenylamine	250	350 U	350 U	330 U	310 U
1,2-Diphenylhydrazine	250	350 U	350 U	330 U	310 U
4-Bromophenyl phenylether	250	350 U	350 U	330 U	310 U
Hexachlorobenzene	250	350 U	350 U	330 U	310 U
Pentachlorophenol	500	700 U	690 U	660 U	630 U
Phenanthrene	250	77 J	350 U	330 U	65 J
Anthracene	250	350 U	350 U	330 U	310 U
Carbazole	250	350 U	350 U	330 U	310 U
Di-n-butylphthalate	250	350 U	350 U	330 U	310 U
Fluoranthene	250	140 J	120 J	77 J	130 J
Benzidine	250	350 U	350 U	330 U	310 U
Pyrene	250	140 J	110 J	72 J	120 J
Butyl benzyl phthalate	250	350 U	350 U	330 U	310 U
bis(2-ethylhexyl)phthalate	250	350 U	350 U	330 U	310 U
3,3'-Dichlorobenzidine	250	350 UJ	350 UJ	330 UJ	310 UJ
Benzo(a)anthracene	250	71 J	350 U	330 U	68 J
Chrysene	250	110 J	80 J	330 U	92 J

Table I

Semivolatile Validated Results
Method 8270C

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

Client Sample Number:		BRSWSD-05	BRSWSD-06	BRSWSD-07	BRSWSD-08
Lab Sample Number:		9911028-01B	9911028-02B	9911028-03B	9911028-04B
Matrix/Analysis:		Sed/Low	Sed/Low	Sed/Low	Sed/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/22/99	11/22/99	11/22/99	11/22/99
Date Extracted:		11/29/1999	11/29/1999	11/29/1999	11/29/1999
Date Analyzed		12/03/1999	12/03/1999	12/03/1999	12/03/1999
Percent Moisture:		30.2	29.0	24.5	20.8
Compounds	Limit	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Di-n-octylphthalate	250	350 U	350 U	330 U	310 U
Benzo(b)fluoranthene	250	130 J	110 J	81 J	110 J
Benzo(k)fluoranthene	250	350 U	350 U	330 U	310 U
Benzo(a)pyrene	250	81 J	350 U	330 U	66 J
Dibenz(a,h)anthracene	250	350 U	350 U	330 U	310 U
Indeno(1,2,3-cd)pyrene	250	350 U	350 U	330 U	64 J
Benzo(g,h,i)perylene	250	73 J	350 U	330 U	69 J

aqueous results ug/L solid results ug/Kg dry weight.

J - The associated numerical value is an estimated quantity.

U - The compound was not detected. The associated numerical value is the compound quantitation limit.

UJ - The compound was not detected. The compound quantitation limit is an estimated value.

R - The datum was rejected.

Feb. 05, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/22/99
4 Sediment samples
1 trip blank
Lab Order: 9911028

Volatile Organics Analysis

Samples Collected:

BRSWSD-05	BRSWSD-06	BRSWSD-07	BRSWSD-08
TRIP BLANK V			

Dear Ms. Doherty:

A modified Tier II data validation was performed on the volatile organic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 method 8260B.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (Dec. 1996) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

- chain of custody documents
- sample log-in documents
- trip blanks, rinsate blanks, and method blanks
- MS/MSD results
- LCS results
- field duplicate results

* - laboratory duplicate results
* - surrogate recoveries

* - holding times

* All criteria were met for this parameter.
** Not included in data package

Tables 1a and 1b summarize the validation recommendations that are based upon the following information:

Chain of Custody Records

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were not present.

The COC indicates that no cooler temperature blank was included in the cooler.

No rinsate blank was submitted with the samples collected on 11/22/99. Rinsate blank BRSWRB02, submitted on 11/24/99, following all sediment sample collections was used to evaluate field potential field sample contamination.

Sample Log-in Documents

No cooler temperatures were recorded on the sample receipt checklist. The form does not indicate that the samples were received on ice. The samples were received on the same day as sampled. The laboratory provided a courier service and the time between sample release by the field crew and receipt at the laboratory was less than 4 hours. The validator did not qualify results due to this deviation. The field crew was asked to submit any additional information regarding this deviation. Discussions with the field crew indicated that the samples were packed in ice before transport to the laboratory. The field crew did not remember if temperature blanks were included in all coolers.

The laboratory was contacted on 01/26/2000 and asked to clarify the cooler receipt temperature omission. The laboratory response received 02/04/2000 indicates that the cooler temperature was <6° C. No temperature blank was received with this cooler.

The sample receipt checklist indicated that no soil/sediment samples were received with laboratory lot 9911028. This was a clerical error. The laboratory was notified on 01/26/2000 and asked to clarify this matter. The laboratory's response, on 02/04/2000, did state that the Encore samplers were received and properly preserved.

The sample receipt checklist indicates that samples were properly preserved however pH information is not provided for the aqueous VOA sample.

Trip Blanks, Field Blanks, and Method Blanks

No target compound analytes were detected in field rinsate blank sample BRSWRB02 (collected 11/24/99) and no validation actions were required. Methylene chloride was detected in the laboratory VOA soil method blank at 17ug/Kg and the method quantitation limit was 25 ug/Kg. Methylene chloride was detected in TRIP BLANK V at 0.90ug/L. This result is reported as estimated because the result is below the method quantitation limit. Methylene chloride was not detected in the accompanying sediment samples so no validation actions were required based upon the blank results.

No aqueous method blank results were reported in laboratory order 9911028. TRIP BLANK V was analyzed on 12/02/99 for VOAs. The validator did evaluate the 12/02/99 aqueous method blank results submitted with package 9911041 and all VOA results were reported as non-detected (U). No VOA method blank contamination is indicated. Methylene chloride is a common laboratory contaminant.

No validation actions were taken based upon the trip blank, field equipment blank, and method blank results.

Matrix Spike / Matrix Spike Duplicate Results

Sample BRSWSD03 (9911033-04) was the batch MS/MSD sample for laboratory order 9911028. Most compounds did not meet the MS/MSD recovery criteria (70-130%). MS/MSD recoveries were typically 40-70%. MS/MSD validation actions typically apply to that sample only so no results are qualified in laboratory order 9911028 based upon the MS/MSD results.

Laboratory Control Sample

The laboratory VOA LCS soil recovery acceptance criteria are 70-130%. A list of compounds not meeting this criterion is summarized below.

Compound	% Recovery	Action
Dichlorodifluoromethane	59.8	Non-detects UJ; Detects J
Chloroethane	65.9	Non-detects UJ; Detects J
Bromomethane	65.5	Non-detects UJ; Detects J

Based upon the soil LCS recoveries the dichlorodifluoromethane, chloroethane, and bromomethane results for all soil samples are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists.

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The trans-1,2-dichloroethene, 1,1-dichloroethane, 2-butanone, 2,2-dichloropropane, chloroform, and 1,2-dichloropropane LCS recoveries exceed the 130% limit. All sample results for these compounds are non-detected and a high bias is indicated. These compound results are not qualified.

No aqueous LCS results were submitted with laboratory order 9911028. The aqueous LCS results from 12/02/99, submitted with laboratory order 9911041, were used to validate the TRIP BLANK V results. The trichlorofluoromethane result for sample TRIP BLANK V is reported as estimated. The aqueous LCS recovery is 48.8% and a low bias is indicated. False negative results are possible.

Field Duplicate Results

No field duplicate samples were submitted with the VOA samples collected on 11/22/99.

Laboratory Duplicate Results

No laboratory duplicate sample was analyzed with laboratory work order 9911026.

Surrogate Results

All surrogate recoveries met the method specified acceptance criteria. No data validation action is recommended.

Holding Times

All holding times were met. No data validation action is recommended.

Summary

The laboratory did not submit aqueous method blank, aqueous LCS and aqueous MS/MSD results. These results should be included in the data package. The only aqueous sample is TRIP BLANK V and this aqueous sample was analyzed on 12/02/99. All VOA method blank results, analyzed on 12/02/99, submitted with laboratory order 9911041, are reported as non-detected. Methylene chloride is reported as estimated (J) in TRIP BLANK V. The result (0.90ug/L) is below the method quantitation limit. Methylene chloride was not detected in any sediment field samples. No methylene chloride results are qualified based upon the trip blank results.

Based upon the soil LCS recoveries the dichlorodifluoromethane, chloroethane, and bromomethane results for all soil samples are reported as non-detected estimated (UJ). These results are biased low and the possibility of false negatives exists.

Based upon the aqueous LCS analyzed 12/02/99 the trichlorofluoromethane result for sample TRIP BLANK V is reported as estimated. The recovery is 48.8% and a low bias is indicated. False negative results are possible.

No laboratory duplicate results were submitted.

Tables 1a and 1b provide a summary of the data validation qualifications recommended by Kestrel Environmental Technologies, Inc. for the soil and aqueous 8260 VOC results respectively. Validated result tables are appended to this submittal.

Sincerely,
Kestrel Environmental Technologies, Inc.

Timothy Lewis, Validator

Attachments: Table 1a 8260B sediments
Table 1b 8260B aqueous

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Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

Table Ia- Volatiles-8260B Soil Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
BRSWSD05	A, J^1
BRSWSD06	A, J^1
BRSWSD07	A, J^1
BRSWSD08	A, J^1

A Accept all data.

J^1 The dichlorodifluoromethane, chloroethane, and bromomethane results for all soil samples are reported as non-detected estimated (UJ) based upon low LCS recoveries. These results are biased low and the possibility of false negatives exists.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table 1b- Volatiles-8260B Aqueous
Recommendation Summary

Gordon Craig Army Reserve	
Sample ID	*Qualifier*
Trip Blank V (aq)	A,J^1, J^2

A Accept all data.

J^1 The methylene chloride result is reported as estimated (J). The result is below the method quantitation limit.

J^2 The trichlorofluoromethane result is reported as non-detected estimated (UJ). The LCS recovery was low and false negative results are possible.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Table I

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSD-05	BRSWSD-06	BRSWSD-07	BRSWSD-08
S&W Sample (cont)					
Lab Sample Number:		9911028-01A	9911028-02A	9911028-03A	9911028-04A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/22/99	11/22/99	11/22/99	11/22/99
Date Extracted:		12/01/99	12/01/99	12/01/99	12/01/99
Date Analyzed:		12/01/99	12/01/99	12/01/99	12/01/99
Percent Moisture:		30.2	29.0	24.5	20.8
Target Compounds	Report Limit	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dichlorodifluoromethane	4	6.7 UJ	6.8 UJ	5.9 UJ	5.4 UJ
Chloromethane	4	6.7 U	6.8 U	5.9 U	5.4 U
Vinyl Chloride	4	6.7 U	6.8 U	5.9 U	5.4 U
Chloroethane	4	6.7 UJ	6.8 UJ	5.9 UJ	5.4 UJ
Bromomethane	4	6.7 UJ	6.8 UJ	59 UJ	5.4 UJ
Trichlorofluoromethane	4	6.7 U	6.8 U	5.9 U	5.4 U
Acetone	20	19 J	63	20 J	30
1,1-Dichloroethene	4	6.7 U	6.8 U	5.9 U	5.4 U
Carbon disulfide	4	6.7 U	6.8 U	5.9 U	5.4 U
Methylene Chloride	20	33 U	34 U	29 U	27 U
Methyl tert-butyl ether	4	6.7 U	6.8 U	5.9 U	5.4 U
trans-1,2-Dichloroethene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,1-Dichloroethane	4	6.7 U	6.8 U	5.9 U	5.4 U
2-Butanone	20	33 U	34 U	29 U	27 U
2,2-Dichloropropane	4	6.7 U	6.8 U	5.9 U	5.4 U
cis-1,2-Dichloroethene	4	6.7 U	6.8 U	5.9 U	5.4 U
Chloroform	4	6.7 U	6.8 U	5.9 U	5.4 U
Bromochloromethane	4	6.7 U	6.8 U	5.9 U	5.4 U
1,1,1-Trichloroethane	4	6.7 U	6.8 U	5.9 U	5.4 U
1,1-Dichloropropene	4	6.7 U	6.8 U	5.9 U	5.4 U
Carbon tetrachloride	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dichloroethane	4	6.7 U	6.8 U	5.9 U	5.4 U
Benzene	4	6.7 U	6.8 U	5.9 U	5.4 U
Trichloroethene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dichloropropane	4	6.7 U	6.8 U	5.9 U	5.4 U
Bromodichloromethane	4	6.7 U	6.8 U	5.9 U	5.4 U
Dibromomethane	4	6.7 U	6.8 U	5.9 U	5.4 U
4-Methyl-2-pentanone	20	33 U	34 U	29 U	27 U
cis-1,3-Dichloropropene	4	6.7 U	6.8 U	5.9 U	5.4 U
Toluene	4	6.7 U	6.8 U	5.9 U	5.4 U
trans-1,3-Dichloropropene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,1,2-Trichloroethane	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dibromoethane	4	6.7 U	6.8 U	5.9 U	5.4 U
2-Hexanone	20	37 U	34 U	29 U	27 U
1,3-Dichloropropane	4	6.7 U	6.8 U	5.9 U	5.4 U
Tetrachloroethene	4	6.7 U	6.8 U	5.9 U	5.4 U

Table I

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSD-05	BRSWSD-06	BRSWSD-07	BRSWSD-08
S&W Sample (cont)					
Lab Sample Number:		9911028-01A	9911028-02A	9911028-03A	9911028-04A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/22/99	11/22/99	11/22/99	11/22/99
Date Extracted:		12/01/99	12/01/99	12/01/99	12/01/99
Date Analyzed:		12/01/99	12/01/99	12/01/99	12/01/99
Percent Moisture:		30.2	29.0	24.5	20.8
Dibromochloromethane	4	6.7 U	6.8 U	5.9 U	5.4 U

Table I

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

S&W Sample Number:		BRSWSD-05	BRSWSD-06	BRSWSD-07	BRSWSD-08
S&W Sample (cont)					
Lab Sample Number:		9911028-01A	9911028-02A	9911028-03A	9911028-04A
Matrix/Analysis:		Soil/Low	Soil/Low	Soil/Low	Soil/Low
Sample Type:		ROUTINE	ROUTINE	ROUTINE	ROUTINE
Dilution Factor:		1	1	1	1
Date Sampled:		11/22/99	11/22/99	11/22/99	11/22/99
Date Extracted:		12/01/99	12/01/99	12/01/99	12/01/99
Date Analyzed:		12/01/99	12/01/99	12/01/99	12/01/99
Percent Moisture:		30.2	29.0	24.5	20.8
Chlorobenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,1,1,2-Tetrachloroethane	4	6.7 U	6.8 U	5.9 U	5.4 U
Ethylbenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
m,p-Xylene	4	6.7 U	6.8 U	5.9 U	5.4 U
o-Xylene	4	6.7 U	6.8 U	5.9 U	5.4 U
Styrene	4	6.7 U	6.8 U	5.9 U	5.4 U
Bromoform	4	6.7 U	6.8 U	5.9 U	5.4 U
Isopropylbenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,1,2,2-Tetrachloroethane	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2,3-Trichloropropane	4	6.7 U	6.8 U	5.9 U	5.4 U
Bromobenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
n-Propylbenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
2-Chlorotoluene	4	6.7 U	6.8 U	5.9 U	5.4 U
4-Chlorotoluene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,3,5-Trimethylbenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
tert-Butylbenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2,4,-Trimethylbenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
sec-Butylbenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
4-isopropyltoluene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,3-dichlorobenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,4-dichlorobenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
n-Butylbenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dichlorobenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2-Dibromo-3-chloropropane	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2,4-Trichlorobenzene	4	6.7 U	6.8 U	5.9 U	5.4 U
Hexachlorobutadiene	4	6.7 U	6.8 U	5.9 U	5.4 U
Naphthalene	4	6.7 U	6.8 U	5.9 U	5.4 U
1,2,3-Trichlorobenzene	4	6.7 U	6.8 U	5.9 U	5.4 U

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Soil units mg/Kg based upon 100% total solids

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 01				
S&W Sample (cont)						
Lab Sample Number:		9911028-05A				
Matrix/Analysis:		Aq/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		11/22/1999				
Date Extracted:		12/02/1999				
Date Analyzed:		12/02/1999				
Percent Moisture:		NA				
Target Compounds	Report Limit	ug/L				
Dichlorodifluoromethane	5	5.0U				
Chloromethane	5	5.0 U				
Vinyl Chloride	2	2.0U				
Chloroethane	5	5.0 U				
Bromomethane	5	5.0 U				
Trichlorofluoromethane	2	2.0 UJ				
Acetone	10	10.0 U				
1,1-Dichloroethene	1	1.0 U				
Carbon disulfide	2	2.0 U				
Methylene Chloride	5	0.90 J				
Methyl tert-butyl ether	2	2.0 U				
trans-1,2-Dichloroethene	2	2.0 U				
1,1-Dichloroethane	2	2.0 U				
2-Butanone	10	10.0 U				
2,2-Dichloropropane	2	2.0 U				
cis-1,2-Dichloroethene	2	2.0 U				
Chloroform	2	2.0 U				
Bromochloromethane	2	2.0 U				
1,1,1-Trichloroethane	2	2.0 U				
1,1-Dichloropropene	2	2.0 U				
Carbon tetrachloride	2	2.0 U				
1,2-Dichloroethane	2	2.0 U				
Benzene	2	2.0 U				
Trichloroethene	2	2.0 U				
1,2-Dichloropropane	2	2.0 U				
Bromodichloromethane	2	2.0 U				
Dibromomethane	2	2.0 U				
4-Methyl-2-pentanone	10	10.0 U				
cis-1,3-Dichloropropene	1	1.0 U				
Toluene	2	2.0 U				
trans-1,3-Dichloropropene	1	1.0 U				
1,1,2-Trichloroethane	2	2.0 U				
1,2-Dibromoethane	2	2.0 U				
2-Hexanone	10	10.0 U				
1,3-Dichloropropane	2	2.0 U				
Tetrachloroethene	2	2.0 U				

Table I

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 01				
S&W Sample (cont)						
Lab Sample Number:		9911028-05A				
Matrix/Analysis:		Aq/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		11/22/1999				
Date Extracted:		12/02/1999				
Date Analyzed:		12/02/1999				
Percent Moisture:		NA				
Dibromochloromethane	2	2.0 U				

Table 1

Volatile (8260B) Validated Results

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

S&W Sample Number:		Trip Blank 01				
S&W Sample (cont)						
Lab Sample Number:		9911028-05A				
Matrix/Analysis:		Aq/Low				
Sample Type:		Trip Blank				
Dilution Factor:						
Date Sampled:		11/22/1999				
Date Extracted:		12/02/1999				
Date Analyzed:		12/02/1999				
Percent Moisture:		NA				
Chlorobenzene	2	2.0 U				
1,1,1,2-Tetrachloroethane	2	2.0 U				
Ethylbenzene	2	2.0 U				
m,p-Xylene	2	2.0 U				
o-Xylene	2	2.0 U				
Styrene	2	2.0 U				
Bromoform	2	2.0 U				
Isopropylbenzene	2	2.0 U				
1,1,2,2-Tetrachloroethane	2	2.0 U				
1,2,3-Trichloropropane	2	2.0 U				
Bromobenzene	2	2.0 U				
n-Propylbenzene	2	2.0 U				
2-Chlorotoluene	2	2.0 U				
4-Chlorotoluene	2	2.0 U				
1,3,5-Trimethylbenzene	2	2.0 U				
tert-Butylbenzene	2	2.0 U				
1,2,4,-Trimethylbenzene	2	2.0 U				
sec-Butylbenzene	2	2.0 U				
4-isopropyltoluene	2	2.0 U				
1,3-dichlorobenzene	2	2.0 U				
1,4-dichlorobenzene	2	2.0 U				
n-Butylbenzene	2	2.0 U				
1,2-Dichlorobenzene	2	2.0 U				
1,2-Dibromo-3-chloropropa	5	5.0 U				
1,2,4-Trichlorobenzene	2	2.0 U				
Hexachlorobutadiene	2	2.0 U				
Naphthalene	2	2.0 U				
1,2,3-Trichlorobenzene	2	2.0 U				

J - The associated numerical value is an estimated quantity.
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - The datum was rejected.
NR- not reported

Aqueous units ug/L

Jan. 22, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 11/22/99
4 Sediment samples
Lab Order: 9911028

Inorganic Analysis

BRSWSD-05	BRSWSD-06	BRSWSD-07
BRSWSD-08		

Dear Ms. Doherty:

A modified Tier II data validation was performed on the antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver inorganic analytical data from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, AMRO Environmental Laboratories Corporation (Merrimack, N.H.) prepared and analyzed the samples in accordance with US EPA SW-846 methods. Sediment samples were analyzed according to SW-846 EPA Method 6010B,antimony was analyzed by SW-846 EPA Method 7041 and mercury was analyzed by SW-846 Method 7471. Arsenic, barium, chromium, and selenium were analyzed in the aqueous samples according to SW-846 EPA Method 6010B and silver, cadmium, lead, and antimony were analyzed in the aqueous samples according to SW-846 EPA Methods 7761, 7131, 7421, and 7041 respectively. Aqueous mercury samples were analyzed according to SW-846 EPA Method 7470.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
* MS /MSD results
* LCS results

* Field duplicate results
Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. Sample preservation information was not presented on the chains of custodies.

Samples were received in individual plastic bags. Custody seals were not present.

The COC indicates that no cooler temperature blank was included in the cooler.

No rinsate blank was submitted with the samples collected on 11/22/99. Rinsate blank BRSWRB02, submitted on 11/24/99, following all sediment sample collections was used to evaluate field potential field sample contamination. Cadmium, lead, and silver results were not reported for rinsate blank sample BRSWRB02. The laboratory was requested to submit these results if available.

Sample Log-in Documents

No cooler temperatures were recorded on the sample receipt checklist. The form does not indicate that the samples were received on ice. The samples were received on the same day as sampled. The laboratory provided a courier service and the time between sample release by the field crew and receipt at the laboratory was less than 4 hours. Mercury results may be impacted due to temperature deviations, however the validator did not qualify results due to this deviation. The field crew was asked to submit any additional information regarding this deviation. Discussions with the field crew indicated that the samples were packed in ice before transport to the laboratory. The field crew did not remember if temperature blanks were included in all coolers.

The sample receipt checklist indicates that samples were properly preserved however pH information is not provided for the aqueous VOA sample.

Field Blanks and Method Blanks

Chromium and selenium were detected in the soil preparation blanks at 0.452mg/Kg and 1.64 mg/Kg respectively. The resulting action levels were 2.25mg/Kg and 8.20mg/Kg respectively.

295 Lower Flying Point Road Freeport ME 04032
Phone: (207) 865-1256 Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Chromium sample results were above the action level and no chromium results were qualified based upon the method blank results.

Selenium was reported in all field samples as estimated (J). The laboratory estimated the selenium result, because the positive result was below the method quantitation limits. All selenium results are reported as non-detected (U) at the method quantitation levels. The reported selenium results are likely due to laboratory contamination.

No rinsate blank was submitted with sample collected on 11/22/99. Rinsate blank BRSWRB02, submitted on 11/24/99, was used to evaluate potential field sampling contamination. Arsenic, antimony, mercury, selenium, barium, and chromium were non-detected in this rinsate blank. Cadmium, silver and lead results were not reported.

MS/MSD Results

Soil sample BRSWSB17 (9911025-01) was analyzed as the batch MS/MSD sample for all elements but mercury. All acceptance criteria were met. Sediment sample BRSWSD03 was analyzed as the mercury MS/MSD sample. All acceptance criteria were met.

LCS Results

Soil LCS recoveries met the specified acceptance criteria. No results are qualified based upon the LCS results.

Field Duplicates

Sediment field duplicate samples BRSWSD03 and BRSWSD03D were the sediment field duplicate pair samples. All field duplicate precision criteria were met.

Laboratory Duplicates

Soil sample BRSWSB17 (9911025-01) was analyzed as the batch laboratory duplicate sample. The chromium duplicate %RPD was 21.1% and the laboratory RPD acceptance limit is $\leq$ 20%. Army Corp laboratory duplicate acceptance criteria for ICP analyzed elements is $\leq$ 20% for sample results exceeding 5X the reporting limit. All chromium results are reported as estimated (J).

Holding Times

All sample analyses holding time requirements were met.

Summary

Chromium and selenium were detected in the solid preparation blank at 0.45mg/Kg and 1.64mg/Kg respectively and the action levels were 2.25mg/Kg and 8.2mg/Kg respectively. Chromium results were above the action level so no chromium results required qualification. The selenium results for all samples was reported as non-detected (U) at the method quantitation level due to the preparation blank contamination.

Chromium results are reported as estimated (J) based upon the laboratory duplicate precision 21.1% RPD.

Antimony was analyzed by graphite furnace, rather than by ICP, resulting in a quantitation level of 0.5mg/Kg rather than 4.0mg/Kg.

The antimony and arsenic results are reported as estimated (J) for samples BRSWSD-05, BRSWSD-06, and BRSWSD-07. These results are between the method detection limit and the method quantitation limit.

Mercury results are reported as estimated (J) for samples BRSWSD-07, and BRSWSD-08. These results are between the method detection limit and the method quantitation limit.

All barium and cadmium results are reported as estimated (J). The reported results are below the method quantitation limit.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a Inorganic soils

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-Inorganic Soil Recommendation Summary

Antimony	A, J[1]
Arsenic	A, J[1]
Barium	J[2]
Cadmium	J[2]
Chromium	J[3]
Lead	A
Mercury	J[4]
Selenium	A
Silver	A

A- Accept all data

J[1]- Antimony and arsenic results are reported as estimated (J) for samples BRSWSD-05, BRSWSD-06, and BRSWSD-07. These results are between the method detection limit and the method quantitation limit.

J[2]- Barium and cadmium results are reported as estimated (J) for all samples. These results are between the method detection limit and the method quantitation limit.

J[3]- Chromium results are estimated (J) due to laboratory duplicate precision.

J[4]- Mercury results are reported as estimated (J) for samples BRSWSD-07, and BRSWSD-08. These results are between the method detection limit and the method quantitation limit.

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Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 💻 Electronic Mail: tlewis1260@aol.com

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 9911028
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSD-05	BRSWSD-06	BRSWSD-07	BRSWSD-08
Sample Location:						
Sample Type:			SED/LOW	SED/LOW	SED/LOW	SED/LOW
Lab Sample Number:			9911028-01B	9911028-02B	9911028-03B	9911028-04B
Percent Solids:			69.8	71	75.5	79.2
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			11/22/1999	11/22/1999	11/22/1999	11/22/1999
Notes:						
		Report				
Inorganic Analysis	Method	Limit*	mg/kg	mg/kg	mg/kg	mg/kg
Antimony	7041B	0.5	0.81 J	0.70 J	0.71 J	1.2
Arsenic	6010B	5	2.3 J	2.9 J	1.1 J	7.7 U
Barium	6010B	20	28 J	33 J	33 J	19 J
Cadmium	6010B	0.5	0.22 J	0.28 J	0.17 J	0.19 J
Chromium	6010B	1	12 J	13 J	9.2 J	9.1 J
Lead	6010B	5	48	53	15	10
Selenium	6010B	8	14 U	14 U	13 U	12 U
Silver	6010B	1.4	2.4 U	2.4 U	2.3 U	2.2 U
Mercury	7471B	0.025	0.047	0.071	0.030J	0.018 J

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

Jan. 26, 2000

Ms. Amy Doherty
Stone & Webster Environmental Technology & Services
245 Summer Street
Boston, MA 02210

RE: Contract No. 05000.33
Lab Name: AMRO Environmental Laboratories Corporation
Site Name: Gordon Craig Army Reserve
Samples Collected 12/15/99
9 Sediment samples
Lab Order: 7099-332A

Total Organic Carbon Analysis

BRSWSD-01	BRSWSD-02	BRSWSD-03
BRSWSD-03D	BRSWSD-04	BRSWSD-05
BRSWSD-06	BRSWSD-07	BRSWSD-08

Dear Ms. Doherty:

A modified Tier II data validation was performed on the Total Organic Carbon results from samples collected by Stone and Webster at the Gordon Craig Army Reserve site. The laboratory, Severn Trent (Monroe, Ct.) prepared and analyzed the samples in accordance with US EPA SW-846 method 9060.

The data validation was performed as a modified Tier II. The data validation was conducted in accordance with the USACE Shell Chemical Analytical Requirements using U.S. EPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (Feb 1989) in conjunction with the individual method and the laboratory established criteria. The following items were validated:

Chain of custody documents
Sample log-in documents
Field blanks, and method blanks
MS /MSD results
* LCS results
Field duplicate results
Laboratory duplicate results
* Holding times

* All criteria were met for this parameter.

Table 1a summarizes the validation recommendations which are based upon the following information:

Chain of Custody Documents

All chains of custodies were properly signed and dated. The cooler temperature was recorded as 4° C.

The COC indicates that no cooler temperature blank was included in the cooler. The chain of custody documents do not indicate that custody seal were present or intact. The chain of custody documents do not indicate that the samples were individually wrapped.

Internal chain of custody documents were completed and submitted.

Sample Log-in Documents

No sample cooler receipt documents were included.

Field Blanks and Method Blanks

No field blanks were submitted, or required, with the samples collected on 12/15/99. The method blank results are non-detected (U).

MS Results

Sample BRSWSD-03 was analyzed as the matrix spike sample. The recovery was 143% and the acceptance criterion was 75-125%. A high bias is indicated. The LCS/LCSD recoveries were 106% and 93.9% respectively, indicating that the high MS recovery may be matrix dependent.

Based upon the matrix spike result all TOC sediment results are reported as estimated (J). A high bias is indicated.

LCS/LCSD Results

The LCS/ LCSD TOC recoveries were 106% and 93.9% respectively. All acceptance criteria were met.

Field Duplicates

Samples BRSWSD-03 and BRSWSD-03D were the field duplicate samples. The results were 5130 mg/Kg and 7940 mg/kg respectively. The % RPD was 43%. These field duplicate results indicate possible field sampling variability. The TOC field duplicate sample results are reported as estimated based upon these results.

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Laboratory Duplicates

SampleBRSWSD-03 was analyzed as the laboratory duplicate sample. The laboratory duplicate results were 5130 mg/Kg and 5140 mg/Kg respectively. The %RPD was 0.2%. No results were qualified based upon the laboratory duplicate results.

Holding Times

All sample analyses holding time requirements were met.

Summary

The validator has reported all TOC results as estimated based upon the field duplicate precision and the MS results. The matrix spike recovery was of sample BRSWSD03 was 143 % indicating a potential high bias.

The TOC results for samples BRSWSD-03 and BRSWSD-03D are reported as estimated (J). The field duplicate RPD is 43%. The field duplicate precision indicates possible sampling variability.

The MS recovery is high. The high recovery may be due to matrix interferences or sample homogeneity.

The laboratory QC samples, the LCS and the laboratory duplicate results did meet the laboratory acceptance criteria indicating that the variability is due to sample heterogeneity.

Table 1a summarizes the validated sample results. Validated result tables are appended to this submittal.

Sincerely,

Kestrel Environmental Technologies, Inc.

Timothy Lewis
Validator

Attachments: Table 1a TOC Sediments

295 Lower Flying Point Road ✉ Freeport ME 04032
Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

Gordon Craig Army Reserve, Brockton Mass.
Contract No. PO –05000.33

Table 1a-TOC Sediment Recommendation Summary

BRSWSD-01	J^1
BRSWSD-02	J^1
BRSWSD-03	J^1, J^2
BRSWSD-03D	J^1, J^2
BRSWSD-04	J^1
BRSWSD-05	J^1
BRSWSD-06	J^1
BRSWSD-07	J^1
BRSWSD-08	J^1

A- Accept all data

J^1- TOC results are reported as estimated (J) for all samples. The field duplicate results indicate that field sampling homogeneity may be a problem.

J^2- TOC results for samples BRSWSD-03 and BRSWSD-03D are reported as estimated due to the high MS recovery. These results may be biased high.

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Phone: (207) 865-1256 ☎ Fax: (207) 865-1116 Electronic Mail: tlewis1260@aol.com

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 7099-3332A
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSD-01	BRSWSD-02	BRSWSD-03	BRSWSD-03D
Sample Location:						
Sample Type:			Sediment	Sediment	Sediment	Sediment
Lab Sample Number:			993332A-01	993332A-02	993332A-03	993332A-04
Percent Solids:			85.1	86.5	84.6	82
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			12/15/1999	12/15/1999	12/15/1999	12/15/1999
Notes:					Field Dup	Field Dup
		Report				
Inorganic Analysis	Method	Limit*	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Total Organic Carbon	9060	100	8460 J	4380 J	5130 J	7940 J

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 7099-3332A
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSD-04	BRSWSD-05	BRSWSD-06	BRSWSD-07
Sample Location:						
Sample Type:			Sediment	Sediment	Sediment	Sediment
Lab Sample Number:			993332A-05	993332A-06	993332A-07	993332A-08
Percent Solids:			57.8	65.5	73.6	75.5
Dilution Factor:			1	1	1	1
Dilution Factor:						
Date Sampled:			12/15/1999	12/15/1999	12/15/1999	12/15/1999
Notes:						
		Report				
Inorganic Analysis	Method	Limit	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Total Organic Carbon	9060	100	36400 J	36000 J	23400 J	17400 J

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

TABLE I

Inorganic Validated Results

Project No.: 05000.33
Lab Order: 7099-3332A
Site: Gordon Craig Army Reserve

Sample Number:			BRSWSD-08			
Sample Location:						
Sample Type:			Sediment			
Lab Sample Number:			993332A-09			
Percent Solids:			86.9			
Dilution Factor:			1			
Dilution Factor:						
Date Sampled:			12/15/1999			
Notes:						
		Report				
Inorganic Analysis	Method	Limit	mg/Kg			
Total Organic Carbon	9060	100	2760 J			

*Report Limit is based on 100% total solids.
Solid results based upon dry weight

Note:
J - Quantition is approximate due to limitations identified in the quality control review (Date Review).
U - The compound was not detected. The associated numerical value is the compound quantitation limit.
UJ - The compound was not detected. The compound quantitation limit is an estimated value.
R - Value is rejected.

APPENDIX L

COMPLETE VALIDATED 2001 DATA PACKAGE

VALIDATA

Chemical Services, Inc.

4070 Balleycastle Lane, Duluth, GA 30097

(770) 232-0130
(770) 232-5082 (Fax)
www.datavalidator.com

DATA VALIDATION SUMMARY
REPORT

COMPANY:	Stone & Webster, Inc.
SITE NAME:	CPL Gordon Craig U. S. Army Reserve Center, Brockton, MA
CONTRACTED LAB:	Severn Trent Laboratories, Inc.
PRIME CONTRACT NUMBER:	DACW33-94-D-0007
SUBCONTRACT NUMBER:	05000-342804-6739
QA/QC LEVEL:	EPA Level III
DATA VALIDATION LEVEL:	USEPA Region I Modified Tier II
VALIDATION GUIDELINES:	*Region I, EPA-NE Data Validation Guidelines for Evaluating Environmental Analyses, 1996; Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis,* 1988
SAMPLE MATRIX:	Sediments
TYPES OF ANALYSES:	Acid Volatile Sulfides (AVS), Simultaneously Extracted Metals (SEM), Percent Solids
SDG NUMBER:	83656 (Tier II)

OVERVIEW

SAMPLES:

Client Sample #	Lab Sample #	Matrix	AVS	SEM*	Percent Solids
BRSWSD01R	458214	Sediment	X	X	X
BRSWSD02R	458215	Sediment	X	X	X
BRSWSD03R	458216	Sediment	X	X	X
BRSWSD04R	458217	Sediment	X	X	X
BRSWSD05R	458218	Sediment	X	X	X
BRSWSD06R	458219	Sediment	X	X	X
BRSWSD07R	458220	Sediment	X	X	X
BRSWSD08R	458221	Sediment	X	X	X
BRSWSD09D	458222	Sediment	X	X	X
BRSWSD01RMD	458214DP	Sediment	X	X	X
BRSWSD01RMS	458214MS	Sediment	X	X	X

* Metals included analyses for cadmium, copper, lead, mercury, nickel and zinc only.

Suffix Codes: MD = MATRIX DUPLICATE, MS = MATRIX SPIKE

DATA REVIEWER(S): Marvin L. Smith, Jean M. Delashmit

RELEASE SIGNATURE:

Data Qualifier Definitions

J	-	The associated numerical value is an estimated quantity.
R	-	The data are unusable (the compound/analyte may or may not be present). Resampling and reanalysis are necessary for verification.
U	-	The compound/analyte was analyzed for, but not detected. The associated numerical value is the sample quantitation limit.
UJ	-	The compound/analyte was analyzed for, but not detected. The sample quantitation limit is an estimated quantity.

DATA QUALIFICATION SUMMARY

Severn Trent Laboratories, Inc. - 83656 Inorganics

SAMPLES: BRSWSD01R, BRSWSD02R, BRSWSD03R, BRSWSD04R, BRSWSD05R, BRSWSD06R, BRSWSD07R, BRSWSD08R, BRSWSD09D

ACID VOLATILE SULFIDES (AVS)

SUMMARY

I.) General:

Validation:

Data validation was performed according to Region I, Data Validation Functional Guidelines for Evaluating Environmental Analyses using Modified Tier II validation.

Methods:

The analyses for acid volatile sulfides were performed using AVS Methods 9030B and 9034.

QC Parameters:

The following QC parameters were used for data validation:

Criteria	Parameter
*	Holding Time
*	Calibration
*	Blank Contamination
*	Lab Control Sample
*	Lab Matrix Duplicate
*	Lab Matrix Spike
*	Field Duplicate

Where: * = All criteria met.

II.) Overall Assessment of Data:

All laboratory data were acceptable without qualification.

MAJOR ISSUES

No major problems were observed in this fraction of the SDG.

MINOR ISSUES

I.) Holding Times:

All Holding Time criteria were met. No action was required.

II.) Calibration:

All Initial and Continuing Calibration criteria were met. No action was required.

III.) Blanks:

Method Blank:

AVS was not detected in the method blank. No action was necessary.

Field Blanks:

Rinsate and field blanks were not analyzed for AVS in this SDG. No action was taken.

IV.) Laboratory Control Samples (LCS):

One LCS was analyzed with this fraction of the SDG. The LCS Recovery criteria were met. No action was taken.

V.) Matrix Duplicate (MD):

The Relative Percent Difference (RPD) criteria was met. No action was necessary.

VI.) Matrix Spike Recovery (MS):

The Matrix Spike Percent Recovery (%R) criteria was met. No action was necessary.

VII.) Field Duplicates:

Field duplicate samples BRSWSD03R and BRSWSD09D were identified for this SDG. AVS was not detected in either field duplicate sample. No data qualification was required.

VIII.) TCL Compound Identification:

All TCL Compound Identification criteria were met. No action was necessary.

IX.) Compound Quantitation and Reported Contract Required Quantitation Limits (CRQL):

All Compound Quantitation and CRQL criteria were met. No action was required.

X.) System Performance:

No analytical problems impacting usability of data were observed in this fraction of the SDG. No data qualification action was necessary.

SIMULTANEOUSLY EXTRACTED METALS (SEM)

SUMMARY

I.) General:

Validation:

Data validation was performed according to Region I, Data Validation Functional Guidelines for Evaluating Environmental Analyses using Modified Tier II validation.

Methods:

The analyses for simultaneously extracted metals were performed using SW-846 Methods 6010B and 7470A, ILM 245.1.

QC Parameters:

The following QC parameters were used for data validation:

Criteria	Parameter
*	Holding Time
*	Calibration
x	CRDL Standards
x	Blank Contamination
*	Laboratory Control Sample
*	Laboratory Matrix Duplicate
x	Laboratory Matrix Spike
*	Serial Dilution Analysis
*	Field Duplicate

Where: * = All criteria met
x = Qualifications required

II.) Overall Assessment of Data:

All laboratory data were acceptable with qualifications.

MAJOR ISSUES

No major problems were observed in this fraction of the SDG.

MINOR ISSUES

I.) Holding Times:

All Holding Time criteria were met. No action was taken.

II.) Calibration:

All Initial and Continuing Calibration criteria were met. No action was necessary.

III.) Contact Required Detection Limits Standard (CRDL):

The Percent Recovery (%R) was 75% for mercury in the CRDL standard, which was below the 80-120% QC limits. All positive and non-detect results for mercury in the SDG samples were qualified as estimated (J) and (UJ).

IV.) Blanks:

The following blank results represent the highest detections associated with the samples and were used for data qualification:

Blank ID	Analyte	Blank Conc.	Action Level
PBS	mercury	0.002 mg/kg	0.010 mg/kg
PBS	nickel	0.024 mg/kg	0.120 mg/kg
PBS	zinc	0.038 mg/kg	0.190 mg/kg

PBS = Preparation Blank (Solid)

All positive results for mercury in the SDG samples less than 5X the blank amount after correction for percent solids (Action Level) were qualified as undetected (U). All positive results for nickel and zinc were greater than 5X the blank amounts (Action Level). No further action was required.

The following analytes had negative results with absolute values greater than the IDL:

Blank ID	Analyte	Neg. Conc.	Action Level
CCB2	cadmium	-0.0004 mg/L	0.0020 mg/kg
CCB2	copper	-0.0023 mg/L	0.0115 mg/kg

CCB = Continuing Calibration Blank

All associated sample results for cadmium and copper, which consisted entirely of positive results, were greater than 5X the absolute value of the negative blank result (Action Level). No action was required.

V.) ICP Interference Check Sample Results:

All Interference Check Sample criteria were met. No action was required.

VI.) ICP Serial Dilution Analysis:

All Serial Dilution criteria were meet. No action was taken.

VII.) Laboratory Control Samples (LCS):

One LCS was analyzed for this fraction of the SDG. All LCS Recovery criteria were met. No action was required.

VIII.) Duplicate Sample Analysis (MD):

All Matrix Duplicate criteria were met. No action was necessary.

IX.) Matrix Spike Recovery (MS):

The Percent Recovery (%R) was 43.6% for copper in spiked sediment sample BRSWSD01RMS, which was below the 75-125% QC limits. All results for copper in the SDG samples, which consisted entirely of positive detections, were qualified as estimated (J). The sample concentrations of lead and zinc exceeded the concentrations of the spikes added in MS sample, as well as in the post digestion spike sample. No further action was required.

X.) Field Duplicates:

Field duplicate samples BRSWSD03R and BRSWSD09D were identified for this SDG. The following were the CRDL difference comparison and RPD results for analytes with positive detections:

Analyte	RPD	RPD Limit	Difference	Difference Control Limit (4X CRDL)
Cadmium	-	-	0.97 mg/kg	1.2 mg/kg
Copper	33.7%	50%	-	-
Lead	17.1%	50%	-	-
Nickel	-	-	0.6 mg/kg	5.6 mg/kg
Zinc	48%	50%	-	-

All field duplicate results were within the applicable QC limits. No data qualification action was required.

XI.) Sample Result, Calculation/Transcription Verification:

The cadmium result in sample BRSWSD02R was flagged as estimated because it was less than or equal to 2X IDL. All other criteria were met.

XII.) Quarterly Verification of Instrumental Parameters:

All criteria were met, so no action was taken.

XIII.) System Performance:

The blank contamination of mercury in the preparation blank (PBS) resulted in the qualification (U) of this analyte in samples BRSWSD01R, BRSWSD02R, BRSWSD03R, BRSWSD07R and BRSWSD09D. No other analytical problems impacting usability of data were observed in this fraction of the SDG.

PERCENT SOLIDS

SUMMARY

I.) General:

Validation:

Data validation was performed according to Region I, Data Validation Functional Guidelines for Evaluating Environmental Analyses using Modified Tier II validation.

Methods:

The analyses for percent solids were performed using Method IN623.

QC Parameters:

The following QC parameters were used for data validation:

Criteria	Parameter
*	Holding Time
N/A	Calibration
N/A	Blank Contamination
N/A	Lab Control Sample
*	Lab Matrix Duplicate
N/A	Lab Matrix Spike
*	Field Duplicate Analysis

Where: * = All criteria met
N/A = Parameter not available

II.) Overall Assessment of Data:

All laboratory data were acceptable without qualifications.

MAJOR ISSUES

No major problems were observed in this fraction of the SDG.

MINOR ISSUES

I.) Holding Times:

All Holding Time criteria were met. No action was taken.

II.) Calibration:

Calibration data was not submitted. No action was necessary.

III.) Blanks:

Blank data was not submitted. No action was taken.

IV.) Laboratory Control Sample (LCS):

LCS data was not submitted. No action was taken.

V.) Laboratory Duplicate Analysis (MD):

The Relative Percent Difference (RPD) criteria were met. No action was necessary.

VI.) Matrix Spike Recovery (MS)):

MS samples were not analyzed in this fraction of the SDG. No action was required.

VII.) Field Duplicates:

Field duplicate samples BRSWSD03R and BRSWSD09D were identified for this SDG. The RPD was 9.0%, which was within the 50% RPD limit. No data qualification was required.

VIII.) Compound Quantitation and Reported Contract Required Detection Limits (CRDL's):

All Compound Quantitation and CRDL criteria were met. No action was necessary.

IX.) System Performance:

No analytical problems impacting usability of data were observed in this fraction of the SDG. No data qualification action was necessary.

CPL Gordon Craig U. S. Army Reserve Center, Brockton, MA

Table I - Recommendation Summary

AVS	
SEM:	
Cadmium	J^1
Copper	J^2
Lead	
Mercury	A^1, J^3
Nickel	
Zinc	
Percent Solids	

No Flags - All data acceptable without qualification.

A^1 - Accept data, qualify as undetected (U) due to blank contamination (Preparation Blank) for samples BRSWSD01R, BRSWSD02R, BRSWSD03R, BRSWSD07R and BRSWSD09D.

J^1 - Estimate (J) the cadmium result in sample BRSWSD02R because it was less than or equal to 2X IDL. This estimated result should be considered imprecise.

J^2 - Estimate (J) all SDG sample results due to low matrix spike recovery. These estimated results should be considered minimum values.

J^3 - Estimate (J) all positive and non-detect SDG sample results due to low CRDL standard recovery. The estimated results should be considered minimum values.

CPL Gordon Craig U. S. Army Reserve Center, Brockton, MA

Table II - Overall Evaluation of Data

ACID VOLATILE SULFIDES (AVS)

Analytical QC Error	Description	Sample	Usability
none	N/A	none	all

SIMULTANEOUSLY EXTRACTED METALS (SEM)

Analytical QC Error	Description	Samples	Usability
blank analysis	blank contamination	BRSWSD01R	Reduced
		BRSWSD02R	Reduced
		BRSWSD03R	Reduced
		BRSWSD07R	Reduced
		BRSWSD09D	Reduced

PERCENT SOLIDS

Analytical QC Error	Description	Sample	Usability
none	N/A	none	all

Appendix A

Qualified Data Tables

Client Sample ID	Sample Matrix	Parameter	Units	Result	Qualifier	Validated Result	Validated Qualifier	Method	MDL	PQL	Lab File ID
BRSWSD01R	SO	Cadmium	mg/Kg	0.16		0.16		6010B	0.0048	0.125	
BRSWSD01R	SO	Copper	mg/Kg	6.2		6.2	J	6010B	0.0216	0.64	
BRSWSD01R	SO	Lead	mg/Kg	9.8		9.8		6010B	0.0131	0.109	
BRSWSD01R	SO	Mercury	mg/Kg	0.003	B	0.003	UJ	7470	0.0033	0.0032	
BRSWSD01R	SO	Nickel	mg/Kg	1.8		1.8		6010B	0.0486	1.03	
BRSWSD01R	SO	Zinc	mg/Kg	57.4		57.4		6010B	0.1290	0.516	
BRSWSD01R	SO	Acid Volatile Sulfide	mg/Kg	31.4		31.4		AVS	9.4000	10	
BRSWSD01R	SO	Solids, Percent	%	85.5		85.5		IN623		0	
BRSWSD01RREP	SO	Cadmium	mg/Kg	0.1475		0.1475		6010B	0.0048	0.125	
BRSWSD01RREP	SO	Copper	mg/Kg	6.7824		6.7824		6010B	0.0216	0.64	
BRSWSD01RREP	SO	Lead	mg/Kg	9.5719		9.5719		6010B	0.0131	0.109	
BRSWSD01RREP	SO	Mercury	mg/Kg	0.0027	B	0.0027	B	7470	0.0033	0.0032	
BRSWSD01RREP	SO	Nickel	mg/Kg	2.0325		2.0325		6010B	0.0486	1.03	
BRSWSD01RREP	SO	Zinc	mg/Kg	58.1884		58.1884		6010B	0.1290	0.516	
BRSWSD01RREP	SO	Acid Volatile Sulfide	mg/Kg	28.8		28.8		AVS	9.4000	10	
BRSWSD01RREP	SO	Solids, Percent	%	84.2		84.2		IN623		0	
BRSWSD01RMS	SO	Cadmium	mg/Kg	0.6751		0.6751		6010B	0.0048	0.125	
BRSWSD01RMS	SO	Copper	mg/Kg	7.5865		7.5865		6010B	0.0216	0.64	
BRSWSD01RMS	SO	Lead	mg/Kg	11.4072		11.4072		6010B	0.0131	0.109	
BRSWSD01RMS	SO	Mercury	mg/Kg	0.0249		0.0249		7470	0.0033	0.0032	
BRSWSD01RMS	SO	Nickel	mg/Kg	7.1228		7.1228		6010B	0.0486	1.03	
BRSWSD01RMS	SO	Zinc	mg/Kg	50.0231		50.0231		6010B	0.1290	0.516	
BRSWSD01RMS	SO	Acid Volatile Sulfide	mg/Kg	434		434		AVS	9.4000	10	
BRSWSD01RMS	SO	Solids, Percent	%	85.5		85.5		IN623		0	
BRSWSD02R	SO	Cadmium	mg/Kg	0.06	B	0.06	J	6010B	0.0048	0.125	
BRSWSD02R	SO	Copper	mg/Kg	1.1		1.1	J	6010B	0.0216	0.64	
BRSWSD02R	SO	Lead	mg/Kg	4.2		4.2		6010B	0.0131	0.109	
BRSWSD02R	SO	Mercury	mg/Kg	0.003		0.003	UJ	7470	0.0033	0.0032	
BRSWSD02R	SO	Nickel	mg/Kg	0.77		0.77		6010B	0.0486	1.03	
BRSWSD02R	SO	Zinc	mg/Kg	11.2		11.2		6010B	0.1290	0.516	
BRSWSD02R	SO	Acid Volatile Sulfide	mg/Kg	10.2	U	10.2	U	AVS	9.4000	10	
BRSWSD02R	SO	Solids, Percent	%	78.1		78.1		IN623		0	
BRSWSD03R	SO	Cadmium	mg/Kg	1.8		1.8		6010B	0.0048	0.125	
BRSWSD03R	SO	Copper	mg/Kg	19.4		19.4	J	6010B	0.0216	0.64	
BRSWSD03R	SO	Lead	mg/Kg	26.7		26.7		6010B	0.0131	0.109	
BRSWSD03R	SO	Mercury	mg/Kg	0.01		0.01	UJ	7470	0.0033	0.0032	
BRSWSD03R	SO	Nickel	mg/Kg	2.2		2.2		6010B	0.0486	1.03	

Client Sample ID	Sample Matrix	Parameter	Units	Result	Qualifier	Validated Result	Validated Qualifier	Method	MDL	PQL	Lab File ID
BRSWSD03R	SO	Zinc	mg/Kg	71.3		71.3		6010B	0.1290	0.516	
BRSWSD03R	SO	Acid Volatile Sulfide	mg/Kg	10.3	U	10.3	U	AVS	9.4000	10	
BRSWSD03R	SO	Solids, Percent	%	69.3		69.3		IN623		0	
BRSWSD04R	SO	Cadmium	mg/Kg	1.3		1.3		6010B	0.0048	0.125	
BRSWSD04R	SO	Copper	mg/Kg	20.4		20.4	J	6010B	0.0216	0.64	
BRSWSD04R	SO	Lead	mg/Kg	120		120		6010B	0.0131	0.109	
BRSWSD04R	SO	Mercury	mg/Kg	0.12		0.12	J	7470	0.0033	0.0032	
BRSWSD04R	SO	Nickel	mg/Kg	8.3		8.3		6010B	0.0486	1.03	
BRSWSD04R	SO	Zinc	mg/Kg	150		150		6010B	0.1290	0.516	
BRSWSD04R	SO	Acid Volatile Sulfide	mg/Kg	22.3		22.3		AVS	9.4000	10	
BRSWSD04R	SO	Solids, Percent	%	35.4		35.4		IN623		0	
BRSWSD05R	SO	Cadmium	mg/Kg	0.28		0.28		6010B	0.0048	0.125	
BRSWSD05R	SO	Copper	mg/Kg	18.6		18.6	J	6010B	0.0216	0.64	
BRSWSD05R	SO	Lead	mg/Kg	73.8		73.8		6010B	0.0131	0.109	
BRSWSD05R	SO	Mercury	mg/Kg	0.05		0.05	J	7470	0.0033	0.0032	
BRSWSD05R	SO	Nickel	mg/Kg	4		4		6010B	0.0486	1.03	
BRSWSD05R	SO	Zinc	mg/Kg	45.6		45.6		6010B	0.1290	0.516	
BRSWSD05R	SO	Acid Volatile Sulfide	mg/Kg	12.2		12.2		AVS	9.4000	10	
BRSWSD05R	SO	Solids, Percent	%	62		62		IN623		0	
BRSWSD06R	SO	Cadmium	mg/Kg	0.24		0.24		6010B	0.0048	0.125	
BRSWSD06R	SO	Copper	mg/Kg	8.2		8.2	J	6010B	0.0216	0.64	
BRSWSD06R	SO	Lead	mg/Kg	36.3		36.3		6010B	0.0131	0.109	
BRSWSD06R	SO	Mercury	mg/Kg	0.04		0.04	J	7470	0.0033	0.0032	
BRSWSD06R	SO	Nickel	mg/Kg	3		3		6010B	0.0486	1.03	
BRSWSD06R	SO	Zinc	mg/Kg	21.4		21.4		6010B	0.1290	0.516	
BRSWSD06R	SO	Acid Volatile Sulfide	mg/Kg	12.1		12.1		AVS	9.4000	10	
BRSWSD06R	SO	Solids, Percent	%	66.1		66.1		IN623		0	
BRSWSD07R	SO	Cadmium	mg/Kg	0.54		0.54		6010B	0.0048	0.125	
BRSWSD07R	SO	Copper	mg/Kg	4.3		4.3	J	6010B	0.0216	0.64	
BRSWSD07R	SO	Lead	mg/Kg	17.3		17.3		6010B	0.0131	0.109	
BRSWSD07R	SO	Mercury	mg/Kg	0.02		0.02	J	7470	0.0033	0.0032	
BRSWSD07R	SO	Nickel	mg/Kg	1.9		1.9		6010B	0.0486	1.03	
BRSWSD07R	SO	Zinc	mg/Kg	27.1		27.1		6010B	0.1290	0.516	
BRSWSD07R	SO	Acid Volatile Sulfide	mg/Kg	9.6	U	9.6	U	AVS	9.4000	10	
BRSWSD07R	SO	Solids, Percent	%	80.8		80.8		IN623		0	
BRSWSD08R	SO	Cadmium	mg/Kg	0.89		0.89		6010B	0.0048	0.125	
BRSWSD08R	SO	Copper	mg/Kg	10.3		10.3	J	6010B	0.0216	0.64	

Client Sample ID	Sample Matrix	Parameter	Units	Result	Qualifier	Validated Result	Validated Qualifier	Method	MDL	PQL	Lab File ID
BRSWSD08R	SO	Lead	mg/Kg	47.3		47.3		6010B	0.0131	0.109	
BRSWSD08R	SO	Mercury	mg/Kg	0.05		0.05	J	7470	0.0033	0.0032	
BRSWSD08R	SO	Nickel	mg/Kg	3.9		3.9		6010B	0.0486	1.03	
BRSWSD08R	SO	Zinc	mg/Kg	39.3		39.3		6010B	0.1290	0.516	
BRSWSD08R	SO	Acid Volatile Sulfide	mg/Kg	10.6		10.6		AVS	9.4000	10	
BRSWSD08R	SO	Solids, Percent	%	71.5		71.5		IN623		0	
BRSWSD09D	SO	Cadmium	mg/Kg	0.97		0.97		6010B	0.0048	0.125	
BRSWSD09D	SO	Copper	mg/Kg	13.8		13.8	J	6010B	0.0216	0.64	
BRSWSD09D	SO	Lead	mg/Kg	22.5		22.5		6010B	0.0131	0.109	
BRSWSD09D	SO	Mercury	mg/Kg	0.01		0.01	UJ	7470	0.0033	0.0032	
BRSWSD09D	SO	Nickel	mg/Kg	1.6		1.6		6010B	0.0486	1.03	
BRSWSD09D	SO	Zinc	mg/Kg	43.7		43.7		6010B	0.1290	0.516	
BRSWSD09D	SO	Acid Volatile Sulfide	mg/Kg	9.5	U	9.5	U	AVS	9.4000	10	
BRSWSD09D	SO	Solids, Percent	%	75.8		75.8		IN623		0	
BLKAS0702	SO	Acid Volatile Sulfide	mg/L	1.6	U	1.6	U	AVS	9.4000	10	
LCSAS0702	SO	Acid Volatile Sulfide	mg/L	888		888		AVS	9.4000	10	
PBWAVS/SEM	SO	Mercury	mg/Kg	0.002	B	0.002	B	7470	0.0033	0.0032	
BLANK(07/02/01)	SO	Cadmium	mg/Kg	0.004	U	0.004	U	6010B	0.0048	0.125	
BLANK(07/02/01)	SO	Copper	mg/Kg	0.024	U	0.024	U	6010B	0.0216	0.64	
BLANK(07/02/01)	SO	Lead	mg/Kg	0.019	U	0.019	U	6010B	0.0131	0.109	
BLANK(07/02/01)	SO	Nickel	mg/Kg	0.024	B	0.024	B	6010B	0.0486	1.03	
BLANK(07/02/01)	SO	Zinc	mg/Kg	0.038	B	0.038	B	6010B	0.1290	0.516	

VALIDATA

Chemical Services, Inc.

4070 Balleycastle Lane, Duluth, GA 30097

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(770) 232-5082 (Fax)
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DATA VALIDATION SUMMARY
REPORT

COMPANY:	Stone & Webster, Inc.
SITE NAME:	CPL Gordon Craig U. S. Army Reserve Center, Brockton, MA
CONTRACTED LAB:	Severn Trent Laboratories, Inc.
PRIME CONTRACT NUMBER:	DACW33-94-D-0007
SUBCONTRACT NUMBER:	05000-342804-6739
QA/QC LEVEL:	EPA Level III
DATA VALIDATION LEVEL:	USEPA Region I Modified Tier II
VALIDATION GUIDELINES:	*Region I, EPA-NE Data Validation Guidelines for Evaluating Environmental Analyses, 1996; Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis,* 1988
SAMPLE MATRIX:	Water
TYPES OF ANALYSES:	Total Metals, Total Hardness
SDG NUMBER:	83727 (Tier II)

OVERVIEW

SAMPLES:

Client Sample #	Lab Sample #	Matrix	Total Metals*	Total Hardness
BRSWSW01R	458645	Water	X	X
BRSWSW02R	458646	Water	X	X
BRSWSW03R	458647	Water	X	X
BRSWSW04R	458648	Water	X	X
BRSWSW09D	458649	Water	X	X
BRSWRB11	458644	Water	X	
BRSWSW02RMD	458646DP	Water	X	X
BRSWSW02RMS	458646MS	Water	X	X

* Total metals included the analyses for cadmium, lead and selenium only.

Sample ID Code: RB = RINSATE BLANK

Suffix Codes: MD = MATRIX DUPLICATE, MS = MATRIX SPIKE

DATA REVIEWER(S): Marvin L. Smith, Jean M. Delashmit

RELEASE SIGNATURE:

Data Qualifier Definitions

J	-	The associated numerical value is an estimated quantity.
R	-	The data are unusable (the compound/analyte may or may not be present). Resampling and reanalysis are necessary for verification.
U	-	The compound/analyte was analyzed for, but not detected. The associated numerical value is the sample quantitation limit.
UJ	-	The compound/analyte was analyzed for, but not detected. The sample quantitation limit is an estimated quantity.

DATA QUALIFICATION SUMMARY

Severn Trent Laboratories, Inc. - 83727 Inorganics

SAMPLES: BRSWSW01R, BRSWSW02R, BRSWSW03R, BRSWSW04R, BRSWSW09R, BRSWRB11

TOTAL METALS

SUMMARY

I.) General:

Validation:

Data validation was performed according to Region I, Data Validation Functional Guidelines for Evaluating Environmental Analyses using Modified Tier II validation.

Methods:

The analyses for total metals were performed using SW-846 Method 6010B.

QC Parameters:

The following QC parameters were used for data validation:

Criteria	Parameter
*	Holding Time
*	Calibration
*	CRDL Standards
*	Blank Contamination
*	ICP Interference Sample
*	Lab Control Sample
*	Lab Matrix Duplicate
*	Lab Matrix Spike
*	Serial Dilution Analysis
*	Field Duplicate Analysis

Where: * = All criteria met

II.) Overall Assessment of Data:

All laboratory data were acceptable without qualification.

MAJOR ISSUES

No major problems were observed in this fraction of the SDG.

MINOR ISSUES

I.) Holding Times:

All Holding Time criteria were met. No action was taken.

II.) Calibration:

All Initial and Continuing Calibration criteria were met. No action was necessary.

III.) Contact Required Detection Limits Standard (CRDL):

All CRDL Recovery criteria were met. No action was required.

IV.) Blanks:

There were no detections in the calibration, preparation or rinsate blanks. No action was taken.

V.) ICP Interference Check Sample Results:

All Interference Check Sample criteria were met. No action was required.

VI.) ICP Serial Dilution Analysis:

All Serial Dilution criteria were met. No action was taken.

VII.) Laboratory Control Samples (LCS):

One LCS was analyzed for this fraction of the SDG. All LCS Recovery criteria were met. No action was required.

VIII.) Duplicate Sample Analysis (MD):

All Matrix Duplicate criteria were met. No action was necessary.

IX.) Matrix Spike Recovery (MS):

All Matrix Spike Percent Recovery criteria were met. No action was taken.

X.) Field Duplicates:

Field duplicate samples BRSWSW03R and BRSWSW09D were identified for this SDG. The following were the CRDL difference comparison results:

Analyte	Difference	Control Limit (2X CRDL)
Cadmium	0.18 ug/L	0.60 ug/L
Selenium	0.7 ug/L	4.60 ug/L

Both field duplicate results were within the QC limits. No data qualification action was required.

XI.) Sample Result, Calculation/Transcription Verification:

Sample BRSWSW09D was misnamed BRSWSW09R by the laboratory on the Form I and in the EDD. The Form I and EDD sample numbers were corrected by the validator.

The positive cadmium results in samples BRSWSW02R, BRSWSW03R, BRSWSW04R, and BRSWSW09D, the positive lead results in samples BRSWSW01R and BRSWSW02R, and the positive selenium result in sample BRSWSW03R were flagged as estimated because the results were less than or equal to 2X IDL. All other criteria were met.

XII.) Quarterly Verification of Instrumental Parameters:

All criteria were met, so no action was taken.

XIII.) System Performance:

No analytical problems impacting usability of data were observed in this fraction of the SDG. No action was necessary.

TOTAL HARDNESS

SUMMARY

I.) General:

Validation:

Data validation was performed according to Region I, Data Validation Functional Guidelines for Evaluating Environmental Analyses using Modified Tier II validation.

Method:

The analyses for total hardness were performed using EPA Method 130.2.

QC Parameters:

The following QC parameters were used for data validation:

Criteria	Parameter
*	Holding Time
*	Calibration

Criteria	Parameter
*	Blank Contamination
*	Laboratory Control Sample
*	Laboratory Matrix Duplicate
*	Laboratory Matrix Spike
*	Field Duplicate Analysis

Where: * = All criteria met

II.) Overall Assessment of Data:

All laboratory data were acceptable without qualification.

MAJOR ISSUES

No major problems were observed in this fraction of the SDG.

MINOR ISSUES

I.) Holding Times:

All Holding Time criteria were met. No action was taken.

II.) Calibration:

All Calibration criteria were met. No action was necessary.

III.) Blanks:

Total hardness was not detected in the method blank. No action was taken.

IV.) Laboratory Control Sample (LCS):

The LCS Recovery criteria were met. No action was necessary.

V.) Laboratory Duplicate Analysis (MD):

The Relative Percent Difference (RPD) criteria were met. No action was necessary.

VI.) Matrix Spike Recovery (MS):

The Matrix Spike Recovery criteria were met. No action was required.

VII.) Field Duplicates:

Field duplicate samples BRSWSW03R and BRSWSW09D were identified for this SDG. The RPD was 4.3%, which was within the 30% RPD limit. No data qualification was required.

VIII.) Compound Quantitation and Reported Contract Required Detection Limits (CRDL's):

All CRDL criteria were met. No action was necessary.

IX.) Sample Result Transcription:

Sample BRSWSW09D was misnamed BRSWSW09R by the laboratory on the Form I and in the EDD. The Form I and EDD sample numbers were corrected by the validator. All other criteria were met.

X.) System Performance:

No analytical problems impacting usability of data were observed in this fraction of the SDG. No action was necessary.

CPL Gordon Craig U. S. Army Reserve Center, Brockton, MA

Table I - Recommendation Summary

Total Metals:	
Cadmium	J^1
Lead	J^1
Selenium	J^1
Hardness	

No Flags - All data acceptable without qualification.

J^1 - Estimate (J) the positive cadmium results in samples BRSWSW02R, BRSWSW03R, BRSWSW04R, and BRSWSW09D, the positive lead results in BRSWSW01R and BRSWSW02R, and the positive selenium result in BRSWSW03R because they were less than or equal to 2X IDL. These estimated values should be considered imprecise.

CPL Gordon Craig U. S. Army Reserve Center, Brockton, MA

Table II - Overall Evaluation of Data

TOTAL METALS

Analytical QC Error	Description	Sample	Usability
none	N/A	none	all

TOTAL HARDNESS

Analytical QC Error	Description	Sample	Usability
none	N/A	none	all

Appendix A

Qualified Data Tables

Client Sample ID	Sample Matrix	Parameter	Units	Result	Qualifier	Validated Result	Validated Qualifier	Method	MDL	PQL	Lab File ID
BRSWRB11	WA	Cadmium	ug/L	0.3	U	0.3	U	6010B	0.3	0.3	
BRSWRB11	WA	Lead	ug/L	1.5	U	1.5	U	6010B	1.5	1.5	
BRSWRB11	WA	Selenium	ug/L	2.3	U	2.3	U	6010B	2	2.3	
BRSWSW01R	WA	Total Hardness as CaCO3	mg/L	44		44		130.2	1.19	2	
BRSWSW01R	WA	Cadmium	ug/L	0.3	U	0.3	U	6010B	0.3	0.3	
BRSWSW01R	WA	Lead	ug/L	2.5	B	2.5	J	6010B	1.5	1.5	
BRSWSW01R	WA	Selenium	ug/L	2.3	U	2.3	U	6010B	2	2.3	
BRSWSW02R	WA	Total Hardness as CaCO3	mg/L	70		70		130.2	1.19	2	
BRSWSW02R	WA	Cadmium	ug/L	0.33	B	0.33	J	6010B	0.3	0.3	
BRSWSW02R	WA	Lead	ug/L	2.4	B	2.4	J	6010B	1.5	1.5	
BRSWSW02R	WA	Selenium	ug/L	2.3	U	2.3	U	6010B	2	2.3	
BRSWSW02REP	WA	Total Hardness as CaCO3	mg/L	80		80		130.2	1.19	2	
BRSWSW02REP	WA	Cadmium	ug/L	0.3449	B	0.3449	B	6010B	0.3	0.3	
BRSWSW02REP	WA	Lead	ug/L	1.5	U	1.5	U	6010B	1.5	1.5	
BRSWSW02REP	WA	Selenium	ug/L	2.3	U	2.3	U	6010B	2	2.3	
BRSWSW02RMS	WA	Total Hardness as CaCO3	mg/L	220		220		130.2	1.19	2	
BRSWSW02RMS	WA	Cadmium	ug/L	51.72		51.72		6010B	0.3	0.3	
BRSWSW02RMS	WA	Lead	ug/L	22.36		22.36		6010B	1.5	1.5	
BRSWSW02RMS	WA	Selenium	ug/L	11.43		11.43		6010B	2	2.3	
BRSWSW03R	WA	Total Hardness as CaCO3	mg/L	92		92		130.2	1.19	2	
BRSWSW03R	WA	Cadmium	ug/L	0.33	B	0.33	J	6010B	0.3	0.3	
BRSWSW03R	WA	Lead	ug/L	1.5	U	1.5	U	6010B	1.5	1.5	
BRSWSW03R	WA	Selenium	ug/L	3	B	3	J	6010B	2	2.3	
BRSWSW04R	WA	Total Hardness as CaCO3	mg/L	58		58		130.2	1.19	2	
BRSWSW04R	WA	Cadmium	ug/L	0.58	B	0.58	J	6010B	0.3	0.3	
BRSWSW04R	WA	Lead	ug/L	4		4		6010B	1.5	1.5	
BRSWSW04R	WA	Selenium	ug/L	2.3	U	2.3	U	6010B	2	2.3	
BRSWSW09D	WA	Total Hardness as CaCO3	mg/L	96		96		130.2	1.19	2	
BRSWSW09D	WA	Cadmium	ug/L	0.51	B	0.51	J	6010B	0.3	0.3	
BRSWSW09D	WA	Lead	ug/L	1.5	U	1.5	U	6010B	1.5	1.5	
BRSWSW09D	WA	Selenium	ug/L	2.3	U	2.3	U	6010B	2	2.3	
BLKHA0706	Wa	Total Hardness as CaCO3	mg/L	2	U	2	U	130.2	1.19	2	
LCSHA0706	Wa	Total Hardness as CaCO3	mg/L	250		250		130.2	1.19	2	
LCSW0709A	WA	Cadmium	ug/L	518.6		518.6		6010B	0.3	0.3	
LCSW0709A	WA	Lead	ug/L	1010		1010		6010B	1.5	1.5	
LCSW0709A	WA	Selenium	ug/L	510.3		510.3		6010B	2	2.3	
PBW0709A	WA	Cadmium	ug/L	0.3	U	0.3	U	6010B	0.3	0.3	

Client Sample ID	Sample Matrix	Parameter	Units	Result	Qualifier	Validated Result	Validated Qualifier	Method	MDL	PQL	Lab File ID
PBW0709A	WA	Lead	ug/L	1.5	U	1.5	U	6010B	1.5	1.5	
PBW0709A	WA	Selenium	ug/L	2.3	U	2.3	U	6010B	2	2.3	

APPENDIX M

SAMPLES USED IN HUMAN HEALTH RISK ASSESSMENT

UNFENCED, UNPAVED
SOILS 0-3 FT BGS

Parameter	Norm Units	Medium	#Hit		#Samp	MinSQL		MaxSQL	MinHit		MaxHit	Avg	B1-SS1 0.5-1.4	B2-SS1 0.4-0.7	B3-SS1 0.3-0.9	B6-SS1 0.2-0.9
Acetone	mg/Kg	SO	4	/	4		:		0.019	-	0.063	0.033				
Benzo(a)anthracene	mg/Kg	SO	2	/	4	0.33	:	0.35	0.068	-	0.071	0.11975				
Benzo(a)pyrene	mg/Kg	SO	2	/	4	0.33	:	0.35	0.066	-	0.081	0.12175				
Benzo(b)fluoranthene	mg/Kg	SO	4	/	4		:		0.081	-	0.13	0.10775				
Benzo(g,h,i)perylene	mg/Kg	SO	2	/	4	0.33	:	0.35	0.069	-	0.073	0.1205				
Chrysene	mg/Kg	SO	3	/	4	0.33	:	0.33	0.08	-	0.11	0.11175				
Fluoranthene	mg/Kg	SO	4	/	4		:		0.077	-	0.14	0.11675				
Indeno(1,2,3-cd)pyrene	mg/Kg	SO	1	/	4	0.33	:	0.35	0.064	-	0.064	0.14475				
Phenanthrene	mg/Kg	SO	2	/	4	0.33	:	0.35	0.065	-	0.077	0.1205				
Pyrene	mg/Kg	SO	4	/	4		:		0.072	-	0.14	0.1105				
Antimony	mg/Kg	SO	4	/	4		:		0.7	-	1.2	0.855				
Arsenic	mg/Kg	SO	7	/	8	7.7	:	7.7	1.1	-	3.7	2.40625	3.7	1.6	1.9	1.9
Barium	mg/Kg	SO	8	/	8		:		12	-	33	22.125	16	19	17	12
Cadmium	mg/Kg	SO	4	/	8	0.25	:	0.25	0.17	-	0.28	0.17	0.25 U	0.25 U	0.25 U	0.25 U
Chromium	mg/Kg	SO	8	/	8		:		5.5	-	13	9.2625	8.5	9.2	7.6	5.5
Lead	mg/Kg	SO	8	/	8		:		10	-	53	24	19	13	20	14
Mercury	mg/Kg	SO	4	/	8	0.1	:	0.1	0.018	-	0.071	0.04575	0.1 U	0.1 U	0.1 U	0.1 U
Total Organic Carbon	mg/Kg	SO	4	/	4		:		2760	-	36000	19890				
TPH	mg/Kg	SO	2	/	4	10	:	10	14	-	54	19.5	10 U	14	54	10 U

UNFENCED, UNPAVED
SOILS 0-3 FT BGS **(continued)**

Parameter	Norm Units	B6-SS1 0.2-0.9	BRSWSD05	BRSWSD06	BRSWSD07	BRSWSD08
Acetone	mg/Kg		0.019 J	0.063	0.02 J	0.03
Benzo(a)anthracene	mg/Kg		0.071 J	0.35 U	0.33 U	0.068 J
Benzo(a)pyrene	mg/Kg		0.081 J	0.35 U	0.33 U	0.066 J
Benzo(b)fluoranthene	mg/Kg		0.13 J	0.11 J	0.081 J	0.11 J
Benzo(g,h,i)perylene	mg/Kg		0.073 J	0.35 U	0.33 U	0.069 J
Chrysene	mg/Kg		0.11 J	0.08 J	0.33 U	0.092 J
Fluoranthene	mg/Kg		0.14 J	0.12 J	0.077 J	0.13 J
Indeno(1,2,3-cd)pyrene	mg/Kg		0.35 U	0.35 U	0.33 U	0.064 J
Phenanthrene	mg/Kg		0.077 J	0.35 U	0.33 U	0.065 J
Pyrene	mg/Kg		0.14 J	0.11 J	0.072 J	0.12 J
Antimony	mg/Kg		0.81 J	0.7 J	0.71 J	1.2
Arsenic	mg/Kg	1.9	2.3 J	2.9 J	1.1 J	7.7 U
Barium	mg/Kg	12	28 J	33 J	33 J	19 J
Cadmium	mg/Kg	0.25 U	0.22 J	0.28 J	0.17 J	0.19 J
Chromium	mg/Kg	5.5	12 J	13 J	9.2 J	9.1 J
Lead	mg/Kg	14	48	53	15	10
Mercury	mg/Kg	0.1 U	0.047	0.071	0.03 J	0.018 J
Total Organic Carbon	mg/Kg		36000 J	23400 J	17400 J	2760 J
TPH	mg/Kg	10 U				

ALL SOILS 0-15 FT BGS

Parameter	Norm Units	Medium	#Hit		#Samp	MinSQL		MaxSQL	MinHit		MaxHit	Avg	B1-SS1 0_5-1_4	B1-SS2 4_5-5	B10-SS1 0_5-1_3
1,2,4,-Trimethylbenzene	mg/Kg	SO	1	/	15	0.0043	:	0.0074	0.23	-	0.23	0.01789			
1,3,5-Trimethylbenzene	mg/Kg	SO	1	/	15	0.0043	:	0.0074	0.038	-	0.038	0.00509			
4-isopropyltoluene	mg/Kg	SO	1	/	15	0.0043	:	0.0074	0.044	-	0.044	0.00549			
Acetone	mg/Kg	SO	11	/	15	0.021	:	0.024	0.018	-	0.2	0.03807			
Ethylbenzene	mg/Kg	SO	1	/	27	0.0043	:	0.048	0.0021	-	0.0021	0.01006			
Isopropylbenzene	mg/Kg	SO	1	/	15	0.0043	:	0.0074	0.036	-	0.036	0.00496			
m,p-Xylene	mg/Kg	SO	1	/	27	0.0043	:	0.048	0.019	-	0.019	0.01069			
Methylene Chloride	mg/Kg	SO	5	/	15	0.021	:	0.034	0.014	-	0.025	0.01492			
n-Propylbenzene	mg/Kg	SO	1	/	15	0.0043	:	0.0074	0.069	-	0.069	0.00716			
o-Xylene	mg/Kg	SO	1	/	27	0.0043	:	0.048	0.0046	-	0.0046	0.01016			
sec-Butylbenzene	mg/Kg	SO	1	/	15	0.0043	:	0.0074	0.075	-	0.075	0.00756			
Toluene	mg/Kg	SO	1	/	27	0.0042	:	0.048	0.021	-	0.021	0.01007			
Benzo(a)anthracene	mg/Kg	SO	2	/	27	0.265	:	0.35	0.068	-	0.071	0.1345			
Benzo(a)pyrene	mg/Kg	SO	2	/	27	0.265	:	0.35	0.066	-	0.081	0.1348			
Benzo(b)fluoranthene	mg/Kg	SO	4	/	27	0.265	:	0.3	0.081	-	0.13	0.13272			
Benzo(g,h,i)perylene	mg/Kg	SO	2	/	27	0.265	:	0.35	0.069	-	0.073	0.13461			
Chrysene	mg/Kg	SO	3	/	27	0.265	:	0.33	0.08	-	0.11	0.13331			
Dibenzofuran	mg/Kg	SO	1	/	15	0.27	:	0.35	0.064	-	0.064	0.14227			
Fluoranthene	mg/Kg	SO	6	/	27	0.265	:	0.3	0.069	-	0.16	0.13254			
Fluorene	mg/Kg	SO	2	/	27	0.265	:	0.35	0.061	-	0.11	0.13791			
Indeno(1,2,3-cd)pyrene	mg/Kg	SO	1	/	27	0.265	:	0.35	0.064	-	0.064	0.1382			
Naphthalene	mg/Kg	SO	1	/	27	0.0043	:	0.048	0.19	-	0.19	0.01702			
Phenanthrene	mg/Kg	SO	4	/	27	0.265	:	0.35	0.065	-	0.3	0.13831			
Pyrene	mg/Kg	SO	6	/	27	0.265	:	0.3	0.072	-	0.14	0.13098			
Antimony	mg/Kg	SO	7	/	15	5.2	:	6.1	0.7	-	20	3.348			
Arsenic	mg/Kg	SO	24	/	30	6.6	:	7.7	0.9	-	4.8	2.6475	3.7	1.7	3
Barium	mg/Kg	SO	30	/	30		:		7.1	-	37	18.2893	16	37	17
Cadmium	mg/Kg	SO	9	/	30	0.25	:	0.76	0.17	-	1	0.301	0.25 U	0.25 U	0.86
Chromium	mg/Kg	SO	30	/	30		:		3.4	-	30	10.01	8.5	30	12
Lead	mg/Kg	SO	30	/	30		:		2.8	-	53	15.6337	19	17	19
Mercury	mg/Kg	SO	4	/	30	0.024	:	0.1	0.018	-	0.071	0.03529	0.1 U	0.1 U	0.1 U
Total Organic Carbon	mg/Kg	SO	4	/	4		:		2760	-	36000	19890			
TPH	mg/Kg	SO	10	/	16	10	:	10	13	-	1800	128.438	10 U	18	10 U
C11-C22 Aromatic	mg/Kg	SO	1	/	20	53	:	73	45.5	-	45.5	28.65			
C19-C36 Aliphatic	mg/Kg	SO	3	/	20	53	:	73	56.5	-	71	32.875			
C9-C10 Aromatic	mg/Kg	SO	1	/	20	0.32	:	1	1.7	-	1.7	0.33925			
C9-C12 Aliphatic	mg/Kg	SO	1	/	20	0.32	:	1	1.4	-	1.4	0.32425			

ALL SOILS 0-15 FT BGS **(continued)**

Parameter	Norm Units	B12-SS1 0.4-0.7	B2-SS1 0.4-0.7	B3-SS1 0.3-0.9	B4-SS1 0.4-0.9	B5-SS1 0.1-0.6	B5-SS2 4.5-5.5	B6-SS1 0.2-0.9	B6-SS2 4-5	B7A-SS1 0.4-0.8	B7C-SS1 0.3-0.7	B8-SS1 0.3-0.6	BB2-SS1 0.15-0.9
1,2,4,-Trimethylbenzene	mg/Kg												
1,3,5-Trimethylbenzene	mg/Kg												
4-isopropyltoluene	mg/Kg												
Acetone	mg/Kg												
Ethylbenzene	mg/Kg												
Isopropylbenzene	mg/Kg												
m,p-Xylene	mg/Kg												
Methylene Chloride	mg/Kg												
n-Propylbenzene	mg/Kg												
o-Xylene	mg/Kg												
sec-Butylbenzene	mg/Kg												
Toluene	mg/Kg												
Benzo(a)anthracene	mg/Kg												
Benzo(a)pyrene	mg/Kg												
Benzo(b)fluoranthene	mg/Kg												
Benzo(g,h,i)perylene	mg/Kg												
Chrysene	mg/Kg												
Dibenzofuran	mg/Kg												
Fluoranthene	mg/Kg												
Fluorene	mg/Kg												
Indeno(1,2,3-cd)pyrene	mg/Kg												
Naphthalene	mg/Kg												
Phenanthrene	mg/Kg												
Pyrene	mg/Kg												
Antimony	mg/Kg												
Arsenic	mg/Kg	3	1.6	1.9	2.5	2.6	2.1	1.9	2.4	3.7	4.4	3.6	1.6
Barium	mg/Kg	13	19	17	11.08	33	20	12	23	19	18	15	13
Cadmium	mg/Kg	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.46	1	0.4	0.25 U
Chromium	mg/Kg	6.2	9.2	7.6	10.15	16	11	5.5	12	12	10	8.4	7.6
Lead	mg/Kg	14	13	20	16.41	48	18	14	19	21	22	20	17
Mercury	mg/Kg	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Total Organic Carbon	mg/Kg												
TPH	mg/Kg	15	14	54	10 U	1800	24	10 U	16	10 U	53	13	18
C11-C22 Aromatic	mg/Kg												
C19-C36 Aliphatic	mg/Kg												
C9-C10 Aromatic	mg/Kg												
C9-C12 Aliphatic	mg/Kg												

ALL SOILS 0-15 FT BGS **(continued)**

Parameter	Norm Units	BB2-SS2 9-10	BRSWSB08 0-3	BRSWSB09 6-8	BRSWSB10 3-5	BRSWSB11 3-6	BRSWSB12 3-6	BRSWSB13 0-3	BRSWSB14 0-2	BRSWSB15
1,2,4,-Trimethylbenzene	mg/Kg									0.0044 U
1,3,5-Trimethylbenzene	mg/Kg									0.0044 U
4-isopropyltoluene	mg/Kg									0.0044 U
Acetone	mg/Kg									0.022 U
Ethylbenzene	mg/Kg		0.038 U	0.04 U	0.047 U	0.048 U	0.04 U	0.037 U	0.039 U	0.0044 U
Isopropylbenzene	mg/Kg									0.0044 U
m,p-Xylene	mg/Kg		0.038 U	0.04 U	0.047 U	0.048 U	0.04 U	0.037 U	0.039 U	0.0044 U
Methylene Chloride	mg/Kg									0.022 U
n-Propylbenzene	mg/Kg									0.0044 U
o-Xylene	mg/Kg		0.038 U	0.04 U	0.047 U	0.048 U	0.04 U	0.037 U	0.039 U	0.0044 U
sec-Butylbenzene	mg/Kg									0.0044 U
Toluene	mg/Kg		0.038 U	0.04 U	0.047 U	0.048 U	0.04 U	0.037 U	0.039 U	0.0044 U
Benzo(a)anthracene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Benzo(a)pyrene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Benzo(b)fluoranthene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Benzo(g,h,i)perylene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Chrysene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Dibenzofuran	mg/Kg									0.28 U
Fluoranthene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Fluorene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Indeno(1,2,3-cd)pyrene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Naphthalene	mg/Kg		0.038 U	0.04 U	0.047 U	0.048 U	0.04 U	0.037 U	0.039 U	0.0044 UJ
Phenanthrene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Pyrene	mg/Kg		0.27 U	0.27 U	0.28 U	0.27 U	0.27 U	0.27 U	0.27 UJ	0.27 U
Antimony	mg/Kg									20 J
Arsenic	mg/Kg									6.7 U
Barium	mg/Kg									13 J
Cadmium	mg/Kg									0.67 U
Chromium	mg/Kg									11 J
Lead	mg/Kg									3.9 J
Mercury	mg/Kg									0.027 U
Total Organic Carbon	mg/Kg									
TPH	mg/Kg	10 U								
C11-C22 Aromatic	mg/Kg		55 U	55 U	55 U	53 U	53 U	53 U	54 U	54 U
C19-C36 Aliphatic	mg/Kg		55 U	55 U	55 U	53 U	53 U	53 U	54 U	71 EB
C9-C10 Aromatic	mg/Kg		0.47 U	0.5 U	0.58 U	0.6 U	0.5 U	0.47 U	0.48 U	0.56 U
C9-C12 Aliphatic	mg/Kg		0.47 U	0.5 U	0.58 U	0.6 U	0.5 U	0.47 U	0.48 U	0.56 U

ALL SOILS 0-15 FT BGS **(continued)**

Parameter	Norm Units	BRSWSB16 4.6-8	BRSWSB17	BRSWSB18 4-6	BRSWSB19	BRSWSD05	BRSWSD06	BRSWSD07	BRSWSD08	BRSWSS09 0-3
1,2,4,-Trimethylbenzene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.23	0.0067 U	0.0068 U	0.0059 U	0.0054 U	
1,3,5-Trimethylbenzene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.038	0.0067 U	0.0068 U	0.0059 U	0.0054 U	
4-isopropyltoluene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.044	0.0067 U	0.0068 U	0.0059 U	0.0054 U	
Acetone	mg/Kg	0.023 U	0.018 J	0.028 J	0.021 U	0.019 J	0.063	0.02 J	0.03	
Ethylbenzene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.0021 J	0.0067 U	0.0068 U	0.0059 U	0.0054 U	0.025 U
Isopropylbenzene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.036	0.0067 U	0.0068 U	0.0059 U	0.0054 U	
m,p-Xylene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.019	0.0067 U	0.0068 U	0.0059 U	0.0054 U	0.025 U
Methylene Chloride	mg/Kg	0.023 U	0.022 U	0.019 J	0.021 U	0.033 U	0.034 U	0.029 U	0.027 U	
n-Propylbenzene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.069	0.0067 U	0.0068 U	0.0059 U	0.0054 U	
o-Xylene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.0046	0.0067 U	0.0068 U	0.0059 U	0.0054 U	0.025 U
sec-Butylbenzene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.075	0.0067 U	0.0068 U	0.0059 U	0.0054 U	
Toluene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.0042 U	0.0067 U	0.0068 U	0.0059 U	0.0054 U	0.025 U
Benzo(a)anthracene	mg/Kg	0.28 U	0.27 U	0.29 U	0.27 U	0.071 J	0.35 U	0.33 U	0.068 J	0.28 U
Benzo(a)pyrene	mg/Kg	0.28 U	0.27 U	0.29 U	0.27 U	0.081 J	0.35 U	0.33 U	0.066 J	0.28 U
Benzo(b)fluoranthene	mg/Kg	0.28 U	0.27 U	0.29 U	0.27 U	0.13 J	0.11 J	0.081 J	0.11 J	0.28 U
Benzo(g,h,i)perylene	mg/Kg	0.28 U	0.27 U	0.29 U	0.27 U	0.073 J	0.35 U	0.33 U	0.069 J	0.28 U
Chrysene	mg/Kg	0.28 U	0.27 U	0.29 U	0.27 U	0.11 J	0.08 J	0.33 U	0.092 J	0.28 U
Dibenzofuran	mg/Kg	0.28 U	0.27 U	0.29 U	0.064 J	0.35 U	0.35 U	0.33 U	0.31 U	
Fluoranthene	mg/Kg	0.28 U	0.27 U	0.29 U	0.27 U	0.14 J	0.12 J	0.077 J	0.13 J	0.28 U
Fluorene	mg/Kg	0.28 U	0.27 U	0.29 U	0.11 J	0.35 U	0.35 U	0.33 U	0.31 U	0.28 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.28 U	0.27 U	0.29 U	0.27 U	0.35 U	0.35 U	0.33 U	0.064 J	0.28 U
Naphthalene	mg/Kg	0.0046 U	0.0043 U	0.0053 U	0.19	0.0067 U	0.0068 U	0.0059 U	0.0054 U	0.025 U
Phenanthrene	mg/Kg	0.28 U	0.27 U	0.29 U	0.3	0.077 J	0.35 U	0.33 U	0.065 J	0.28 U
Pyrene	mg/Kg	0.28 U	0.27 U	0.29 U	0.27 U	0.14 J	0.11 J	0.072 J	0.12 J	0.28 U
Antimony	mg/Kg	2.7 J	2 J	5.7 U	5.2 U	0.81 J	0.7 J	0.71 J	1.2	
Arsenic	mg/Kg	4.8 J	1.5 J	7.2 U	6.6 U	2.3 J	2.9 J	1.1 J	7.7 U	
Barium	mg/Kg	20 J	12 J	11 J	14 J	28 J	33 J	33 J	19 J	
Cadmium	mg/Kg	0.64	0.65 U	0.72 U	0.66 U	0.22 J	0.28 J	0.17 J	0.19 J	
Chromium	mg/Kg	12 J	7.6 J	4.1 J	8.2 J	12 J	13 J	9.2 J	9.1 J	
Lead	mg/Kg	7.7	4 J	5 J	3.4 J	48	53	15	10	
Mercury	mg/Kg	0.024 U	0.026 U	0.026 U	0.025 U	0.047	0.071	0.03 J	0.018 J	
Total Organic Carbon	mg/Kg					36000 J	23400 J	17400 J	2760 J	
TPH	mg/Kg									
C11-C22 Aromatic	mg/Kg	54 U	55 U	57 U	55 U			73 U		57 U
C19-C36 Aliphatic	mg/Kg	54 U	55 U	57 U	55 U			73 U		58 EB
C9-C10 Aromatic	mg/Kg	0.5 U	0.51 U	0.57 U	1.7			1 UJ		0.32 U
C9-C12 Aliphatic	mg/Kg	0.5 U	0.51 U	0.57 U	1.4			1 U		0.32 U

ALL SOILS 0-15 FT BGS (continued)

Parameter	Norm Units	BRSWSS10 0-3	BRSWSS11 0-3	BRSWSS12 0-3	BRWSB02 6-8	BRWSB03 4-6	BRWSB04 6-8	BRWSB06 4-6	BRWSWB0 1 6-8	RISK BRSWSB07 0-3	RISK BRWSB05 4-6
1,2,4,-Trimethylbenzene	mg/Kg				0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U		0.0059 U
1,3,5-Trimethylbenzene	mg/Kg				0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U		0.0059 U
4-isopropyltoluene	mg/Kg				0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U		0.0059 U
Acetone	mg/Kg				0.05	0.2 J	0.021 J	0.024 UJ	0.045		0.032 J
Ethylbenzene	mg/Kg	0.032 U	0.041 U	0.034 U	0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U	0.0415 U	0.0059 U
Isopropylbenzene	mg/Kg				0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U		0.0059 U
m,p-Xylene	mg/Kg	0.032 U	0.041 U	0.034 U	0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U	0.0415 U	0.0059 U
Methylene Chloride	mg/Kg				0.015 J	0.025 J	0.017 J	0.014 J	0.027 U		0.0295 U
n-Propylbenzene	mg/Kg				0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U		0.0059 U
o-Xylene	mg/Kg	0.032 U	0.041 U	0.034 U	0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U	0.0415 U	0.0059 U
sec-Butylbenzene	mg/Kg				0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U		0.0059 U
Toluene	mg/Kg	0.032 U	0.041 U	0.034 U	0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U	0.021 J	0.0059 U
Benzo(a)anthracene	mg/Kg	0.27 U	0.27 U	0.27 U	0.27 U	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Benzo(a)pyrene	mg/Kg	0.27 U	0.27 U	0.27 U	0.27 U	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Benzo(b)fluoranthene	mg/Kg	0.27 U	0.27 U	0.27 U	0.27 U	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Benzo(g,h,i)perylene	mg/Kg	0.27 U	0.27 U	0.27 U	0.27 U	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Chrysene	mg/Kg	0.27 U	0.27 U	0.27 U	0.27 U	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Dibenzofuran	mg/Kg				0.27 U	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Fluoranthene	mg/Kg	0.27 U	0.27 U	0.16 J	0.069 J	0.3 U	0.27 U	0.28 U	0.28 U		0.28 U
Fluorene	mg/Kg	0.27 U	0.27 U	0.27 U	0.061 J	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Indeno(1,2,3-cd)pyrene	mg/Kg	0.27 U	0.27 U	0.27 U	0.27 U	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Naphthalene	mg/Kg	0.032 U	0.041 U	0.034 U	0.0047 U	0.0074 U	0.005 U	0.0049 U	0.0055 U	0.0415 U	0.0059 U
Phenanthrene	mg/Kg	0.27 U	0.27 U	0.27 U	0.07 J	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Pyrene	mg/Kg	0.27 U	0.27 U	0.14 J	0.072 J	0.3 U	0.27 U	0.28 U	0.28 U	0.265 U	0.27 U
Antimony	mg/Kg				5.4 U	6.1 U	5.3 U	5.4 U	5.7 U		5.4 U
Arsenic	mg/Kg				6.8 U	7.6 U	0.9 J	1.2 J	1.4 J		2.325 J
Barium	mg/Kg				14 J	18 J	12 J	16 J	7.1 J		15.5 J
Cadmium	mg/Kg				0.68 U	0.76 U	0.66 U	0.68 U	0.71 U		0.68 U
Chromium	mg/Kg				8.1 J	12 J	7.6 J	9.3 J	3.4 J		7.55 J
Lead	mg/Kg				3.2 J	4.3 J	3.2 J	4.4 J	2.8 J		3.7 J
Mercury	mg/Kg				0.026 U	0.029 U	0.025 U	0.027 U	0.026 U		0.0245 U
Total Organic Carbon	mg/Kg										
TPH	mg/Kg										
C11-C22 Aromatic	mg/Kg	53 U	54 U	55 U	56 U					45.5	54 U
C19-C36 Aliphatic	mg/Kg	53 U	54 U	55 U	56 U					56.5 EB	54 U
C9-C10 Aromatic	mg/Kg	0.39 U	0.52 U	0.42 U	0.66 U					0.52 U	0.6 U
C9-C12 Aliphatic	mg/Kg	0.39 U	0.52 U	0.42 U	0.66 U					0.52 U	0.6 U

GROUNDWATER

Parameter	Norm Units	Matrix	#Hit	#Samp	MinSQL	MaxSQL	MinHit	MaxHit	Avg	B10 10/28/92	B11 10/27/92	B4 10/28/92	B5B 10/29/92
1,2,4-Trimethylbenzene	mg/L	GW	2	15	0.002	0.002	0.000635	0.001	0.000976	0.002 U	0.002 U	0.002 U	0.001 J
1,3,5-Trimethylbenzene	mg/L	GW	1	15	0.002	0.002	0.0006	0.0006	0.000973	0.002 U	0.002 U	0.002 U	0.0006 J
4-isopropyltoluene	mg/L	GW	1	11	0.002	0.002	0.00092	0.00092	0.000993				
Isopropylbenzene	mg/L	GW	1	15	0.002	0.002	0.0003	0.0003	0.000953	0.002 U	0.002 U	0.002 U	0.0003 J
m,p-Xylene	mg/L	GW	1	15	0.002	0.002	0.0007	0.0007	0.00098	0.002 U	0.002 U	0.002 U	0.0007 J
Methyl tert-butyl ether (MTBE)	mg/L	GW	1	11	0.002	0.002	0.00375	0.00375	0.00125				
n-Propylbenzene	mg/L	GW	1	11	0.002	0.002	0.00054	0.00054	0.000958				
sec-Butylbenzene	mg/L	GW	2	15	0.002	0.002	0.0006	0.00835	0.001463	0.002 U	0.002 U	0.002 U	0.0006 J
Toluene	mg/L	GW	10	15	0.002	0.002	0.00054	0.00705	0.002342	0.002 U	0.002 U	0.002 U	0.001 J
bis(2-ethylhexyl) phthalate	mg/L	GW	2	15	0.01	0.01	0.0018	0.0046	0.00476	0.01 U	0.01 U	0.01 U	0.01 U
Naphthalene	mg/L	GW	1	15	0.002	0.002	0.003	0.003	0.001133	0.002 U	0.002 U	0.002 U	0.003
Phenol	mg/L	GW	7	15	0.01	0.01	0.0018	0.0385	0.007987	0.01 U	0.01 U	0.01 U	0.01 U
Chromium	mg/L	GW	1	1			0.0025	0.0025	0.0025				
Barium, dissolved	mg/L	GW	8	14	0.01	0.29	0.01	0.34	0.140964	0.01	0.01 U	0.04	0.036
Chromium, dissolved	mg/L	GW	3	14	0.001	0.01	0.0025	0.0036	0.003279	0.001 U	0.001 U	0.001 U	0.001 U
Lead, dissolved	mg/L	GW	3	14	0.001	0.025	0.003	0.006	0.009107	0.001 U	0.003	0.001 U	0.005
Mercury, dissolved	mg/L	GW	1	14	0.0002	0.0005	0.0002	0.0002	0.000118	0.0002	0.0002 U	0.0002 U	0.0002 U
Thallium, dissolved	mg/L	GW	1	4	0.001	0.001	0.002	0.002	0.000875	0.001 U	0.002	0.001 U	0.001 U
Zinc, dissolved	mg/L	GW	3	4	0.01	0.01	0.01	0.018	0.01075	0.01	0.01	0.01 U	0.018
Ammonia	mg/L	GW	2	4	0.05	0.05	0.06	0.11	0.055	0.11	0.05 U	0.06	0.05 U
Ca-Mg Hardness	mg/L	GW	5	11	33	210	41	210	76.20455				
Nitrate-Nitrite-N	mg/L	GW	3	4	0.05	0.05	0.08	0.52	0.23625	0.08	0.52	0.32	0.05 U
C11-C22 Aromatic	mg/L	GW	1	2	0.1	0.1	0.355	0.355	0.2025				
C19-C36 Aliphatic	mg/L	GW	2	2			0.1	0.145	0.1225				
C9-C18 Aliphatic	mg/L	GW	1	2	0.1	0.1	0.535	0.535	0.2925				
C9-C10 Aromatic	mg/L	GW	1	2	0.025	0.025	0.053	0.053	0.03275				
C9-C12 Aliphatic	mg/L	GW	1	2	0.025	0.025	0.141	0.141	0.07675				

GROUNDWATER (continued)

Parameter	Norm Units	BRSWGW01	BRSWGW02	BRSWGW03	BRSWGW06	BRSWGW07D	BRSWGW08	BRSWGW13	BRSWGW14
1,2,4-Trimethylbenzene	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
1,3,5-Trimethylbenzene	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
4-isopropyltoluene	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Isopropylbenzene	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
m,p-Xylene	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Methyl tert-butyl ether (MTBE)	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
n-Propylbenzene	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
sec-Butylbenzene	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Toluene	mg/L	0.002 U	0.002 U	0.00054 J	0.0038	0.0013 J	0.0047	0.00094 J	0.0027
bis(2-ethylhexyl) phthalate	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0018 J	0.01 U	0.01 U	0.01 U
Naphthalene	mg/L	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Phenol	mg/L	0.0021 J	0.0018 J	0.0045 J	0.0068 J	0.01 UJ	0.01 UJ	0.0096 J	0.01 U
Chromium	mg/L	0.0025 J							
Barium, dissolved	mg/L		0.34	0.29 J	0.19 J	0.26 J	0.23 J	0.2 U	0.29 UJ
Chromium, dissolved	mg/L		0.0025 J	0.01 U	0.01 U	0.01 U	0.01 U	0.0036 J	0.01 U
Lead, dissolved	mg/L		0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.006 J	0.025 U
Mercury, dissolved	mg/L		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Thallium, dissolved	mg/L								
Zinc, dissolved	mg/L								
Ammonia	mg/L								
Ca-Mg Hardness	mg/L	210	41	77	160	33 U	53	210 U	93 U
Nitrate-Nitrite-N	mg/L								
C11-C22 Aromatic	mg/L							0.1 UJ	
C19-C36 Aliphatic	mg/L							0.1 J	
C9-C18 Aliphatic	mg/L							0.1 UJ	
C9-C10 Aromatic	mg/L							0.025 U	
C9-C12 Aliphatic	mg/L							0.025 U	

GROUNDWATER (continued)

Parameter	Norm Units	BRSWGW15	BRSWGW12	BRSWGW05A
1,2,4-Trimethylbenzene	mg/L	0.002 U	0.002 U	0.000635 J
1,3,5-Trimethylbenzene	mg/L	0.002 U	0.002 U	0.002 U
4-isopropyltoluene	mg/L	0.002 U	0.002 U	0.00092 J
Isopropylbenzene	mg/L	0.002 U	0.002 U	0.002 U
m,p-Xylene	mg/L	0.002 U	0.002 U	0.002 U
Methyl tert-butyl ether (MTBE)	mg/L	0.002 U	0.00375	0.002 U
n-Propylbenzene	mg/L	0.002 U	0.002 U	0.00054 J
sec-Butylbenzene	mg/L	0.002 U	0.002 U	0.00835 J
Toluene	mg/L	0.0038	0.00705	0.0043
bis(2-ethylhexyl) phthalate	mg/L	0.01 U	0.01 U	0.0046 J
Naphthalene	mg/L	0.002 U	0.002 UJ	0.002 U
Phenol	mg/L	0.01 U	0.0165 J	0.0385 J
Chromium	mg/L			
Barium, dissolved	mg/L	0.2 UJ	0.255 UJ	0.2 U
Chromium, dissolved	mg/L	0.0028 J	0.01 U	0.01 U
Lead, dissolved	mg/L	0.025 U	0.025 U	0.025 U
Mercury, dissolved	mg/L	0.0002 U	0.0002 U	0.0005 U
Thallium, dissolved	mg/L			
Zinc, dissolved	mg/L			
Ammonia	mg/L			
Ca-Mg Hardness	mg/L	33 U	70.5 U	155 U
Nitrate-Nitrite-N	mg/L			
C11-C22 Aromatic	mg/L			0.355 J
C19-C36 Aliphatic	mg/L			0.145 J
C9-C18 Aliphatic	mg/L			0.535 J
C9-C10 Aromatic	mg/L			0.053 J
C9-C12 Aliphatic	mg/L			0.141 J

SURFACE WATER

Parameter	Norm Units	Medium	#Hit		#Samp	MinSQL		MaxSQL	MinHit		MaxHit	Avg	BRSWSW01
Carbon disulfide	mg/L	SW	1	/	4	0.002	:	0.002	0.00081	-	0.00081	0.000953	0.002 U
bis(2-ethylhexyl) phthalate	mg/L	SW	2	/	6	0.01	:	10	0.0013	-	4	1.502883	0.01 U
Antimony	mg/L	SW	4	/	6	0.005	:	0.005	0.0025	-	0.013	0.0043	0.005 U
Arsenic	mg/L	SW	1	/	6	0.005	:	0.025	0.01	-	0.01	0.010417	0.025 U
Barium	mg/L	SW	4	/	6	0.2	:	0.2	0.04	-	0.15	0.0825	0.2 U
Cadmium	mg/L	SW	2	/	6	0.0005	:	0.0025	0.00225	-	0.028	0.005375	0.0005 UJ
Chromium	mg/L	SW	3	/	6	0.001	:	0.01	0.0027	-	0.061	0.012933	0.01 U
Copper	mg/L	SW	2	/	2		:		0.02	-	0.33	0.175	
Lead	mg/L	SW	4	/	6	0.005	:	0.005	0.005	-	0.43	0.079167	0.005 U
Mercury	mg/L	SW	2	/	6	0.0002	:	0.0002	0.0002	-	0.0003	0.00015	0.0002 U
Nickel	mg/L	SW	1	/	2	0.05	:	0.05	0.05	-	0.05	0.0375	
Selenium	mg/L	SW	1	/	6	0.001	:	0.04	0.0091	-	0.0091	0.011683	0.0091 J
Zinc	mg/L	SW	2	/	2		:		0.16	-	0.56	0.36	
Ammonia	mg/L	SW	2	/	2		:		0.14	-	1.2	0.67	
Ca-Mg Hardness	mg/L	SW	4	/	4		:		35	-	75.5	46.625	35
Chloride	mg/L	SW	2	/	2		:		4	-	22	13	
Nitrate-Nitrite-N	mg/L	SW	2	/	2		:		0.37	-	1.9	1.135	
Sulfate	mg/L	SW	2	/	2		:		7.4	-	8.5	7.95	
C11-C22 Aromatic	mg/L	SW	1	/	1		:		0.115	-	0.115	0.115	
C19-C36 Aliphatic	mg/L	SW	1	/	1		:		0.25	-	0.25	0.25	

SURFACE WATER **(continued)**

Parameter	Units	BRSWSW02	BRSWSW03	BRSWSW04	BSS1	BSS2
Carbon disulfide	mg/L	0.00081 J	0.002 U	0.002 U		
bis(2-ethylhexyl) phthalate	mg/L	0.012 U	0.0013 J	0.01 U	0.004 JB	0.01 U
Antimony	mg/L	0.0025 J	0.0025 J	0.0028 J	0.005 U	0.013
Arsenic	mg/L	0.025 U	0.025 U	0.025 U	0.005 U	0.01
Barium	mg/L	0.06 J	0.2 U	0.045 J	0.04	0.15
Cadmium	mg/L	0.0025 UJ	0.0005 UJ	0.0005 U	0.028	0.00225 J
Chromium	mg/L	0.0034 J	0.0027 J	0.01 U	0.001 U	0.061
Copper	mg/L				0.02	0.33
Lead	mg/L	0.005 U	0.026	0.005	0.009	0.43
Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0003	0.0002
Nickel	mg/L				0.05 U	0.05
Selenium	mg/L	0.04 U	0.04 U	0.04 U	0.001 U	0.001 U
Zinc	mg/L				0.16	0.56
Ammonia	mg/L				1.2	0.14
Ca-Mg Hardness	mg/L	39	75.5	37		
Chloride	mg/L				22	4
Nitrate-Nitrite-N	mg/L				0.37	1.9
Sulfate	mg/L				7.4	8.5
C11-C22 Aromatic	mg/L		0.115 J			
C19-C36 Aliphatic	mg/L		0.25 J			

SEDIMENT

Parameter	Norm. Units	Medium	#Hit		#Samp	MinSQL		MaxSQL	MinHit		MaxHit	Avg.	BRSWSD01	BRSWSD02
Acetone	mg/Kg	SD	2	/	4	0.028	:	0.028	0.018	-	0.089	0.03025	0.018 J	0.028 U
Benzo(a)anthracene	mg/Kg	SD	2	/	4	0.3	:	0.45	0.088	-	0.19	0.16325	0.19 J	0.3 U
Benzo(a)pyrene	mg/Kg	SD	3	/	4	0.3	:	0.3	0.099	-	0.27	0.15525	0.27 J	0.3 U
Benzo(b)fluoranthene	mg/Kg	SD	4	/	4		:		0.089	-	0.43	0.21075	0.43	0.089 J
Benzo(g,h,i)perylene	mg/Kg	SD	3	/	4	0.3	:	0.3	0.086	-	0.26	0.1515	0.26 J	0.3 U
Benzo(k)fluoranthene	mg/Kg	SD	2	/	4	0.3	:	0.45	0.115	-	0.12	0.1525	0.12 J	0.3 U
bis(2-ethylhexyl) phthalate	mg/Kg	SD	2	/	4	0.3	:	0.45	0.25	-	0.48	0.27625	0.25 J	0.3 U
Chrysene	mg/Kg	SD	4	/	4		:		0.06	-	0.31	0.173	0.31	0.06 J
Fluoranthene	mg/Kg	SD	4	/	4		:		0.06	-	0.57	0.2425	0.57	0.06 J
Indeno(1,2,3-cd)pyrene	mg/Kg	SD	3	/	4	0.3	:	0.3	0.076	-	0.28	0.154	0.28	0.3 U
Phenanthrene	mg/Kg	SD	2	/	4	0.3	:	0.45	0.13	-	0.26	0.19125	0.26 J	0.3 U
Pyrene	mg/Kg	SD	3	/	4	0.3	:	0.3	0.18	-	0.48	0.2525	0.48	0.3 U
Antimony	mg/Kg	SD	4	/	4		:		0.55	-	5.3	1.88	0.55 J	0.57 J
Arsenic	mg/Kg	SD	5	/	6	7.4	:	7.4	1.5	-	11	5.533333	2.3 J	7.4 U
Barium	mg/Kg	SD	6	/	6		:		13	-	120	46	13 J	15 J
Cadmium	mg/Kg	SD	4	/	6	0.25	:	0.74	0.22	-	20	4.210833	0.22 J	0.74 U
Chromium	mg/Kg	SD	6	/	6		:		7.8	-	65	23.38333	11	7.8
Lead	mg/Kg	SD	6	/	6		:		7.2	-	390	112.45	24	7.2 J
Mercury	mg/Kg	SD	3	/	6	0.025	:	0.1	0.016	-	0.13	0.04625	0.025 U	0.016 J
Silver	mg/Kg	SD	1	/	6	0.5	:	2.15	3.1	-	3.1	1.104167	1.8 U	2.1 U
Total Organic Carbon	mg/Kg	SD	4	/	4		:		4380	-	36400	13943.75	8460 J	4380 J
TPH	mg/Kg	SD	2	/	2		:		82	-	200	141		
C19-C36 Aliphatic	mg/Kg	SD	1	/	1		:		370	-	370	370		

SEDIMENT **(continued)**

Parameter	Norm. Units	BRSWSD02	BRSWSD03	BRSWSD04	BSC1	BSC2
Acetone	mg/Kg	0.028 U	J	0.089 J		
Benzo(a)anthracene	mg/Kg	0.3 U	0.088 J	0.45 U		
Benzo(a)pyrene	mg/Kg	0.3 U	0.102 J	0.099 J		
Benzo(b)fluoranthene	mg/Kg	0.089 J	0.114 J	0.21 J		
Benzo(g,h,i)perylene	mg/Kg	0.3 U	0.086 J	0.11 J		
Benzo(k)fluoranthene	mg/Kg	0.3 U	0.115 J	0.45 U		
bis(2-ethylhexyl) phthalate	mg/Kg	0.3 U	0.48	0.45 U		
Chrysene	mg/Kg	0.06 J	0.162 J	0.16 J		
Fluoranthene	mg/Kg	0.06 J	0.15 J	0.19 J		
Indeno(1,2,3-cd)pyrene	mg/Kg	0.3 U	0.076 J	0.11 J		
Phenanthrene	mg/Kg	0.3 U	0.13 J	0.45 U		
Pyrene	mg/Kg	0.3 U	0.2 J	0.18 J		
Antimony	mg/Kg	0.57 J	5.3	1.1 J		
Arsenic	mg/Kg	7.4 U	7.2 J	7.5 J	1.5	11
Barium	mg/Kg	15 J	29 J	84	15	120
Cadmium	mg/Kg	0.74 U	3.15	1.4	0.25 U	20
Chromium	mg/Kg	7.8	28.5	18	10	65
Lead	mg/Kg	7.2 J	56.5	170	27	390
Mercury	mg/Kg	0.016 J	0.019 J	0.13	0.1 U	0.1 U
Silver	mg/Kg	2.1 U	2.15 U	3.1 J	0.5 U	0.5 U
Total Organic Carbon	mg/Kg	4380 J	6535 J	36400 J		
TPH	mg/Kg				82	200
C19-C36 Aliphatic	mg/Kg		370 J			

APPENDIX N

HUMAN HEALTH DOSE-RESPONSE DATA AND RELATIVE ABSORPTION FACTORS

ABLE 1
ORAL DOSE-RESPONSE DATA
FOR CARCINOGENIC EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Compound	Chemical Group	Weight of Evidence	Oral Slope Factor (mg/kg/day)		Test Species	Study Type	Tumor Type	Source
ACID EXTRACTABLE COMPOUNDS								
Phenol	A	D						IRIS
BASE NEUTRAL COMPOUNDS								
Benzo(a)anthracene	B	B2	7.3E-01	**				NCEA
Benzo(a)pyrene	B	B2	7.3E+00		Mouse	Oral-diet	Forestomach	IRIS
Benzo(b)fluoranthene	B	B2	7.3E-01	**				NCEA
Benzo(g,h,i)perylene	B	D						IRIS
Benzo(k)fluoranthene	B	B2	7.3E-02	**				NCEA
Bis (2-ethylhexyl) phthalate (BEHP)	B	B2	1.4E-02		Mouse	Oral-diet	Liver	IRIS
Chrysene	B	B2	7.3E-03	**				NCEA
Fluoranthene	B	D						IRIS
Indeno(1,2,3-cd)pyrene	B	B2	7.3E-01	**				NCEA
Naphthalene	B, V	C						IRIS
Phenanthrene	B	D						IRIS
Pyrene	B	D						IRIS
INORGANICS/METALS								
Antimony	I/M	ND						
Arsenic	I/M	A	1.5E+00		Human	Oral-DW	Skin	IRIS
Barium	I/M	ND						
Cadmium (food)	I/M	B1						
Cadmium (water)	I/M	B1	ND					IRIS
Chromium III	I/M	ND						
Chromium VI	I/M	ND						
Copper	I/M	D						IRIS
Lead	I/M	B2	ND					IRIS
Mercury-Inorganic (as mercuric chloride)	I/M	C	ND					IRIS
Mercury-Organic (as methyl mercury)	I/M	C	ND					IRIS
Nickel	I/M	ND						
Nitrate	I/M	ND						
Nitrite	I/M	ND						
Nitrogen, ammonia	I/M	ND						
Selenium	I/M	D						IRIS
Silver	I/M	D						IRIS
Thallium (based on thallium sulfate)	I/M	D						IRIS
Zinc	I/M	D						IRIS
VOLATILES								
1,2,4-Trimethylbenzene	V	ND						
1,3,5-Trimethylbenzene	V	ND						
Acetone	V	D						IRIS
Butylbenzene, sec-	V	ND						
Carbon Disulfide	V	ND						
Ethylbenzene	V	D						IRIS
Isopropylbenzene	V	ND						
Isopropyltoluene	V	ND						
Methylene Chloride (Dichloromethane)	V	B2	7.5E-03		Mouse	Oral-DW	Liver	IRIS
Methyl-tert-butyl ether	V	ND						IRIS

BLE 1
ORAL DOSE-RESPONSE DATA
FOR CARCINOGENIC EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Compound	Chemical Group	Weight of Evidence	Oral Slope Factor (mg/kg/day)	Test Species	Study Type	Tumor Type	Source
Propylbenzene	V	ND					
Toluene	V	D					IRIS
Xylenes (total)	V	D					IRIS
TPH							
EPH							
C9-C18 Aliphatics	B	D					MADEP
C19-C36 Aliphatics	B	D					MADEP
C10-C22 Aromatics	B	D					MADEP
VPH							
C5-C8 Aliphatics	V	D					MADEP
C9-C12 Aliphatics	V	D					MADEP
C9-C10 Aromatics	V	D					MADEP

NOTES:
ND - Not determined/No data
DW - Drinking water
mg - milligram
kg - kilogram
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
MADEP - Massachusetts Department of Environmental Protection
"Background Documentation for the Development of the MCP Numerical Standards" April, 1994
CA EPA - California Environmental Protection Agency
"California Environmental Protection Agency Criteria for Carcinogens" November, 1994
NCEA - National Center for Environmental Assessment

+ - Based on IRIS for 2,4-; 2,6-Dinitrotoluene mixture.
*- The value for chlordane is used as surrogate for the isomers.
** - Slope Factor for Benzo(a)Pyrene used for other carcinogenic PAHs, adjusted by Relative Potency Factors of 1.0 [benzo(a)pyrene, dibenz(a,h)anthracene]; 0.1 [benzo(a)anthracene, benzo(b)flouoranthene, indeno(1,2,3-c,d)pyrene]; 0.01 [benzo(k)fluoranthene]; 0.001 [chrysene].
*** - Slope factors are applicable to Aroclors 1016, 1248, 1254, and 1260.

Weight of Evidence (Route-Specific):
A - Human carcinogen
B - Probable human carcinogen
  B1 - limited evidence of cancer in humans
  B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans
C - Possible human carcinogen
D - Not classifiable as to human carcinogenicity
E - Evidence of lack of carcinogenicity to humans

Sources (in order used, per MADEP, 1995):
IRIS as of 11/98
HEAST, 1997
CA EPA, 1994
MADEP, 1994
NCEA, date varies

Chemical Groups:
A - Acid extractable
B - Base neutral extractable
I/M - Inorganic/Metal
P - Pesticide
V - Volatile
W - Waste

W1 = Value was withdrawn from HEAST in FY 1992 update
W2 = Value of 1.1E-02 was withdrawn from HEAST in FY 1992 update
W3 = Value was withdrawn from IRIS 4/98.

N1 = An NCEA provisional regional support value of 2.9E-03 has been published in Region III RBC Table MADEP does not recommend the use of this value
N2 = An NCEA provisional regional support value of 5.2E-02 has been published in Region III RBC Table. MADEP does not recommend the use of this value
N3 = An NCEA provisional regional support value of 7.6E-03 has been published in Region III RBC Table. MADEP does not recommend the use of this value
USEPA Region III Risk Based Concentrations, April 12, 1999.

TABLE 2
ORAL DOSE-RESPONSE DATA
FOR NONCARCINOGENIC EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Compound	CHEMICAL SOURCE	CHRONIC ORAL RfD (mg/kg-day)		SUBCHRONIC ORAL RfD(1) (mg/kg-day)		STUDY TYPE	CONFIDENCE LEVEL	CRITICAL EFFECT	TEST ANIMAL	UNCERTAINTY FACTOR	SOURCE
ACID EXTRACTABLE COMPOUNDS											
Phenol	A	6.0E-01		6.0E-01		Oral-gavage	Low	Reduced fetal body weight	Rat	100 H,A	IRIS
BASE NEUTRAL COMPOUNDS											
Benzo(a)anthracene	B	3.0E-02	*	3.0E-01	*						IRIS
Benzo(a)pyrene	B	3.0E-02	*	3.0E-01	*						IRIS
Benzo(b)fluoranthene	B	3.0E-02	*	3.0E-01	*						IRIS
Benzo(g,h,i)perylene	B	3.0E-02	*	3.0E-01	*						IRIS
Benzo(k)fluoranthene	B	3.0E-02	*	3.0E-01	*						IRIS
Bis (2-ethylhexyl) phthalate (BEHP)	B	2.0E-02		2.0E-02	(W1)	Oral-diet	Medium	Increased liver weight	Guinea Pig	1000 H,A,S	IRIS, MADEP
Chrysene	B	3.0E-02	*	3.0E-01	*						IRIS
Fluoranthene	B	4.0E-02		4.0E-01		Oral-gavage	Medium	Increased liver weight	Mouse	3,000 H,A,S	IRIS
Indeno(1,2,3-cd)pyrene	B	3.0E-02	*	3.0E-01	*						IRIS
Naphthalene	B, V	2.0E-02		2.0E-02		Oral-gavage	Low	Decreased body weight	Rat	3000 H,A,S,D	IRIS
Phenanthrene	B	3.0E-02	*	3.0E-01	*						IRIS
Pyrene	B	3.0E-02		3.0E-01		Oral-gavage	Low	Renal tubular pathology	Mouse	3,000 H,A,S,D	IRIS
INORGANICS/METALS											
Antimony	I/M	4.0E-04		4.0E-04		Oral-DW	Low	Reduced lifespan	Rat	1000 H,A,L	IRIS
Arsenic	I/M	3.0E-04		3.0E-04		Oral-DW	Medium	Keratosis and hyperpigmentation	Human	3 H	IRIS
Barium	I/M	7.0E-02		7.0E-02		Oral-DW	Medium	Increased blood pressure	Human	3 H	IRIS
Cadmium (food)	I/M	1.0E-03		ND		Oral-diet	High	Proteinuria	Human	10 H	IRIS
Cadmium (water)	I/M	5.0E-04		ND		Oral-DW	High	Proteinuria	Human	10 H	IRIS
Chromium III	I/M	1.5E+00		1.5E+00		Oral-diet	Low	No effects observed	Rat	100 H,A; 10 M	IRIS
Chromium VI	I/M	3.0E-03		2.0E-02		Oral-DW	Low	No effects observed	Rat	300 H,A,S	IRIS
Copper	I/M	(H1)		ND							HEAST
Lead	I/M	7.5E-04		7.5E-04							MADEP
Mercury-Inorganic (as mercuric chloride)	I/M	3.0E-04		3.0E-03		Oral-diet	High	Autoimmune effects	Rat	1,000 H,A,S,L	IRIS
Mercury-Organic (as methyl mercury)	I/M	1.0E-04		1.0E-04		Oral-diet		Developmental effects	Human	10 H	IRIS
Nickel	I/M	2.0E-02		2.0E-02		Oral-diet	Medium	Decreased body and organ weights	Rat	300 H,A,D	IRIS
Nitrate	I/M	1.6E+00		ND		Oral-DW	High	Early clinical signs of methemoglobinemia	Human	1	IRIS
Nitrite	I/M	1.0E-01		1.0E-01		Oral-DW	High	Early clinical signs of methemoglobinemia	Human	1	IRIS
Nitrogen, ammonia	I/M	9.7E-01	***	9.7E-01	***	Oral-DW	ND	Organoleptic effects	Human	1	HEAST
Selenium	I/M	5.0E-03		5.0E-03		Oral-diet	High	Clinical selenosis	Human	3 H	IRIS
Silver	I/M	5.0E-03		5.0E-03		Intravenous	Low	Argyria	Human	3 H	IRIS
Thallium (based on thallium sulfate)	I/M	8.0E-05		8.0E-04		Oral-gavage	Low	No effects observed	Rat	3000 H,A,S,D	IRIS
Zinc	I/M	3.0E-01		3.0E-01		Oral-diet	Medium	Decreased ESOD activity	Human	3 H	IRIS
VOLATILES											
1,2,4-Trimethylbenzene	V	5.0E-02	(N1)	ND							NCEA
1,3,5-Trimethylbenzene	V	5.0E-02	(N1)	ND							NCEA
Acetone	V	1.0E-01		1.0E+00		Oral-gavage	Low	Increased liver and kidney weights	Rat	1,000 H,A,S	IRIS
Butylbenzene, sec-	V	1.0E-02	(N1)	ND							NCEA
Carbon Disulfide	V	1.0E-01		1.0E-01		Inhalation	Medium	Fetal toxicity/teratogenicity	Rabbit	100 H,A	IRIS
Ethylbenzene	V	1.0E-01		1.0E+00	(W1)	Oral-gavage	Low	Liver and kidney toxicity	Rat	1,000 H,A,S	IRIS, MADEP
Isopropylbenzene	V	1.0E-01		ND		Oral-gavage	Low	Increased kidney weight	Rat	1000 H,A,S	IRIS
Isopropyltoluene	V	1.0E-01	@	ND							IRIS
Methylene Chloride (Dichloromethane)	V	6.0E-02		6.0E-02		Oral-DW	Medium	Liver toxicity	Rat	100 H,A	IRIS
Methyl-tert-butyl ether (MTBE)	V	ND		ND							NCEA
Propylbenzene	V	1.0E-01	@	ND							IRIS
Toluene	V	2.0E-01		2.0E+00		Oral-gavage	Medium	Weight change in liver and kidneys	Rat	1,000 H,A,S	IRIS
Xylenes (total)	V	2.0E+00		4.0E+00	(W1)	Oral-gavage	Medium	Hyperactivity, decreased body weight	Rat	100 H,A	IRIS, MADEP

BLE 2
ORAL DOSE-RESPONSE DATA
FOR NONCARCINOGENIC EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

Compound	CHEMICAL SOURCE	CHRONIC ORAL RfD (mg/kg-day)		SUBCHRONIC ORAL RfD(1) (mg/kg-day)		STUDY TYPE	CONFIDENCE LEVEL	CRITICAL EFFECT	TEST ANIMAL	UNCERTAINTY FACTOR	SOURCE
TPH											
EPH											
C9-C18 Aliphatics	B	6.0E-01	@@@	6.0E+00	@@@	ND		ND			MADEP (2)
C19-C36 Aliphatics	B	6.0E+00	@@@	6.0E+01	@@@	ND		ND			MADEP (2)
C10-C22 Aromatics	B	3.0E-02	*	3.0E-01	*	ND		ND			IRIS, MADEP (2)
VPH											
C5-C8 Aliphatics	V	6.0E-02	@@	6.0E-01	@@	ND		ND			HEAST, MADEP (2)
C9-C12 Aliphatics	V	6.0E-01	@@@	6.0E+00	@@@	ND		ND			MADEP (2)
C9-C10 Aromatics	V	3.0E-02	*	3.0E-01	*	ND		ND			IRIS, MADEP (2)

NOTES:
ND - No data available
W - RfD withdrawn from IRIS/HEAST
mg - milligram
kg - kilogram
DW - Drinking Water
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
USEPA - United States Environmental Protection Agency (Office of Water; "Drinking Water Regulations and Health Advisories"; October, 1996))
NCEA - National Center for Environmental Assessment (formerly ECAO)
ATSDR - Agency for Toxic Substances Disease Registry (Toxicological Profiles; chemical-specific)
MADEP - Massachusetts Department of Environmental Protection
"Background Documentation for the Development of the MCP Numerical Standards" April, 1994
MADEP(2) - "Interim Final Petroleum Report: Development of Health-Based Alternative to the Total Petroleum Hydrocarbon (TPH) Parameter (1994)" and Revisions to the MCP - 10/31/97.

[1] - Source for all subchronic RfDs is HEAST (1997) if chronic RfD is from IRIS or HEAST (1997), *unless otherwise indicated.*
* RfD for pyene is used as surrogate for PAHs without assigned RfD
This value was also used for the aromatics EPH and VPH fractions, per MADEP 1997
** RfD for DDT is used as surrogate
*** RfD for Aroclor 1254 used as surrogate
**** RfD for naphthalene used as surrogate
~ RfD for Endosulfan used as a surrogate
~~ RfD for Endrin used as a surrogate
~~~ RfD for chloromethane used as a surrogate
! RfD for manganese in food divided by modifying factor of 3, as recommended in IRIS
!! RfD for manganese in food divided by modifying factor of 3, as recommended in IRIS
+ RfD for 2,4-dinitrophenol used as a surrogate
++ RfD for 1,2,4-Trichlorobenzene used as a surrogate
^ RfD for 2-nitroaniline used as a surrogate
^^ RfD for bis(2-chloroisopropyl)ether used as a surrogate
^^^ RfD for 2-chlorophenol used as a surrogate
` Value for chlordane used for alpha- and gamma- isomers
`` Value is the proposed MCL (500mg/L), converted to a dose (2 L/day x 500 mg/L / 70 Kg)
``` Value is the drinking water value (34 mg/L), converted to a dose (2L/day x 500 mg/L / 70 Kg): not a health-based value
@ Value for isopropylbenzene used as a surrogate
@@ Value for n-hexane used as surrogate, per MADEP, 1997
*@@@ Value based on n-hexane, per MADEP, 1997*

Uncertainty factors:
H - variation in human sensitivity
A - animal to human extrapolation
S - extrapolation from subchronic to chronic NOAEL
L - extrapolation from LOAEL to NOAEL
N - NOEL not attained
D - Lack of supporting data
*M - additional modifying factor*

SOURCES (in order used, per MADEP, 1995):
IRIS as of 11/98; chronic RfDs
HEAST, FY 1997; chronic and subchronic RfDs
MADEP, 1994; MADEP (2); RfDs
ATSDR (chemical-specific); Minimum Risk Levels (MRLs)
USEPA; RfDs
NCEA; RfDs

Chemical Group:
A - Acid extractable
B - Base neutral extractable
I/M - Inorganic/Metal
P - Pesticide
V - Volatile
W - Waste
X - Other

W1 = Value was withdrawn from HEAST in FY 1993 update.
W2 = Value was withdrawn from HEAST in FY 1994 supplement #1 update.
W3 = Value was withdrawn from HEAST in FY 1992 supplement #2 update.
W4 = Value was withdrawn from HEAST in FY 1997 update.

N1 = An NCEA provisional regional support value has been published in Region III RBC Table.
N2 = An NCEA provisional regional support value of 9E-04 has been published in Region III RBC Table. MADEP does not recommend the use of this vallue.
N3 = An NCEA provisional regional support value of 3E-02 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
N5 = An NCEA provisional regional support value of 1E+00 has been published in Region III RBC Table; not a health-based value.
N6 = An NCEA provisional regional support value of 3E-01 has been published in Region III RBC Table; not a health-based value.
N7 = An NCEA provisional regional support value of 2E-02 has been published in Region III RBC Table; MADEP does not recommend the use of this value.
N8 = An NCEA provisional regional support value of 3E-02 has been published in Region III RBC Table
N9 = An NCEA provisional regional support value of 3E-03 has been published in Region III RBC Table
N10 = An NCEA provisional regional support value of 6E-03 has been published in Region III RBC Table; MADEP does not recommend the use of this value.
*USEPA Region III Risk Based Concentrations, April 12, 1999.*
H1 =Value is the drinking water value (1.3 mg/L) converted to a dose (2Lday/ x 1.3 mg/L / 70 Kg); not a health-based value.
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INHALATION DOSE-RESPONSE DATA
FOR CARCINOGENI EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

| Compound | Chemical Group | Weight of Evidence | Inhalation Slope Factor* (mg/kg/day)-1 | | Unit Risk (µg/m3)-1 | | Test Species | Study Type | Tumor Type | Source |
|---|---|---|---|---|---|---|---|---|---|---|
| ACID EXTRACTABLE COMPOUNDS | | | | | | | | | | |
| Phenol | A | D | | | | | | | | IRIS |
| BASE NEUTRAL COMPOUNDS | | | | | | | | | | |
| Benzo(a)anthracene | B | B2 | 3.9E-01 | ** | 1.1E-04 | ** | | | | CA EPA |
| Benzo(a)pyrene | B | B2 | 3.9E+00 | (N2)(W2) | 1.1E-03 | | Hamster | Inhalation | Respiratory tract | CA EPA |
| Benzo(b)fluoranthene | B | B2 | 3.9E-01 | ** | 1.1E-04 | ** | | | | CA EPA |
| Benzo(g,h,i)perylene | B | D | | | | | | | | IRIS |
| Benzo(k)fluoranthene | B | B2 | 3.9E-02 | ** | 1.1E-05 | ** | Hamster | Inhalation | Respiratory tract | CA EPA |
| Bis (2-ethylhexyl) phthalate (BEHP) | B | B2 | 8.4E-03 | (N3) | 2.4E-06 | | Mouse | Oral-diet | Liver | CA EPA |
| Chrysene | B | B2 | 3.9E-03 | ** | 1.1E-06 | ** | | | | CA EPA |
| Fluoranthene | B | D | | | | | | | | IRIS |
| Indeno(1,2,3-cd)pyrene | B | B2 | 3.9E-01 | ** | 1.1E-04 | ** | | | | CA EPA |
| Naphthalene | B, V | C | ND | | | | | | | IRIS |
| Phenanthrene | B | D | | | | | | | | IRIS |
| Pyrene | B | D | | | | | | | | IRIS |
| INORGANICS/METALS | | | | | | | | | | |
| Antimony | I/M | ND | | | | | | | | |
| Arsenic | I/M | A | 1.5E+01 | (W1) | 4.3E-03 | | Human | Inhalation | Lung | IRIS |
| Barium | I/M | ND | | | | | | | | |
| Cadmium (food) | I/M | B1 | 6.3E+00 | | | | | | | |
| Cadmium (water) | I/M | B1 | 6.3E+00 | c | 1.8E-03 | | Human | Inhalation | Lung | IRIS |
| Chromium III | I/M | ND | | | | | | | | |
| Chromium VI | I/M | A | 4.1E+01 | | 1.2E-02 | | Human | Inhalation | Lung | IRIS |
| Copper | I/M | D | | | | | | | | IRIS |
| Lead | I/M | B2 | ND | | ND | | | | | IRIS |
| Mercury-Inorganic (as mercuric chloride) | I/M | C | ND | | ND | | | | | IRIS |
| Mercury-Organic (as methyl mercury) | I/M | C | ND | | ND | | | | | |
| Nickel | I/M | A | 8.4E-01 | | 2.4E-04 | | Human | Inhalation | Lung | IRIS |
| Nitrate | I/M | ND | | | | | | | | |
| Nitrite | I/M | ND | | | | | | | | |
| Nitrogen, ammonia | I/M | ND | | | | | | | | |
| Selenium | I/M | D | | | | | | | | IRIS |
| Silver | I/M | D | | | | | | | | IRIS |
| Thallium (based on thallium sulfate) | I/M | D | | | | | | | | IRIS |
| Zinc | I/M | D | | | | | | | | IRIS |
| VOLATILES | | | | | | | | | | |
| 1,2,4-Trimethylbenzene | V | ND | | | | | | | | |
| 1,3,5-Trimethylbenzene | V | ND | | | | | | | | |
| Acetone | V | D | | | | | | | | IRIS |
| Butylbenzene, sec- | V | ND | | | | | | | | |
| Carbon Disulfide | V | ND | | | | | | | | |
| Ethylbenzene | V | D | | | | | | | | IRIS |
| Isopropylbenzene | V | ND | | | | | | | | |
| Isopropyltoluene | V | ND | | | | | | | | |
| Methylene chloride (Dichloromethane) | V | B2 | 1.7E-03 | c | 4.7E-07 | | Mouse | Inhalation | Liver | IRIS |
| Methyl-tert-butyl ether | V | ND | | | | | | | | IRIS |
| Propylbenzene | V | ND | | | | | | | | |

INHALATION DOSE-RESPONSE DATA
FOR CARCINOGENI EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

| Compound | Chemical Group | Weight of Evidence | Inhalation Slope Factor* (mg/kg/day)** | Unit Risk (µg/m³)*** | Test Species | Study Type | Tumor Type | Source |
|---|---|---|---|---|---|---|---|---|
| Toluene | V | D | | | | | | IRIS |
| Xylenes (total) | V | D | | | | | | IRIS |
| TPH | | | | | | | | |
| *EPH* | | | | | | | | |
| C9-C18 Aliphatics | B | D | | | | | | MADEP |
| C19-C36 Aliphatics | B | D | | | | | | MADEP |
| C10-C22 Aromatics | B | D | | | | | | MADEP |
| *VPH* | | | | | | | | |
| C5-C8 Aliphatics | V | D | | | | | | MADEP |
| C9-C12 Aliphatics | V | D | | | | | | MADEP |
| C9-C10 Aromatics | V | D | | | | | | MADEP |

**NOTES:**
ND - Not determined/No data
DW - Drinking water
µg - microgram
mg - milligram
kg - kilogram
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
MADEP - Massachusetts Department of Environmental Protection
"Background Documentation for the Development of the MCP Numerical Standards" April, 1994
CA EPA - California Environmental Protection Agency
"California Environmental Protection Agency Criteria for Carcinogens" November, 1994
NCEA - National Center for Environmental Assessment

Sources (in order used, per MADEP, 1995):
IRIS as of 11/98
HEAST, 1997 (including July updates)
CA EPA, 1994
MADEP, 1994
NCEA, date varies

Chemical Groups:
A - Acid extractable
B - Base neutral extractable
I/M - Inorganic/Metal
P - Pesticide
V - Volatile
W - Waste

Weight of Evidence (Route-Specific):
A - Human carcinogen
B - Probable human carcinogen
B1 - limited evidence of cancer in humans
B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans
C - Possible human carcinogen
D - Not classifiable as to human carcinogenicity
E - Evidence of lack of carcinogenicity to humans

* Source of slope factor is HEAST, 1995 unless otherwise noted
c - Calculated by HLA from unit risk [slope = ((unit risk x 70 kg)/20 m³/day) x 1000 ug/mg]
** Slope factor for benzo(a)pyrene used for other carcinogenic PAHs, adjusted by
Relative Potency Factors of 1.0 [benzo(a)pyrene, dibenz(a,h)anthracene];
0.1 [benzo(a)anthracene, benzo(b)flouoranthene, indeno(1,2,3-cd)pyrene];
0.01 [benzo(k)fluoranthene]; 0.001 [chrysene].
*** Slope factos are applicable to Aroclors 1016, 1248, 1254, and 1260
+ Value for chlordane used for alpha- and gamma- isomers

W1 = Value was withdrawn from HEAST in FY 1997 update
W2 = Value of 6.1E+00 was withdrawn from HEAST in FY 1993 update
W3 = Value was withdrawn from HEAST in FY 1992 update
W4 = Value of 5.9E-06 was withdrawn from HEAST in FY 1992 update

N1 = An NCEA provisional regional support value of 2.2E-02 has been published in Region III RBC Table
MADEP does not recommend the use of this value.
N2 = An NCEA provisional regional support value of 3.1E+00 has been published in Region III RBC Table
MADEP does not recommend the use of this value.
N3 = An NCEA provisional regional support value of 1.4E-02 has been published in Region III RBC Table.
MADEP does not recommend the use of this value.
N4 = An NCEA provisional regional support value of 2e-3 has been published in Region III RBC Table.
MADEP does not recommend the use of this value.
N5 = An NCEA provisional support value of 6.0E-03 has been published in Region III RBC Table.
MADEP does not recommend the use of this value
N6 = An NCEA provisional support value of 6.8E-03 has been published in Region III RBC Table.
MADEP does not recommend the use of this value
USEPA Region III Risk Based Concentrations, April 12, 1999.

INHALATION DOSE-RESPONSE DATA
FOR NON-CARCINOGENIC EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

| COMPOUND | CHEMICAL GROUP | CHRONIC INHALATION RfC (mg/m[3]) | | SUBCHRONIC[1] INHALATION RfC (mg/m[3]) | CHRONIC INHALATION RfD[2] (mg/kg-day) | | SUBCHRONIC INHALATION RfD[2] (mg/kg-day) | | STUDY TYPE | CONFIDENCE LEVEL | CRITICAL EFFECT | TEST ANIMAL | UNCERTAINTY FACTOR | SOURCE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ACID EXTRACTABLE COMPOUNDS | | | | | | | | | | | | | | |
| Phenol | A | 2.6E-01 | | ND | ND | | ND | | | | | | | MADEP |
| BASE NEUTRAL COMPOUNDS | | | | | | | | | | | | | | |
| Benzo(a)anthracene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Benzo(a)pyrene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Benzo(b)fluoranthene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Benzo(g,h,i)perylene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Benzo(k)fluoranthene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Bis (2-ethylhexyl) phthalate (BEHP) | B | 7.0E-03 | | ND | ND | | ND | | | | | | | MADEP |
| Chrysene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Fluoranthene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Indeno(1,2,3-cd)pyrene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Naphthalene | B, V | 3.0E-03 | | 3.0E-03 | 8.5E-04 | | 8.5E-04 | | Inhalation | Medium | Hyperplasia and metaplasia in respiratory | Rat | 3000 H, A, S, D | IRIS |
| Phenanthrene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| Pyrene | B | 7.1E-02 | ~ | ND | ND | | ND | | | | | | | MADEP |
| INORGANICS/METALS | | | | | | | | | | | | | | |
| Antimony | I/M | 1.0E-02 | | ND | ND | | ND | | | | | | | ATC |
| Arsenic | I/M | 2.5E-06 | | ND | ND | | ND | | | | | | | ATC |
| Barium | I/M | 5.0E-04 | | 5.0E-03 | 1.0E-04 | [3] | 1.0E-04 | [3] | Inhalation | Low | Fetotoxicity | Rat | 1,000 H,A,S | HEAST |
| Cadmium (food) | I/M | 1.5E-05 | | | | | | | | | | | | |
| Cadmium (water) | I/M | 1.5E-05 | | ND | ND | | ND | | | | | | | ATC |
| Chromium III | I/M | 6.8E-03 | | ND | ND | | ND | | | | | | | ATC |
| Chromium VI | I/M | 1.0E-04 | [5] | ND | 2.9E-05 | | ND | | Inhalation | Medium | Increase in Lactate Dehydogenase | Rat | 300 H, S, A | IRIS |
| Copper | I/M | 2.7E-03 | | ND | ND | | ND | | | | | | | ATC |
| Lead | I/M | 7.0E-04 | [4] | ND | ND | | ND | | | | | | | ATC |
| Mercury-Inorganic (as elemental mercury) | I/M | 3.0E-04 | | 3.0E-04 | ND | | ND | | Inhalation | Low | Neurotoxicity | Human | 30 H,D | HEAST |
| Mercury-Organic (as methyl mercury) | I/M | 1.0E-04 | | ND | ND | | ND | | | | | | | IRIS |
| Nickel | I/M | 2.0E-04 | | ND | ND | | ND | | Inhalation | ND | Respiratory effects | Mice | 100 H,A | ATSDR, 1997 |
| Nitrate | I/M | ND | | ND | ND | | ND | | | | | | | |
| Nitrite | I/M | ND | | ND | ND | | ND | | | | | | | |
| Nitrogen, ammonia | I/M | 1.0E-01 | | 1.0E-01 | ND | | ND | | Inhalation | Medium | Lack of respiratory effects | Human | 30 H,D | IRIS |
| Selenium | I/M | 2.7E-03 | | ND | ND | | ND | | | | | | | ATC |
| Silver | I/M | ND | | ND | ND | | ND | | | | | | | |
| Thallium | I/M | ND | | ND | ND | | ND | | | | | | | |
| Zinc | I/M | ND | | ND | ND | | ND | | | | | | | |
| VOLATILES | | | | | | | | | | | | | | |
| 1,2,4-Trimethylbenzene | V | 3.0E-01 | ~~~ | ND | ND | (N3) | ND | | | | | | | MADEP |
| 1,3,5-Trimethylbenzene | V | 3.0E-01 | ~~~ | ND | ND | (N4) | ND | | | | | | | MADEP |
| Acetone | V | 8.0E-01 | | ND | ND | | ND | | | | | | | MADEP |
| Butylbenzene, sec- | V | 4.0E-01 | @ | ND | ND | | ND | | | | | | | IRIS |
| Carbon Disulfide | V | 7.0E-01 | | 7.0E-01 | ND | | ND | | Inhalation | Medium | Peripheral nervous system dysfunction | Human | 30 H,D | IRIS |
| Ethylbenzene | V | 1.0E+00 | | ND | ND | | ND | | Inhalation | Low | Developmental toxicity | Rat/Rabbit | 300 H,A,S | IRIS |
| Isopropylbenzene | V | 4.0E-01 | | ND | ND | | ND | | Inhalation | High | Increased kidney and adrenal weights | Rat | 1000 H,A,S | IRIS |
| Isopropyltoluene | V | 4.0E-01 | @ | ND | ND | | ND | | | | | | | IRIS |
| Methylene Chloride (Dichloromethane) | V | 3.0E+00 | | 3.0E+00 | 8.6E-01 | | 8.6E-01 | | Inhalation | Low | Liver toxicity | Rat | 100 H,A | HEAST |
| Methyl-tert-butyl ether | V | 3.0E+00 | | ND | ND | | ND | | Inhalation | Medium | Increased liver and kidney weights | Rat | 100 H,A,D | IRIS |
| Propylbenzene | V | 4.0E-01 | @ | ND | ND | | ND | | | | | | | IRIS |
| Toluene | V | 4.0E-01 | | ND | 1.1E-01 | | ND | | Inhalation | Medium | Neurological effects | Human | 300 H,L,D | IRIS |
| Xylenes (total) | V | 3.0E-01 | | ND | ND | | ND | | | | | | | MADEP |

INHALATION DOSE-RESPONSE DATA
FOR NON-CARCINOGENIC EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

| COMPOUND | CHEMICAL GROUP | CHRONIC INHALATION RfC (mg/m[3]) | | SUBCHRONIC[1] INHALATION RfC (mg/m[3]) | | CHRONIC INHALATION RfD[2] (mg/kg-day) | SUBCHRONIC INHALATION RfD[2] (mg/kg-day) | STUDY TYPE | CONFIDENCE LEVEL | CRITICAL EFFECT | TEST ANIMAL | UNCERTAINTY FACTOR | SOURCE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TPH | | | | | | | | | | | | | |
| EPH | | | | | | | | | | | | | |
| C9-C18 Aliphatics | B | 2.0E+00 | @@@ | ND | | ND | ND | | | | | | MADEP (2) |
| C19-C36 Aliphatics | B | ND | | ND | | ND | ND | | | | | | MADEP (2) |
| C10-C22 Aromatics | B | 7.1E-02 | | ND | | ND | ND | | | | | | MADEP (2) |
| VPH | | | | | | | | | | | | | |
| C5-C8 Aliphatics | V | 2.0E-01 | @@ | 2.0E-01 | @@ | ND | ND | | | | | | IRIS, MADEP (2) |
| C9-C12 Aliphatics | V | 2.0E+00 | @@@ | ND | | ND | ND | | | | | | MADEP (2) |
| C9-C10 Aromatics | V | 6.0E-02 | ~~~ | ND | | ND | ND | | | | | | MADEP (2) |

NOTES:
ND - No data available
W - RfD withdrawn from IRIS/HEAST
mg - milligram
kg - kilogram
µg - microgram

DW - Drinking Water
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
ATSDR - Agency for Toxic Substances Disease Registry (Toxicological Profiles; chemical-specific)
MADEP - Massachusetts Department of Environmental Protection

"Background Documentation for the Development of the MCP Numerical Standards" April, 1994
ATC - Ambient Threshold Concentration. Calculated from Threshold Effects Exposure Limits (TELs) provided in "Massachusetts Threshold Effects Exposure Limits and Allowable Ambient Limits for Ambient Air" (December, 1995). ATC calculated as follows: TEL (ug/m3) x 5 x 0.001 mg/ug
MADEP(2) - "Interim Final Petroleum Report: Development of Health-Based Alternative to the Total Petroleum Hydrocarbon (TPH) Parameter (1994)" and Revisions to the MCP - 10/31/97.
NCEA - National Center for Environmental Assessment

SOURCES (in order used, per *MADEP, 1995*):
IRIS as of 11/98; chronic RfCs
*HEAST, FY 1997*; chronic and subchronic *RfCs and RfDs*
MADEP, 1994; RfDs; MADEP (2); RfDs
ATSDR (chemical-specific); Minimum Risk Levels (MRLs)
MADEP TEL; ATCs
NCEA, RfDs

Uncertainty factors:
H - variation in human sensitivity
A - animal to human extrapolation
S - extrapolation from subchronic to chronic NOAEL
L - extrapolation from LOAEL to NOAEL
N - NOEL not attained
D - Lack of supporting data
M - additional modifying factor

W1 = Value was withdrawn from HEAST in FY 1993 update
W2 = Value was withdrawn from HEAST in FY 1993 update
W3 = Value was withdrawn from HEAST in FY 1992 supplement #2 update
W4 = Value was withdrawn from HEAST in FY 1993 supplement #2 update
W5 = Value was withdrawn from HEAST in FY 1993 update
N1 = An NCEA provisional regional support value of 1.0E-03 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
N2 = An NCEA provisional regional support value of 1.4E-03 has been published in Region III RBC Table MADEP does not recommend the use of this value.
N3 = An NCEA provisional regional support value of 1.7E-03 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
N4 = An NCEA provisional regional support value of 1.7E-03 has been published in Region III RBC Table. *MADEP does not recommend the use of this value.*
N5 = An NCEA provisional regional support value of 1.4E-03 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
N6 = An NCEA provisional regional support value of 1.7E-03 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
N7 = An NCEA provisional regional support value of 5.7E-04 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
N8 = An NCEA provisional regional support value of 8.6E-05 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
N9 = An NCEA provisional regional support value of 8.6E-02 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
N10 = An NCEA provisional regional support value of 1.4E-01 has been published in Region III RBC Table. MADEP does not recommend the use of this value.
*USEPA Region III Risk Based Concentrations, April 12, 1999.*

[1] Source of all subchronic RfCs is HEAST (1997)
*[2] - RfD calculated by HLA from RfC as follows:*
RfD (mg/kg-d) = RfC (mg/m[3])/ 70 kg x 20 m[3]/d, unless otherwise indicated
[3] - HEAST Table 2: Alternate Methods; RfD calculated from RfC by HEAST
[4] - There is a National Ambient Air Quality Standard for lead of 1.5 µg/m[3] averaged over three months
[5] Value for chromium VI particulates; value for chromium VI as dissolved chromium VI aerosols or chromic acid mists is 8E-6 mg/m$^3$
[6] Oral RfD used as surrogate for inhalation RfD
~Value for napthalene is used as surrogate for PAHs without assigned RfCs.
~~ Value for bis(2-ethylhexyl)phthalate used as surrogate
~~~ Value for xylenes used as surrogate. For the C9-C10 aromatics VPH fraction, the value represents 20% of the xylene RfC, per MADEP, 1997.
^ Value for PCBs used as surrogate
^^ Value for gamma-BHC used as surrogate
^^^ Value for chloroform used as surrogate
+ Value for 1,2,4-trichlorobenzene used as surrogate
++ Value for heptachlor used as surrogate
+++ Value for 4-methylphenol used as surrogate
* Value for chlordane used for alpha- and gamma- isomers
** Value for 1,2-dichlorobenzene used as surrogate
*** Value for 2-nitroaniline used as surrogate
@ Value for isopropylbenzene used as surrogate
@@ Value for n-hexane used as surrogate, per MADEP 1997
@@@ Value based on n-hexane, per MADEP 1997
! Value for 1,1,2,2-Tetrachloroethane used as surrogate
!! Value for bis(chloromethyl)ether used as surrogate

Chemical Group:
A - Acid extractable
B - Base neutral extractable
I/M - Inorganic/Metal
P - Pesticide
V - Volatile
W - Waste
X - Other
~~~

# RELATIVE ABSORPTION FACTORS
## FOR NONCARCINOGENIC EFFECTS

**CPL Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

| | | SITE OF EXPOSURE [a] | | | | | STUDY EXPOSURE ROUTE [a] | | | | | | RAF - NON-CANCER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANALYTE | CHEMICAL TYPE | Soil Ingestion | Soil Dermal Contact | Water Ingestion | Water Dermal Contact | Produce Ingestion | Gavage | Drinking Water | Dietary (food) | Injection | Inhalation | Dermal Contact | Dose-respons Study Type [b] | Soil Subchronic Oral | Soil Subchronic Dermal | Soil Chronic Oral | Soil Chronic Dermal | Water Chronic Oral | Water Chronic Dermal | Produce Ingestion Oral | RAF Source [c] |
| ACID EXTRACTABLE COMPOUNDS | | | | | | | | | | | | | | | | | | | | | |
| Phenol | A | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 1 | 0.26 | 1 | 0.26 | 1 | 1.10 | NA | MADEP, 1994 |
| BASE NEUTRAL COMPOUNDS | | | | | | | | | | | | | | | | | | | | | |
| Benzo(a)anthracene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 0.91 | 0.04 | 0.91 | 0.04 | 0.91 | 1.10 | NA | MADEP, 1994 [d] |
| Benzo(a)pyrene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 0.91 | 0.04 | 0.91 | 0.04 | 0.91 | 1.10 | NA | MADEP, 1994 [d] |
| Benzo(b)fluoranthene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 0.91 | 0.04 | 0.91 | 0.04 | 0.91 | 1.10 | NA | MADEP, 1994 [d] |
| Benzo(g,h,i)perylene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 0.91 | 0.04 | 0.91 | 0.04 | 0.91 | 1.10 | NA | MADEP, 1994 [d] |
| Benzo(k)fluoranthene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 0.91 | 0.04 | 0.91 | 0.04 | 0.91 | 1.10 | NA | MADEP, 1994 [d] |
| Bis(2-ethylhexyl)phthalate (BEHP) | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | D | 1 | 0.02 | 1 | 0.02 | 1 | 1.05 | NA | MADEP, 1994 |
| Chrysene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 0.91 | 0.04 | 0.91 | 0.04 | 0.91 | 1.10 | NA | MADEP, 1994 [d] |
| Fluoranthene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 1 | 0.04 | 1 | 0.04 | 1 | 1.10 | NA | MADEP, 1994 [d] |
| Indeno(1,2,3-cd)pyrene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 0.91 | 0.04 | 0.91 | 0.04 | 0.91 | 1.10 | NA | MADEP, 1994 [d] |
| Naphthalene | B, V | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 1 | 0.04 | 1 | 0.04 | 1 | 1.10 | NA | MADEP, 1994 [d] |
| Phenanthrene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 0.91 | 0.04 | 0.91 | 0.04 | 0.91 | 1.10 | NA | MADEP, 1994 [d] |
| Pyrene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | G | 1 | 0.04 | 1 | 0.04 | 1 | 1.10 | NA | MADEP, 1994 [d] |
| INORGANICS/METALS | | | | | | | | | | | | | | | | | | | | | |
| Antimony | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 1 | 0.1 | 1 | 0.1 | 1 | 1.82 | NA | MADEP, 1994 |
| Arsenic | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 1 | 0.03 | 1 | 0.03 | 1 | 1.82 | NA | MADEP, 1994 |
| Barium | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 0.71 | 0.05 | 0.71 | 0.05 | 0.73 | 1.82 | 0.71 | per MADEP, 1995 |
| Cadmium (food) | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | D | 1.86 | 0.14 | 1.86 | 0.14 | 1.90 | 4.76 | 1.86 | per MADEP, 1995 |
| Cadmium (water) | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 1 | 0.14 | 1 | 0.14 | 1 | 1.82 | NA | MADEP, 1994 |
| Chromium III | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | D | 1 | 0.04 | 1 | 0.04 | 1 | 4.76 | NA | MADEP, 1994 |
| Chromium VI | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 1 | 0.09 | 1 | 0.09 | 1 | 1.82 | NA | MADEP, 1994 |
| Copper | I/M | | | | | | | | | | | | NA | | NA | NA | NA | NA | NA | NA | |
| Lead | I/M | | | | 1 | | | 0.5 | | | | | W | 0.5 | 0.006 | 0.5 | 0.006 | 0.5 | 2.00 | 0.5 | MADEP, 1992 |
| Mercury-Inorganic (as Mercuric chlo | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | D | 1 | 0.05 | 1 | 0.05 | 1 | 4.76 | NA | MADEP, 1994 |
| Mercury-Organic (as Methyl Mercur | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | D | 1.86 | 0.14 | 1.86 | 0.14 | 1.90 | 4.76 | 1.86 | per MADEP, 1995 |
| Nickel | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | D | 1 | 0.35 | 1 | 0.35 | 1 | 4.76 | NA | MADEP, 1994 |
| Nitrate | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 0.71 | 0.05 | 0.71 | 0.05 | 0.73 | 1.82 | 0.71 | per MADEP, 1995 |
| Nitrite | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 0.71 | 0.05 | 0.71 | 0.05 | 0.73 | 1.82 | 0.71 | per MADEP, 1995 |
| Nitrogen, Ammonia | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 0.71 | 0.05 | 0.71 | 0.05 | 0.73 | 1.82 | 0.71 | per MADEP, 1995 |
| Selenium | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | D | 1 | 0.002 | 1 | 0.002 | 1 | 4.76 | NA | MADEP, 1994 |
| Silver | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | IV | 1 | 0.25 | 1 | 0.25 | 1 | 1.00 | NA | MADEP, 1994 |
| Thallium [p] | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | 1 | 0.55 | 0.21 | 1 | NA | 0.017 | G | 1 | 0.01 | 1 | 0.01 | 1 | 1.00 | NA | MADEP, 1994 |
| Zinc | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | D | 1 | 0.02 | 1 | 0.02 | 1 | 4.76 | NA | MADEP, 1994 |

# RELATIVE ABSORPTION FACTORS
# FOR NONCARCINOGENIC EFFECTS

**CPL Gordon Craig US Army Reserve Center**

***Brockton, Massachusetts***

| | | SITE OF EXPOSURE [a] | | | | | STUDY EXPOSURE ROUTE [a] | | | | | | RAF - NON-CANCER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANALYTE | CHEMICAL TYPE | Soil Ingestion | Soil Dermal Contact | Water Ingestion | Water Dermal Contact | Produce Ingestion | Gavage | Drinking Water | Dietary (food) | Injection | Inhalation | Dermal Contact | Dose-respons Study Type [b] | Soil Subchronic Oral | Soil Subchronic Dermal | Soil Chronic Oral | Soil Chronic Dermal | Water Chronic Oral | Water Chronic Dermal | Produce Ingestion Oral | RAF Source [c] |
| VOLATILES | | | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trimethylbenzene [l] | V | | | | | | | | | | | | NA | 1.00 | 0.12 | 1.00 | 0.12 | 1.00 | 1.00 | NA | MADEP, 1994 |
| 1,3,5-Trimethylbenzene [l] | V | | | | | | | | | | | | NA | 1 | 0.12 | 1 | 0.12 | 1 | 1.00 | NA | MADEP, 1994 |
| Acetone | V | 0.99 | 0.11 | 0.99 | 1 | 0.99 | 1 | 1 | NA | 1 | 0.91 | 0.11 | G | 1 | 0.1 | 1 | 0.1 | 1 | 1.00 | NA | MADEP, 1994 |
| Butylbenzene, sec- | V | | | | | | | | | | | | NA | 1 | 0.1 | 1 | 0.1 | 1 | 1.00 | NA | Assumption |
| Carbon Disulfide | V | 0.99 | 0.11 | 0.99 | 1 | 0.99 | 1 | 1 | NA | 1 | 0.91 | 0.11 | I | 1.09 | 0.12 | 1.09 | 0.12 | 1.09 | 1.10 | 1.09 | per MADEP, 1995 |
| Ethylbenzene | V | 0.99 | 0.11 | 0.99 | 1 | 0.99 | 1 | 1 | NA | 1 | 0.91 | 0.11 | G | 1 | 0.2 | 1 | 0.2 | 1 | 1.00 | NA | MADEP, 1994 |
| Isopropylbenzene | V | 0.99 | 0.11 | 0.99 | 1 | 0.99 | 1 | 1 | NA | 1 | 0.91 | 0.11 | G | 0.99 | 0.11 | 0.99 | 0.11 | 0.99 | 1.00 | 0.99 | per MADEP, 1995 |
| Isopropyltoluene [u] | V | | | | | | | | | | | | NA | 0.99 | 0.11 | 0.99 | 0.11 | 0.99 | 1.00 | 0.99 | per MADEP, 1995 |
| Methylene Chloride (Dichloromethar | V | 0.99 | 0.11 | 0.99 | 1 | 0.99 | 1 | 1 | NA | 1 | 0.91 | 0.11 | W | 1 | 0.1 | 1 | 0.1 | 1 | 1.00 | NA | MADEP, 1994 |
| Methyl-tert-butyl ether (MTBE) | V | | | | | | | | | | | | NA | 1 | 0.1 | 1 | 0.1 | 1 | 1.00 | 0.99 | Assumption |
| Propylbenzene [u] | V | | | | | | | | | | | | NA | 0.99 | 0.11 | 0.99 | 0.11 | 0.99 | 1.00 | 0.99 | per MADEP, 1995 |
| Toluene | V | 0.99 | 0.11 | 0.99 | 1 | 0.99 | 1 | 1 | NA | 1 | 0.91 | 0.11 | G | 1 | 0.12 | 1 | 0.12 | 1 | 1.00 | NA | MADEP, 1994 |
| Xylenes (total) | V | 0.99 | 0.11 | 0.99 | 1 | 0.99 | 1 | 1 | NA | 1 | 0.91 | 0.11 | G | 1 | 0.12 | 1 | 0.12 | 1 | 1.00 | NA | MADEP, 1994 |
| TPH | | | | | | | | | | | | | | | | | | | | | |
| *EPH* | | | | | | | | | | | | | | | | | | | | | |
| C9-C18 Aliphatics | B | | | | | | | | | | | | NA | 0.91 | 0.2 | 0.91 | 0.2 | 1 | 1.00 | NA | MADEP, 1997 [v] |
| C19-C36 Aliphatics | B | | | | | | | | | | | | NA | 0.91 | 0.1 | 0.91 | 0.1 | 1 | 1.00 | NA | MADEP, 1997 [v] |
| C10-C22 Aromatics | B | | | | | | | | | | | | NA | 0.91 | 0.18 | 0.91 | 0.18 | 0.91 | 1.10 | NA | MADEP, 1997 [v] |
| *VPH* | | | | | | | | | | | | | | | | | | | | | |
| C5-C8 Aliphatics | V | | | | | | | | | | | | NA | 0.91 | 0.5 | 0.91 | 0.5 | 1 | 1.00 | NA | MADEP, 1997 [v] |
| C9-C12 Aliphatics | V | | | | | | | | | | | | NA | 0.91 | 0.2 | 0.91 | 0.2 | 1 | 1.00 | NA | MADEP, 1997 [v] |
| C9-C10 Aromatics | V | | | | | | | | | | | | NA | 0.91 | 0.18 | 0.91 | 0.18 | 0.91 | 1.10 | NA | MADEP, 1997 [v] |

**NOTES:**

NA = Not available

W = Drinking water

G = Gavage

D = Dietary/food

I = Inhalation

IV = Injection

DC= Dermal contact

RAF = Relative absorption factor

VOC = Volatile organic compound

SVOC = Semivolatile organic compound

**SOURCES:**

MADEP, 1992: Risk Assessment Shortform Residential Scenario. WSC/ORS-142-92.

MADEP, 1994: Background Documentation for the Development of the MCP Numerical Standards (April, 1994).
RAFs are those provided in Table 2-1 of this document, and were not calculated by ABB-ES.

MADEP, 1995: Guidance for Disposal Site Risk Characterization, Appendix B, Section K "Absorption Efficiency".

[a] Source is MADEP, 1995, unless otherwise noted.

[b] Study type for which the dose-response value is based. This information is provided in the dose-response tables.

[c] For RAF sources identified as "per MADEP, 1995", the RAF was calculated by dividing absorption efficiency for the site of exposure by the absorption efficiency for the study exposure route. The default absorption efficiencies provided below were used if data were not located in the literature. The values for SVOCs were used as surrogates for pesticides. All water dermal RAFs were calculated per MADEP, 1995.

[d] Dermal RAFs for PAHs derived from the results of Yang et al. (1989) and Webster et al. (1990). (See Appendix E4)

MADEP, 1995: Guidance for Disposal Site Risk Characterization, Appendix B, Section K "Absorption Efficiency".

Yang, J.J., T.A. Roy, A.J. Krueger, W. Neil and D.R. Mackerer. 1989. In Vitro and In Vivo Percutaneous Absorption of Benzo(a)pyrene from Petroleum Crude-Fortified Soil in the Rat. Bull. Environ. Contam. Toxicol. 43: 207-214.

Wester, R.D., H.I. Maibach, D.A. Bucks, L. Sedik, J. Melendres, C. Liao and S. Dizio. 1990. Percutaneous Absorption of [14C] Benzo(a)pyrene from Soil. Fundamental and Applied Toxicology. 15:510-516.

[e] Quantitative absorption data were not available for the drinking water exposure route. A value of 1 (representing 100% absorption) was used to be conservative.

*[f] For the inhalation exposure route, an inhalation absorption efficiency of 80% (0.8) was used per ATSDR, 1990.*

[g] RAFs for 2-chlorophenol used as surrogate.

[h] RAFs for 2,4-dinitrophenol used as surrogate.

RELATIVE ABSORPTION FACTORS
FOR NONCARCINOGENIC EFFECTS

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

| | | SITE OF EXPOSURE [a] | | | | | STUDY EXPOSURE ROUTE [a] | | | | | | RAF - NON-CANCER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANALYTE | CHEMICAL TYPE | Soil Ingestion | Soil Dermal Contact | Water Ingestion | Water Dermal Contact | Produce Ingestion | Gavage | Drinking Water | Dietary (food) | Injection | Inhalation | Dermal Contact | Dose-respons Study Type [b] | Soil Subchronic Oral | Soil Subchronic Dermal | Soil Chronic Oral | Soil Chronic Dermal | Water Chronic Oral | Water Chronic Dermal | Produce Ingestion Oral | RAF Source [c] |

[i] RAFs for pyrene used as surrogate.
[j] RAFs for 4-chloroanaline used as surrogate.
[k] RAFs for DDT used as surrogate.
[l] RAFs for xylenes used as surrogate.
[m] RAFs for 2-butanone used as surrogate.
[n] RAFs for chloroform used as surrogate.
[o] 1,2,4-trimethylbenzene used as surrogate.
[p] No MADEP default value for the gavage route; a value of 100% oral absorption was obtained from Risk Assessment Residential Shortform (MADEP, 1992).
[q] No MADEP default value for the dietary route; a value of 98% dietary absorption was obtained from Risk Assessment Residential Shortform (MADEP, 1992).
[r] No MADEP default value for the dietary route; a value of 100% dietary absorption was assumed.
[s] Water dermal RAF based on water dermal RAF for dichlorobenzene.
[t] Water dermal RAF based on water dermal RAF for 2-methylphenol.
[u] RAF for isopropylbenzene used as surrogate.
[v] Dermal RAF for water based on n-hexane for all aliphatic fractions, and pyrene for all aromatic fractions.

| Default Absorption Efficiencies (from MADEP, 1995) | | | |
|---|---|---|---|
| Route/Medium of Exposure | VOCs | SVOCs | Inorganics |
| *SITE* | | | |
| Soil Ingestion | 0.99 | 0.91 | 0.39 |
| Soil Dermal Contact | 0.11 | 0.17 | 0.03 |
| Water Ingestion | 0.99 | 0.92 | 0.4 |
| Water Dermal Contact [a] | 1 | 1 | 1 |
| Produce Ingestion | 0.99 | 0.92 | 0.39 |
| *STUDY* | | | |
| Gavage (Oil) | 1 | 0.91 | NA |
| Drinking Water | 1 | NA | 0.55 |
| Food | NA | 0.95 | 0.21 |
| Injection | 1 | 1 | 1 |
| Inhalation | 0.91 | NA | NA |
| Dermal Contact | 0.11 | 0.14 | 0.017 |

[a] Per MADEP (1995), the RAF for dermal contact with water is calculated for an abosorbed dose. Therefore, the absorption efficiency for the site of exposure is assumed to be 100%.

T. S

**RELATIVE ABSORPTION FACTORS**
**FOR CARCINOGENIC EFFECTS**

**CPL Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

| | | SITE OF EXPOSURE [a] | | | | | STUDY EXPOSURE ROUTE [a] | | | | | | RAF - CANCER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANALYTE | CHEMICAL TYPE | Soil Ingestion | Soil Dermal Contact | Water Ingestion | Water Dermal Contact | Produce Ingestion | Gavage | Drinking Water | Dietary (food) | Injection | Inhalation | Dermal Contact | Dose-respons Study Type [b] | Soil Cancer Oral | Soil Cancer Dermal | Water Cancer Oral | Water Cancer Dermal | Produce Ingestion Oral | RAF Source [c] |
| **ACID EXTRACTABLE COMPOUNDS** | | | | | | | | | | | | | | | | | | | |
| Phenol | A | | | | | | | | | | | | NC | | | | | | |
| **BASE NEUTRAL COMPOUNDS** | | | | | | | | | | | | | | | | | | | |
| Benzo(a)anthracene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | D | 1 | 0.04 | 1 | 1.05 | NA | MADEP, 1994 [d] |
| Benzo(a)pyrene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | D | 1 | 0.04 | 1 | 1.05 | NA | MADEP, 1994 [d] |
| *Benzo(b)fluoranthene* | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | D | 1 | 0.04 | 1 | 1.05 | NA | MADEP, 1994 [d] |
| Benzo(g,h,i)perylene | B | | | | | | | | | | | | NC | | | | | | |
| Benzo(k)fluoranthene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | D | 1 | 0.04 | 1 | 1.05 | NA | MADEP, 1994 [d] |
| Bis(2-ethylhexyl)phthalate (BEHP) | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | D | 1 | 0.02 | 1 | 1.05 | NA | MADEP, 1994 |
| Chrysene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | D | 1 | 0.04 | 1 | 1.05 | NA | MADEP, 1994 [d] |
| Fluoranthene | B | | | | | | | | | | | | NC | | | | | | |
| Indeno(1,2,3-cd)pyrene | B | 0.91 | 0.17 | 0.92 | 1 | 0.92 | 0.91 | NA | 0.95 | 1 | NA | 0.14 | D | 1 | 0.04 | 1 | 1.05 | NA | MADEP, 1994 [d] |
| Naphthalene | B, V | | | | | | | | | | | | NC | NA | 0.04 | NA | NA | NA | MADEP, 1994 [d] |
| Phenanthrene | B | | | | | | | | | | | | NC | | | | | | |
| Pyrene | B | | | | | | | | | | | | NC | | | | | | |
| **INORGANICS/METALS** | | | | | | | | | | | | | | | | | | | |
| Antimony | I/M | | | | | | | | | | | | NA | | | | | | |
| Arsenic | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | W | 1 | 0.03 | 1 | 1.82 | NA | MADEP, 1994 |
| Barium | I/M | | | | | | | | | | | | NA | | | | | | |
| Cadmium (food) | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | ND | NA | NA | NA | NA | NA | per MADEP, 199 |
| Cadmium (water) | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | ND | NA | NA | NA | NA | NA | per MADEP, 199 |
| Chromium III | I/M | | | | | | | | | | | | NA | | | | | | |
| *Chromium VI* | I/M | | | | | | | | | | | | NA | | | | | | |
| Copper | I/M | | | | | | | | | | | | NC | | | | | | |
| Lead | I/M | 0.39 | 0.03 | 0.4 | 1 | 0.39 | NA | 0.55 | 0.21 | 1 | NA | 0.017 | ND | NA | NA | NA | NA | NA | per MADEP, 199 |
| Mercury-Inorganic (as Mercuric chloride) | I/M | | | | | | | | | | | | ND | | | | | | |
| Mercury-Organic (as Methyl Mercury) | I/M | | | | | | | | | | | | NA | | | | | | |
| Nickel | I/M | | | | | | | | | | | | NA | | | | | | |
| Nitrate | I/M | | | | | | | | | | | | NA | | | | | | |
| Nitrite | I/M | | | | | | | | | | | | NA | | | | | | |
| Nitrogen, Ammonia | I/M | | | | | | | | | | | | NA | | | | | | |
| Selenium | I/M | | | | | | | | | | | | NC | | | | | | |
| Silver | I/M | | | | | | | | | | | | NC | | | | | | |
| Thallium (based on thallium sulfate) | I/M | | | | | | | | | | | | NC | | | | | | |
| Zinc | I/M | | | | | | | | | | | | NC | | | | | | |

## RELATIVE ABSORPTION FACTORS
## FOR CARCINOGENIC EFFECTS

**CPL Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

| ANALYTE | CHEMICAL TYPE | SITE OF EXPOSURE [a] | | | | | STUDY EXPOSURE ROUTE [a] | | | | | | RAF - CANCER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Soil Ingestion | Soil Dermal Contact | Water Ingestion | Water Dermal Contact | Produce Ingestion | Gavage | Drinking Water | Dietary (food) | Injection | Inhalation | Dermal Contact | Dose-respons Study Type [b] | Soil Cancer Oral | Soil Cancer Dermal | Water Cancer Oral | Water Cancer Dermal | Produce Ingestion Oral | RAF Source [c] |
| **VOLATILES** | | | | | | | | | | | | | | | | | | | |
| 1,2,4-Trimethylbenzene | V | | | | | | | | | | | | NA | | | | | | |
| 1,3,5-Trimethylbenzene | V | | | | | | | | | | | | NA | | | | | | |
| Acetone | V | | | | | | | | | | | | NC | | | | | | |
| Butylbenzene, sec- | V | | | | | | | | | | | | NA | | | | | | |
| Carbon Disulfide | V | | | | | | | | | | | | NA | | | | | | |
| Ethylbenzene | V | | | | | | | | | | | | NC | | | | | | |
| Isopropylbenzene | V | | | | | | | | | | | | NA | | | | | | |
| Isopropyltoluene | V | | | | | | | | | | | | NA | | | | | | |
| Methylene Chloride (Dichloromethane) | V | 0.99 | 0.11 | 0.99 | 1 | 0.99 | 1 | 1 | NA | 1 | 0.91 | 0.11 | W | 1 | 0.1 | 1 | 1.00 | NA | MADEP, 1994 |
| Merthyl-tert-butyl-ether | V | | | | | | | | | | | | NA | | | | | | |
| Propylbenzene | V | | | | | | | | | | | | NA | | | | | | |
| Toluene | V | | | | | | | | | | | | NC | | | | | | |
| Xylenes (total) | V | | | | | | | | | | | | NC | | | | | | |
| **TPH** | | | | | | | | | | | | | | | | | | | |
| *EPH* | | | | | | | | | | | | | | | | | | | |
| C9-C18 Aliphatics | B | | | | | | | | | | | | NA | | | | | | |
| C19-C36 Aliphatics | B | | | | | | | | | | | | NA | | | | | | |
| C10-C22 Aromatics | B | | | | | | | | | | | | NA | | | | | | |
| *VPH* | | | | | | | | | | | | | | | | | | | |
| C5-C8 Aliphatics | V | | | | | | | | | | | | NA | | | | | | |
| C9-C12 Aliphatics | V | | | | | | | | | | | | NA | | | | | | |
| C9-C10 Aromatics | V | | | | | | | | | | | | NA | | | | | | |

**NOTES:**

NC = Not carcinogenic

NA = Not available

ND = Analyte is a potential carcinogen, but dose-response data are not available.

W = Drinking water

G = Gavage

D = Dietary/food

I = Inhalation

IV = Injection

DC= Dermal contact

**SOURCES:**

MADEP, 1994: Background Documentation for the Development of the MCP Numerical Standards (April, 1994).
RAFs are those provided in Table 2-1 of this document, and were not calculated by ABB-ES.

MADEP, 1995: Guidance for Disposal Site Risk Characterization, Appendix B, Section K "Absorption Efficiency".

## RELATIVE ABSORPTION FACTORS
## FOR CARCINOGENIC EFFECTS

**CPL Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

| ANALYTE | CHEMICAL TYPE | SITE OF EXPOSURE [a] | | | | | STUDY EXPOSURE ROUTE [a] | | | | | | RAF - CANCER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Soil Ingestion | Soil Dermal Contact | Water Ingestion | Water Dermal Contact | Produce Ingestion | Gavage | Drinking Water | Dietary (food) | Injection | Inhalation | Dermal Contact | Dose-respons Study Type [b] | Soil Cancer Oral | Soil Cancer Dermal | Water Cancer Oral | Water Cancer Dermal | Produce Ingestion Oral | RAF Source [c] |

RAF = Relative absorption factor

VOC = Volatile organic compound

SVOC = Semivolatile organic compound

[a] Source is MADEP, 1995, unless otherwise noted.

[b] Study type for which the dose-response value is based. This information is provided in the dose-response tables.

[c] For RAF sources identified as "per MADEP, 1995", the RAF was calculated by dividing absorption efficiency for the site of exposure by the absorption efficiency for the study exposure route.
The default absorption efficiencies provided below were used if data were not located in the literature. The values for SVOCs were used as surrogates for pesticides.
All water dermal RAFs were calculated per MADEP, 1995.

[d] Dermal RAFs for PAHs derived from the results of Yang et al. (1989) and Webster et al. (1990). (See Appendix E4)

MADEP, 1995: Guidance for Disposal Site Risk Characterization, Appendix B, Section K "Absorption Efficiency".

Yang, J.J., T.A. Roy, A.J. Krueger, W. Neil and D.R. Mackerer. 1989. In Vitro and In Vivo Percutaneous Absorption of Benzo(a)pyrene from Petroleum Crude-Fortified Soil in the Rat. Bull. Environ. Contam. Toxicol. 43: 207-214.

Wester, R.D., H.I. Maibach, D.A. Bucks, L. Sedik, J. Melendres, C. Liao and S. Dizio. 1990. Percutaneous Absorption of [14C] Benzo(a)pyrene from Soil. Fundamental and Applied Toxicology. 15:510-516.

[e] No MADEP default value for the dietary route; a value of 98% dietary absorption was obtained from Risk Assessment Residential Shortform (MADEP, 1992).

| Default Absorption Efficiencies (from MADEP, 1995) | | | |
|---|---|---|---|
| Route/Medium of Exposure | VOCs | SVOCs | Inorganics |
| *SITE* | | | |
| Soil Ingestion | 0.99 | 0.91 | 0.39 |
| Soil Dermal Contact | 0.11 | 0.17 | 0.03 |
| Water Ingestion | 0.99 | 0.92 | 0.4 |
| Water Dermal Contact [a] | 1 | 1 | 1 |
| Produce Ingestion | 0.99 | 0.92 | 0.39 |
| | | | |
| *STUDY* | | | |
| Gavage (Oil) | 1 | 0.91 | NA |
| *Drinking Water* | 1 | NA | 0.55 |
| Food | NA | 0.95 | 0.21 |
| Injection | 1 | 1 | 1 |
| Inhalation | 0.91 | NA | NA |
| Dermal Contact | 0.11 | 0.14 | 0.017 |

[a] Per MADEP (1995), the RAF for dermal contact with water is calculated for an abosorbed dose. Therefore, the absorption efficiency for the site of exposure is assumed to be 100%.

# RELATIVE ABSORPTION FACTOR FOR PAHs

The dermal relative absorption factor (RAF) for soil/sediment used for PAHs is based on experimental work of Yang et al. (1989) and Wester et al. (1990). Yang et al. measured percutaneous absorption of benzo(a)pyrene (B(a)P) from pure petroleum crude and crude-soaked soils in live rats and in in vitro experiments using excised rat skin over 24-hour and 96-hour periods. Wester et al. measured percutaneous absorption of B(a)P in vivo over 24 hours using monkeys and in in vitro studies over 24 hours using viable human cadaver skin. In these studies, B(a)P is radiolabelled, and absorption is determined by measuring radioactivity in urine, feces, and/or tissue. Percent absorptions of B(a)P (where soil used as the vehicle) measured in the studies are presented in the attached Table.

In experiments of Yang and Wester, absorption was measured over a minimum of 24-hours; however, a 24-hour experiment may not be relevant to human health risk assessment. HLA will assume that humans have PAH-contaminated soil in contact with their skin for 12 hours or less and that absorption is linear over time. The RAF is defined as: absorption from soil/absorption from diet. Based on studies of Hecht et al. (1979), Mirvish et al. (1981), and Goon (1990), the average gastrointestinal absorption of B(a)P from diet as the vehicle is 86%. Using experiment results and the assumptions above, RAFs were derived. The attached table summarizes study results and RAF derivations.

The in vivo-based dermal RAF of 0.04 is used for PAHs in soil. The derived RAF of 0.04 represents the more health protective value presented in the attached table.

References:

Goon, D., N.S. Hatoum, J.D. Jernigan, S.L. Schmitt and P.J. Garvin. 1990. Abstract: Pharmacokinetics and Oral Bioavailability of Soil-Absorbed Benzo(a)Pyrene in Rats. The Toxicologist 10:218.

Hecht, S.S., W. Grabowski and K. Groth. 1979. Analysis of Feces for Benzo(a)Pyrene After Consumption of Charcoal-Broiled Beef by Rats and Humans. Cosmet. Toxicol. 17:223-227.

Mirvish, S.S., P. Ghadirian, L. Wallcave, C. Raha, S. Bronczyk and J.P. Sams. 1981. Effect of Diet on Fecal Excretion and Gastrointestinal Tract Distribution of Unmetabolized Benzo(a)Pyrene and 3-Methylcholanthrene When These Compounds Are Administered Orally to Hamsters. Cancer Research 41:2289-2293.

Wester, R.D., H.I. Maibach, D.A. Bucks, L. Sedik, J. Melendres, C. Liao and S. Dizio. 1990. Percutaneous Absorption of [14C] Benzo(a)Pyrene from Soil. Fundamental and Applied Toxicology. 15:510-516.

Yang, J.J., T.A. Roy, A.J. Krueger, W. Neil and D.R. Mackerer. 1989. In Vitro and In Vivo Percutaneous Absorption of Benzo(a)pyrene from Petroleum Crude-Fortified Soil in the Rat. Bull. Environ. Contam. Toxicol. 43: 207-214.

| Study | % Absorption from Soil Measured in Study | % Absorption Adjusted for 12-Hour Period | Derived RAF* |
|---|---|---|---|
| Yang et al. in vivo study; 24 hours | 1.10 | 0.55 | |
| Yang et al. in vivo study; 96 hours | 9.20 | 1.15 | |
| Yang et al. in vitro study; 24 hours | 1.50 | 0.75 | |
| Yang et al. in vitro study; 96 hours | 8.40 | 1.05 | |
| Wester et al. in vivo study; 24 hours | 13.2 | 6.60 | |
| Wester et al. in vitro study; 24 hours | 1.41 | 0.71 | |
| | ***Average for in vivo studies:**** | **3.88** | **0.045** |
| | ***Average for in vitro studies:*** | **0.84** | **0.01** |

* RAF = average % absorption from soil/absorption from diet
Absorption from diet is assumed to be 86%.
** Data from Yang et al. 24-hour experiment yielding an absorption from soil of 0.55% was not used in deriving RAF. Absorption at this point was only measured in urine and feces of rats. Tissue radioactivity was not measured until the 96-hour time point.

# APPENDIX O

# HUMAN HEALTH TOXICITY PROFILES

# TOXICITY PROFILES

**CPL Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

## VOLATILES

**Alkylbenzenes**. Alkylbenzenes, including compounds such as the various isomers of butylbenzene, trimethylbenzene, and propylbenzene, are common constituents of petroleum products such as gasoline, fuel oil, and mineral spirits.

Dose-response information on these compounds is limited, and the only dose-response values for this group of compounds published in IRIS or HEAST are for ethylbenzene, isopropylbenzene, and xylenes. However, the general pharmacokinetic and toxicological properties of specific compounds in this chemical group are expected to be similar to those for which considerable information is available (e.g., ethylbenzene, xylenes). Therefore, it is expected that these compounds would be readily absorbed through inhalation, oral, and dermal routes, and be distributed throughout the body. Exposures to likely result in central nervous system depression in humans, and liver, kidney, and hematopoietic system toxicity in laboratory animals. No evidence of carcinogenicity has been reported in ethylbenzene, xylenes, and isopropylbenzene in human epidemiological studies. Therefore, based on the similar structures that butylbenzenes and other alkylbenzenes have to these compounds, it is unlikely that they are carcinogenic, although chemical-specific data to support this have not been collected.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Acetone.** Acetone is found both naturally in the environment, resulting from the breakdown of fat in the body, and is also used as a solvent in manufacturing plastics, fibers, drugs, and other pharmaceuticals. Workers, occupationally exposed to acetone, complained of respiratory tract and eye irritation. At higher doses, workers reported headaches, feelings of light-headedness and confusion. The USEPA toxicity value for acetone is based on changes in liver weight and kidney toxicity observed in rats. Information on the carcinogenicity of acetone is inadequate to classify it as carcinogenic.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1993. "Toxicological Profile for Acetone"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1993.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Carbon Disulfide**. Carbon disulfide is used as a commercial fumigant and in the manufacture of soil disinfectants. It is also used as a polymerization inhibitor for vinyl chloride, and as a solvent for cleaning in the metal plating industry.

Epidemiological studies in occupationally-exposed workers suggest that carbon disulfide may produce minor neurological disfunction that does not appear to result in behavioral changes. Carbon disulfide administered orally and by inhalation produced reproductive toxicity, including increased fetal resorption rate and minor malformations, in laboratory animals. No data regarding the carcinogenicity of this chemical is available.

References:
Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Ethylbenzene**. Ethylbenzene is a naturally occurring and synthetically produced volatile hydrocarbon which is used in the manufacture of styrene and other plastics, and in gasoline, which contains approximately 2% ethylbenzene.

Ethylbenzene is readily absorbed through inhalation, oral, and dermal routes, and is distributed throughout the body. Exposures to ethylbenzene have been associated with central nervous system depression in humans, and liver, kidney, and hematopoietic system toxicity in laboratory animals. No evidence of carcinogenicity has been reported in human epidemiological studies, and animal evidence is equivocal.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Methylene Chloride.** Methylene chloride, (also known as dichloromethane) is used as a solvent, paint stripper, and is component of pesticides and other aerosol products. Acute exposure to methylene chloride can cause nose, eyes, and throat irritation via inhalation. Chronic exposure to methylene chloride can cause CNS effects include irritability, nausea, and headaches. The primary targets of this chemical are the liver and the CNS. A USEPA assessment of one study concluded that methylene chloride ingested in drinking water by mice was associated with significant increases in liver carcinoma. It has classified it as a B2, probable human carcinogen.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. "Toxicological Profile for Methylene Chloride"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, 1989.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Toluene.** Toluene is a component of gasoline, paint, lacquers, adhesives, rubber, and printing ink. It is also used as a solvent and industrial degreaser. Acute and chronic exposures to humans of toluene vapor cause eye irritation, headache, nausea, and CNS effects in humans. Acute exposures to very high concentrations can cause narcosis. Similar toxic effects have been observed in both humans and animals. The major target organ in animals is the CNS, with effects produced including impaired motor abilities, narcosis, tremors, changes in levels of brain neurotransmitters, and morphological changes. Evidence from animal studies indicate that toluene is a developmental toxin. Toluene is not thought to be a human carcinogen and has been classified in group D.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. "Toxicological Profile for Toluene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, 1989.

**Xylenes**. Xylene is a volatile organic compound that is generally composed of a mixture of the meta, ortho, and para isomers. Xylenes are used as solvents, in paints, thinners, cleaners, degreasers, and as a component in gasoline.

Xylenes are absorbed by oral, inhalation, and dermal exposures, and distribute to all tissues, particularly those with high fat contents. All three isomers produce similar effects, although the potency with which various effects are produced may vary from effect to effect with each isomer. In both humans and animals, xylene exposure has been associated with central nervous system depression, impaired learning and memory, and tremors. In humans, inhalation of xylene may produce prolonged respiratory tract inflammation and edema. In laboratory animals, exposures to xylenes have produced adverse reproductive effects, including increased fetal death rate and retarded development. There is no evidence of carcinogenicity in humans or animals.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

## SEMIVOLATILES

**Benzo(a)anthracene**. Benzo(a)anthracene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds, which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also man-made.

Benzo(a)anthracene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. It is also product of pyrolysis in tobacco smoke.

Benzo(a)anthracene has produced skin tumors in laboratory animals after dermal application. Benzo(a)anthracene produced mutations in bacteria and in mammalian cells, and transformed mammalian cells in culture. Although there are no human data that specifically link exposure to benzo(a)anthracene to human cancers, benzo(a)anthracene is a component of mixtures that have been associated with human cancer. As such, benzo(a)anthracene has been classified by USEPA as a B2, probable human carcinogen.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Benzo(a)pyrene.** Benzo(a)pyrene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. They are ubiquitous in nature and are also man made. Benzo(a)pyrene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. Human data demonstrating a causal relationship linking benzo(a)pyrene to carcinogenicity are lacking. However, multiple animal studies in many species demonstrate benzo(a)pyrene to be carcinogenic following administration by a variety of routes. The mechanism through which benzo(a)pyrene elicits its carcinogenic potential is well understood. Benzo(a)pyrene has produced positive results in numerous genotoxicity assays. Benzo(a)pyrene has been classified by the EPA as a B2, probable human carcinogen.

References:
ATSDR, 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1989.

Clayton, George D. and Florence E. Clayton, editors, 1981. Patty's Industrial Hygiene and Toxicology, 3rd Revised Edition; John Wiley & Sons; New York.

United States Environmental Protection Agency. Integrated Risk Information System (IRIS), 1993.

**Benzo(b)fluoranthene**. Benzo(b)fluoranthene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also man-made. Benzo(b)fluoranthene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material.

Although there are no human data that specifically link exposure to benzo(b)fluoranthene to human cancers, benzo(b)fluoranthene is a component of mixtures that have been associated with human cancer. These include coal tar, soots, coke oven emissions, and cigarette smoke. Benzo(b)fluoranthene produced tumors in mice after lung implantation, intraperitoneal, subcutaneous injection, and skin painting. Benzo(b)fluoranthene has produced positive results in several genotoxicity assays. It has been classified as a B2, probable human carcinogen, by the USEPA.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Benzo(k)fluoranthene**. Benzo(k)fluoranthene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds, which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also man-made. Benzo(k)fluoranthene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material.

Although there are no human data that specifically link exposure to benzo(k)fluoranthene to human cancers, benzo(k)fluoranthene is a component of mixtures that have been associated with human cancer. These include coal tar, soots, coke oven emissions, and cigarette smoke. Benzo(k)fluoranthene produced tumors after lung implantation in

mice and when administered with a promoting agent in skin-painting studies. Benzo(k)fluoranthene is mutagenic in bacteria. Benzo(k)fluoranthene has been classified by USEPA as a B2, probable human carcinogen.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Benzo(g,h,i)perylene**. Benzo(g,h,i)perylene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also man-made. They occur naturally in coal tar, crude oil, and are formed from incomplete combustion of organic material.

There are no available data regarding human exposures. There are inadequate animal data from lung implant, skin-painting, and subcutaneous injection bioassays. The USEPA has determined that benzo(g,h,i)perylene is not classifiable as to human carcinogenicity, and has assigned it to class D.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Bis(2-ethylhexyl)phthalate (DEHP)**. DEHP is used industrially as a plasticizer for resins and is found in many plastic materials as it makes them more flexible. It is also used in manufacturing organic pump fluids in electrical capacitors. Acute exposure to DEHP has produced eye and mucous membrane irritation, nausea, and diarrhea. Chronic exposure of laboratory animals to DEHP indicate that the target organs are the liver, causing morphological and biochemical changes, as well as the testes, producing damage to the seminiferous tubules. DEHP has produced developmental and reproductive effects in laboratory animals including spina bifida and reduced fertility. DEHP has been shown to cause a dose-related increase in liver tumors in mice and rats. Thus, the USEPA has designated DEHP as a B2, probable human carcinogen.

References:
ATSDR, 1991. Toxicological Profile for Di(2-ethylhexyl)phthalate. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1991.

**Chrysene**. Chrysene is one of the polycyclic aromatic hydrocarbon (PAH) compounds, which are formed during the combustion of organic material. Although there are no human data that specifically link exposure to chrysene to human cancers, chrysene is a component of mixtures that have been associated with human cancer. These include coal tar, soots, coke oven emissions, and cigarette smoke. Chrysene produced chromosomal abnormalities in hamsters and mouse germ cells after gavage exposure, produced positive responses in bacterial gene mutation assays, and transformed mammalian cells exposed in culture. Due to its similarity to benzo(a)pyrene and other carcinogenic PAHs, chrysene has been classified as a B2, probable human carcinogen.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Fluoranthene.** Fluoranthene is one of the polycyclic aromatic hydrocarbon (PAH) compounds, which are formed during the combustion of organic material. Although there are no human data that specifically link exposure to fluoranthene to human cancers, fluoranthene is a component of mixtures that have been associated with human cancer. It is a constituent of coal tar and petroleum-derived asphalt. No data regarding human exposure are available, and animal data suggest that fluoranthene is not carcinogenic. Fluoranthene has been classified by the USEPA as a D carcinogen.

References:
ATSDR, 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1989.

**Indeno(1,2,3-cd)pyrene**. Indeno(1,2,3-c,d)pyrene is one of the polycyclic aromatic hydrocarbon (PAH) compounds, which are formed during the combustion of organic material, and is a component of cigarette smoke and smoke-stack emissions. No carcinogenicity data specifically for indeno(1,2,3-c,d)pyrene are available in humans; however, toxic effects are attributable to mixtures of PAHs. Animal studies indicate that indeno(1,2,3-c,d)pyrene can induce skin tumors in mice, and may have some immunosuppressive effects. In mammalian cell cultures, indeno(1,2,3-c,d)pyrene was found to be genotoxic. It has been classified by the USEPA as a B2 carcinogen.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Naphthalene**. Naphthalene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds, which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also man-made. Naphthalene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. It is also product of pyrolysis in tobacco smoke. Naphthalene is used for the production of phthalic anhydride, which is used for the production of plasticizers. Naphthalene is also used in moth balls, for the production of the insecticide carbaryl, and in numerous resins, dyes, pharmaceuticals, and other organic materials.

Naphthalene is absorbed through the inhalation, oral, and dermal routes, and appears to be more toxic to humans than laboratory animals. The principal toxic effect of naphthalene in humans and animals is hemolysis of red blood cells, which can lead to anemia, decreased oxygen-carrying capacity, and jaundice. Humans pre-disposed to anemia, such as those with G6DP enzyme deficiency, may be particularly sensitive to naphthalene toxicity. Exposure to naphthalene has also been correlated with increased risk of cataract formation. Animal studies were negative for naphthalene reproductive toxicity. Although no human epidemiological data are available for assessing naphthalene carcinogenicity, animal data investigating naphthalene toxicity are equivocal. The USEPA has placed naphthalene in weight-of-evidence Group D, not classifiable as to human carcinogenicity.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1990. "Toxicological Profile for Naphthalene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October, 1990.

**Phenanthrene**. Phenanthrene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds, which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also man-made. Phenanthrene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material.

Phenanthrene has been shown to be a skin photosensitizer in humans. Intraperitoneally injection in rats produced liver effects. Although limited evidence exists that phenanthrene is a mutagen, the majority of tests have proved negative. Equivocal evidence exists for cancer after dermal application of phenanthrene in rats. Ingestion of 200 mg of phenanthrene produced no tumors in rats after two months.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Phenol**. Phenol is a man-made aromatic chemical that is used extensively in the production of numerous products, including a wide variety of aromatic compounds, explosives, fertilizers, paints, rubber, plastic, and textiles.

Phenol is readily absorbed through ingestion, dermal, and inhalation exposures, and is rapidly distributed to tissues. Exposure to phenol can produce adverse effects on the central nervous system, including loss of consciousness and acute respiratory failure. Phenol can also cause severe burning of the mouth and throat if swallowed. Current genotoxicity and cancer studies on phenol are inadequate or inconclusive to allow a determination of the potential carcinogenicity of this chemical at this time.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Pyrene.** Pyrene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds which contain two or more aromatic rings. They are ubiquitous in nature and are also man-made. Pyrene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. Pyrene is reported to be a skin irritant to humans. Rats administered pyrene exhibited blood chemistry changes, as well as liver and kidney damage. Pyrene was shown to be inactive as an initiating agent and thus has been classified by the USEPA as a D carcinogen.

References:
ATSDR, 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1989.

## INORGANICS

**Antimony**. Antimony enters the environment during the mining and processing of its ores and other related compounds. Small amounts of antimony are also released into the environment by incinerators and coal burning power plants. Antimony will strongly adhere to soil which contains iron, manganese, or aluminum. Antimony was used for medicinal purposes to treat people infected with parasites. However, chronic exposure can cause eye, skin, and lung irritation, as well as heart problems, vomiting and diarrhea. The oral RfD, based on an oral drinking water study in rats, showed changes in glucose and cholesterol metabolism. Antimony has not been evaluated by the USEPA for evidence of human carcinogenic potential.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Antimony"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1991.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Arsenic**. Arsenic has been used in pesticide formulations and has industrial uses in tanneries, as well as the glass and wine making industries. Toxicity depends on its chemical form. Arsenic is an irritant of the skin, mucous membranes, and gastrointestinal tract. Symptoms of acute toxicity include vomiting, diarrhea, convulsions, and a severe drop in blood pressure. Subchronic effects include hyperpigmentation, sensory-motor polyneuropathy, persistent headache, and lethargy. Chronic oral exposure has caused skin lesions, peripheral vascular disease, and peripheral neuropathy. The USEPA has classified arsenic in Group A, human carcinogen, based on increased incidence of lung cancer in occupational studies.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1992. "Toxicological Profile for Arsenic"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1992.

**Barium.** Barium is used in paints, soap, paper, rubber, and in the manufacture of glass. Some compounds of barium have been used as insecticides. Acute exposure to barium through ingestion can cause gastroenteritis, muscular paralysis, as well as cardiovascular effects. Chronic inhalation of barium containing dust can cause a reversible, benign pneumoconiosis. There is no evidence for carcinogenicity for barium.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

**Cadmium**. Cadmium is commonly used in electroplating and galvanizing due to its non-corrosive properties. It is a local respiratory tract irritant following exposure to cadmium dust or fumes. Acute exposure to cadmium dust/fumes may produce an acute chemical pneumonitis. Acute, oral exposure to cadmium results in nausea, vomiting, salivation,

abdominal pain, cramps, and diarrhea. Chronic exposure to cadmium results in osteomalacia and osteoporosis (Itai-Itai disease) secondary to renal damage. The USEPA has classified cadmium as a B1 carcinogen via inhalation based on epidemiological data from Japan and China.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Chromium**. Chromium has been used in plating for corrosion resistance and decorative purposes, in the manufacture of alloys and chemicals, and in printing, dying, and photography. The toxicity of chromium depends upon its valence state. Hexavalent chromium is more toxic via inhalation than trivalent chromium. The effects of inhalation exposure to hexavalent chromium include ulcers of the upper respiratory tract, nasal inflammation, perforation of the nasal septa and lung cancer. There is epidemiological evidence of an association between chromium and lung cancer. Therefore, USEPA has classified hexavalent chromium as a Class A, human carcinogen, by the inhalation route. Most trivalent chromium compounds are inactive in short-term genotoxicity assays. Trivalent chromium compounds have not been found to be carcinogenic by any route of exposure. Exposure to trivalent chromium compounds is primarily associated with irritation of the skin or gastrointestinal tract, and inflammation of the liver.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

United States Environmental Protection Agency. Integrated Risk Information System (IRIS), 1993.

**Copper**. Copper is widely distributed in nature and is an essential element. Copper deficiency is characterized by anemia and is used for medicinal purposes as an emetic and an astringent. Acute exposure to copper ingestion causes vomiting, hematesis, hypotension, coma, and jaundice. Chronic exposure of children to elevated concentrations of copper causes liver cirrhosis. Copper is not believed to be a human carcinogen.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

**Lead.** Lead is used as a component in storage batteries and was widely used in gasoline and paints. It is the most ubiquitous toxic metal in the environment. The most serious effects of chronic exposure are encephalopathy, renal damage, and changes in the hematopoietic system, which is the most sensitive indicator of lead exposure. Peripheral nerve dysfunction is observed in adults at blood lead levels of 30 to 50 mg/dL-blood. The nervous systems of children are reported to be affected at levels of 15 mg/dL-blood (Benignus and others, 1981). Chronic lead exposure by workers through inhalation has resulted in statistically significant increases in tumors. Oral exposures of lead salts in animals has been shown to increase tumor formation.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Benignus, V.A., Otto, D.A., Muller, K.E., Seiple, K.J., 1981. "Effects of Age and Body Lead Burden on CNS Function in Young Children. II:EEG Spectra." Electroencephalograph. Clin. Neurophysiol. 52:240-248.

**Mercury**. Mercury has been used in the past for medicinal purposes, however, occupational exposure to mercury can occur during mining, smelting, chloralkali production, and in the manufacturing of mercury containing products. There are three forms in which mercury can exist: elemental, inorganic, and organic. Its chemical form determines its toxicity. Metallic mercury causes behavioral effects and other nervous system damage. Inorganic mercury salts will produce

kidney damage. Organic mercury compounds target the CNS. Most organic mercury compounds that contaminate the environment produce a toxic neuroencephalopathy (paresthesias, ataxia, spasticity, tremor, mental status changes, learning defects and neurasthenic symptoms). Some organic mercury compounds readily break down in the body to inorganic compounds and thus produce toxicity similar to that produced by organic mercury compounds. Some studies have indicated that mercury is genotoxic. It has not been classified as to carcinogenicity by the USEPA.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

**Nickel**. Nickel is a natural element of the earth's crust. Toxic effects of nickel occur mainly through the inhalation route. Nickel is emitted into the air through fossil fuel combustion, incinerators, metallurgy, chemical manufacturing, cement manufacturing, and nickel recovery. Nickel exposure can cause dermatitis and eczema-like lesions at high exposure levels likely to occur only in the work place. The major adverse effects seen in man are dermatitis, chemical pneumonitis, and lung and nasal cancers. Rats fed nickel in their diets showed on adverse effects in three generations infertility, gestation, viability, or lactation. Occupational studies indicate that nickel is a carcinogen via inhalation but there is no evidence that it is a carcinogen in mammals through ingestion or dermal exposure (USEPA, 1985).

References:
United States Environmental Protection Agency (USEPA), 1985. "Health Effect Assessment Document for Nickel." Office of Research and Development. Office of Emergency and Remedial Response.

**Selenium**. Selenium is a naturally occurring element which is essential to the biological functions of living systems. Selenium deficiency can cause cardiomyopathy and "white muscle disease," a form of nutritionally induced muscular dystrophy. The oral RfD is based on an epidemiological study of populations in China exposed to elevated dietary concentrations of selenium. The main symptoms of chronic selenosis are brittle hair and nails, skin lesions, and some neurological symptoms including peripheral anesthesias, pain, and hyperflexia. Animal experiments have shown a loss of fertility and an increase in congenital defects. It has not been classified by the USEPA as to carcinogenicity as it is probably not a human carcinogen.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

**Silver**. Silver is used in photographic processes, electrical products, batteries, paints, dental amalgam, and in medical supplies for burn treatment. Studies in humans and animals indicate that silver is absorbed readily via inhalation and oral exposure, and distributes widely throughout the body. As is the case with many metals, occupational exposure to silver dusts can produce respiratory irritation. However, the most profound effect from long term exposure to silver is a gray to blue-gray discoloration of the skin (argyria). Although this condition has not been associated with any other adverse effects, it is irreversible and can result from all routes of chronic exposures to silver. No data were located regarding cancer in humans or animals following inhalation, oral, or dermal exposures.

References:
ATSDR, 1989. Toxicological Profile for Silver. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1989

**Thallium**. Thallium is a naturally occurring soft metal that is a minor constituent in a variety of ores and is obtained as a by-product of the refining of iron, cadmium, and zinc. It is used as a catalyst, in certain alloys, jewelry, thermometers, semiconductors, dyes and pigments, and optical lenses. It has been used medically as a depilatory agent. Additionally, it is used as a rodenticide and insecticide. Thallium is efficiently absorbed from the gastrointestinal tract. Excretion occurs primarily through urine and feces. Following absorption, distribution occurs to kidney tissue to a large extent, with lesser distribution to thyroid, intestines, testes, pancreas, skin, bone, and spleen.

Thallium is one of the more toxic metals. Acute toxicity results in gastrointestinal irritation, shock, ascending paralysis, seizures, and psychic disturbances. Signs of subacute or chronic thallium poisoning include hair loss, nail dystrophy, cataracts, peripheral muscular weakness and atrophy, chorea, peripheral neuropathy, and kidney damage. Loss of vision have been related to industrial thallium exposures. No information is available which addresses the carcinogenic potential of thallium.

References:

Goyer, R.A., 1991. Toxic Effects of Metals. In: Casarett and Doull's Toxicology: The Basic Science of Poisons, 3rd edition. Eds. C.D. Klaassen, M.O. Amdur and J. Doull. Macmillan Publishing Co. N.Y.

Tweig, M., 1990. Thallium. In: Poisoning and Drug Overdose. Ed. K.R. Olson. Appleton & Lange, CT. pps. 276-7.

**Zinc**. The most common use of zinc is as a protective coating for other metals. Zinc is emitted into the air during mining, refining, manufacturing, and combustion of zinc-containing materials. Zinc is an essential trace element and is found in many foods. Zinc compounds are of relatively low toxicity via ingestion, however, ingestion may result in gastrointestinal distress and diarrhea. Metal fume fever results from occupational inhalation of fumes of zinc oxide whose symptoms include chills, fever, and profuse sweating. There is no evidence that zinc is a carcinogen.

References:

Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

**Ammonia**. Ammonia is a colorless gas with a very sharp odor. It is composed of nitrogen and hydrogen. The odor is familiar to most people because ammonia is used in smelling salts, household cleaners, and window cleaning products. Ammonia easily dissolves in water. In water, most of the ammonia changes to ammonium cation, which is not a gas and does not smell. Ammonia and ammonium cation can change back and forth in water as a function of pH. In wells, rivers, lakes, and wet soils with a pH < 8, the ammonium cation is the only form present.

Ammonia is a chemical that is both naturally occurring and manmade. Manmade ammonia is used in fertilizers and manufacturing processes, and is sometimes used as a refrigerant. Ammonia is also used with chlorine to form chloramine, which is used to treat and disinfect drinking water.

Concentrated solutions of ammonia can cause burns to the skin if contacted, burns and ulceration of the gastrointestinal tract if swallowed, and irritation and burning in the lungs if vapors are inhaled. Ammonia is not known to affect specific target organs; most adverse effects are associated with secondary effects, such as infection and weight loss, which are not directly attributable to exposures to ammonia. In general, these effects occur after exposure to high concentrations. No data were found in the available literature on the chronic toxicity to humans of ammonia following oral administration. The carcinogenic potential of ammonia has not been established in animals or humans.

Reference:

Agency for Toxic Substances and Disease Registry (ATSDR), 1990. "Toxicological Profile for Ammonia." Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. December.

**Nitrate/Nitrite**. Nitrate ($NO_3$) and nitrite ($NO_2$) are naturally occurring ions that are part of the nitrogen cycle. They are produced from the natural decomposition of organic matter (e.g., livestock waste, urban sewage, compost), and are also present at high concentrations in commercial fertilizers. Nitrates and nitrites are also present naturally in some vegetables, and are added as sodium nitrate and sodium nitrite as a preservative to some meats.

Nitrates and nitrites are rapidly and completely absorbed in the gastrointestinal tract. Once absorbed, nitrates are converted to nitrites. The toxicity of nitrate in humans is due to the body's reduction of nitrate to nitrite. Nitrites (and nitrates to a lesser extent) can oxidize iron in blood hemoglobin. This interaction causes methemoglobinemia ("blue baby" syndrome), which is the primary toxic effect associated with nitrate and nitrite exposure. Infants under 4 months old and people with congenital methemoglobinemia are particularly sensitive to the effects of nitrate and

nitrite because their bodies cannot detoxify nitrates and nitrites as efficiently. Methemoglobinemia is reversible, and will naturally dissipate when exposures to nitrates and nitrites are decreased. Nitrates and nitrites have not been shown to produce cancer in laboratory animals or humans.

References:
ATSDR, 1991. "Case Studies in Environmental Medicine, Nitrate/Nitrite Toxicity" Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October.

## VPH/EPH FRACTIONS

Chemical surrogates were chosen to represent the different aliphatic and aromatic fractions of TPH. Appropriate surrogates are referenced below for each fraction.

**C5-C8 Aliphatics.** n-Hexane is the reference compound for the TPH fraction containing C5-C8 alkanes/cycloalkanes. Through epidemiological studies on n-hexane-exposed workers, sensorimotor polyneuropathy has been observed as the main toxic effect of long-term exposure. Other noted effects include cranial neuropathy, blurred vision, and abnormal color vision. The onset of symptoms may be delayed for several months to a year after exposure. Affected individuals may recover completely, but some may retain sensorimotor deficits. A number of animal studies have been conducted that document n-hexane's neuropathic effects.

Reference:
MADEP, 1994. Interim Final Petroleum Report: Development of Health-Based Alternative to the Total Petroleum Hydrocarbon (TPH) Parameter. August.

**C9-C12 Aliphatics.** See profile for n-Hexane provided for C5-C8 Aliphatics above.

**C9-C18 Aliphatics.** See profile for n-Hexane provided for C5-C8 Aliphatics above.

**C19-C36 Aliphatics.** See profile for n-Hexane provided for C5-C8 Aliphatics above.

**C9-C10 Aromatics.** See profiles for xylene and pyrene.

**C10-C22 Aromatics.** See profiles for naphthalene and pyrene.

# APPENDIX P

# HUMAN HEALTH HOT SPOT ANALYSIS

**MCP Hot Spot Analysis**

Consistent with the MCP (310 CMR 40.0924) and the Guidance For Disposal Site Risk Characterization (MADEP, 1995), discrete areas that meet the MCP definition of a hot spot (310 CMR 40.0006) may be evaluated as individual exposure points for the purposes of comparisons to Upper Concentration Limits (UCLs) and human health exposure assessment. A hot spot is identified based on concentrations of OHM within a contaminated area and the spatial pattern of the concentrations. In all cases, a discrete area where the average concentration of an OHM is greater than 100 times the average concentration in the immediate surrounding area shall be considered a hot spot. Discrete areas where the concentration difference is greater than 10 but less than 100 shall be considered a hot spot unless there is no evidence that the discrete area would be associated with greater exposure potential than the surrounding area. In addition, a discrete area where the average thickness of non-aqueous phase liquid (NAPL) is greater than ten-times the average thickness in the surrounding area is a hot spot.

To evaluate the existence of potential hot spots in soils 0-15 feet bgs, groundwater, sediment and surface water site-wide, potential hot spot analytes were identified. Potential hot spot areas that might represent discrete areas of elevated concentrations were then identified. The overall process used to delineate hot spot areas is described below.

- Maximum OHM concentrations in **soil 0-15 feet bgs and groundwater** were compared to applicable Method 1 Standards. According to the MCP, in no case shall concentrations of OHM equal to or less than an applicable Method 1 standard be considered indicative of a hot spot (310 CMR 40.0006). Analytes with concentrations above Method 1 standards (or which have no standards) were evaluated further. This step does not apply to sediment and surface water; Method 1 Standards are not available for these media.

- Data summaries for **soils 0-15 feet bgs, groundwater, sediment, and surface water** were reviewed to identify analytes with wide ranges of analytical results.

A wide range would generally be more than a 10-fold difference between minimum and maximum detected concentrations or more than a 100-fold difference between the maximum detected concentration and the lower end of the range of sample quantitation limits for non-detects (for analytes with relatively low frequency of detection).

Analytes with concentrations above Method 1 standards (if applicable) and wide ranges of analytical results, identified as potential hot spot analytes, were carried through the remainder of the hot spot analysis. Potential hot spot analytes identified in Tables 1 through 4.

- Potential hot spot areas in media were delineated by identifying the sample locations with the highest concentrations of each potential hot spot analyte, identifying sampling locations that might represent discrete areas of elevated concentrations (while also considering known or suspected sources of OHM release), and plotting those areas on a figure.

- Areas were confirmed as hot spots if the potential hot spot represented a discrete area where OHM concentrations are greater than 100 times the average concentration in the immediate surrounding area.

***Soil***

Table 1 shows the identification of potential hot spot OHM in soils 0-15 ft bgs at the Site. As shown in Table 1, six OHM were detected in soil at concentrations that span more than one order of magnitude. A review of the analytical data revealed that the highest concentrations of these OHM were detected in samples B5-SS1, BRSWSB15, and BRSWSB19. These locations are co-located in the vicinity of the former UST. Concentrations of the six potential hot spot OHM were either not detected or were detected at concentrations approximately 100-times lower in the surrounding samples. Therefore, the volume of soil defined by samples B5-SS1, BRSWSB15, and BRSWSB19 was determined to be a soil hot spot.

***Groundwater***

Table 2 shows the hot spot evaluation for groundwater at the Site. As shown in Table 2, no potential hot spot OHM were identified because detected concentrations either did not exceed the applicable Method 1 standards or there was less than a 10-fold difference between detected concentrations and/or SQLs. Therefore, no groundwater hot spots were identified.

***Surface Water***

Table 3 shows the hot spot evaluation for surface water at the Site. As shown in Table 3, chromium, copper, and lead were detected at concentrations that spanned more than one order of magnitude. A review of the analytical data for these OHM revealed that the highest concentrations were detected in samples BBSS2 and BRSWSW04, which are located downstream of the stormwater drainage outfall. However, concentrations in nearby samples were within 100-times the concentrations detected in these two locations. Therefore, a discrete area with concentrations at least 100-times the surrounding area could not be defined; no hot spots in surface water were identified

***Sediment***

Table 4 shows the hot spot evaluation for sediment at the Site. As shown in Table 4, lead was detected at concentrations that spanned more than one order of magnitude. A review of the analytical data for lead revealed a similar pattern to the lead detections in surface water: the highest concentrations were detected in samples BBSS2 and BRSWSW04, which are located downstream of the stormwater drainage outfall. However, concentrations in nearby samples were within 100-times the concentrations detected in

these two locations. Therefore, a discrete area with concentrations at least 100-times the surrounding area could not be defined; no hot spots in sediment were identified

*Table 1*

**Summary Statistics for Soil Samples (0-15 ft) and Identification of Potential Hot Spot OHM**

**CPL Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

| OHM of Concern | Frequency of Detection [1] | Range of SQLs | Range of Detected Concentrations | Arithmetic Mean | S-1/GW2 Standard | S-1/GW-3 Standard | Potential Hot Spot OHM?[2] | Maximum > 10x Minimum conc?[3] | Does a Hot Spot Exist? [4] |
|---|---|---|---|---|---|---|---|---|---|
| **VOCs (mg/kg)** | | | | | | | | | |
| 1,2,4,-Trimethylbenzene | 1 / 15 | 0.0043 : 0.0074 | 0.23 - 0.23 | 0.018 | | | Yes | Yes | Yes [5] |
| 1,3,5-Trimethylbenzene | 1 / 15 | 0.0043 : 0.0074 | 0.038 - 0.038 | 0.0051 | | | Yes | No | |
| 4-isopropyltoluene | 1 / 15 | 0.0043 : 0.0074 | 0.044 - 0.044 | 0.0055 | | | Yes | Yes | Yes [5] |
| Acetone | 11 / 15 | 0.021 : 0.024 | 0.018 - 0.2 | 0.038 | 60 | 60 | No | | |
| Ethylbenzene | 1 / 27 | 0.0043 : 0.048 | 0.0021 - 0.0021 | 0.010 | 500 | 500 | No | | |
| Isopropylbenzene | 1 / 15 | 0.0043 : 0.0074 | 0.036 - 0.036 | 0.0050 | | | Yes | No | |
| m,p-Xylene | 1 / 27 | 0.0043 : 0.048 | 0.019 - 0.019 | 0.011 | 500 | 500 | No | | |
| Methylene Chloride | 5 / 15 | 0.021 : 0.034 | 0.014 - 0.025 | 0.015 | 100 | 100 | No | | |
| n-Propylbenzene | 1 / 15 | 0.0043 : 0.0074 | 0.069 - 0.069 | 0.0072 | | | Yes | Yes | Yes [5] |
| o-Xylene | 1 / 27 | 0.0043 : 0.048 | 0.0046 - 0.0046 | 0.010 | | | Yes | No | |
| sec-Butylbenzene | 1 / 15 | 0.0043 : 0.0074 | 0.075 - 0.075 | 0.0076 | | | Yes | Yes | Yes [5] |
| Toluene | 1 / 27 | 0.0042 : 0.048 | 0.021 - 0.021 | 0.010 | 500 | 500 | No | | |
| **SVOCs (mg/kg)** | | | | | | | | | |
| Benzo(b)fluoranthene | 4 / 27 | 0.265 : 0.3 | 0.081 - 0.13 | 0.13 | 0.7 | 0.7 | No | | |
| Chrysene | 3 / 27 | 0.265 : 0.33 | 0.08 - 0.11 | 0.13 | 7 | 7 | No | | |
| Fluoranthene | 6 / 27 | 0.265 : 0.3 | 0.069 - 0.16 | 0.13 | 1000 | 1000 | No | | |
| Naphthalene | 1 / 27 | 0.0043 : 0.048 | 0.19 - 0.19 | 0.017 | 100 | 100 | No | | |
| Phenanthrene | 4 / 27 | 0.265 : 0.35 | 0.065 - 0.3 | 0.14 | 1000 | 100 | No | | |
| Pyrene | 6 / 27 | 0.265 : 0.3 | 0.072 - 0.14 | 0.13 | 700 | 700 | No | | |
| **Inorganics (mg/kg)** | | | | | | | | | |
| Antimony | 7 / 15 | 5.2 : 6.1 | 0.7 - 20 | 3.3 | 10 | 10 | Yes | Yes | Yes [5] |
| Chromium | 30 / 30 | : | 3.4 - 30 | 10 | 1000 | 1000 | No | | |
| **Other (mg/kg)** | | | | | | | | | |
| TPH | 10 / 16 | 10 : 10 | 13 - 1800 | 128 | 800 | 800 | Yes | Yes | Yes [5] |
| C11-C22 Aromatic | 1 / 20 | 53 : 73 | 45.5 - 45.5 | 29 | 800 | 800 | No | | |
| C19-C36 Aliphatic | 3 / 20 | 53 : 73 | 56.5 - 71 | 33 | 2500 | 2500 | No | | |
| C9-C10 Aromatic | 1 / 20 | 0.32 : 1 | 1.7 - 1.7 | 0.34 | 100 | 100 | No | | |
| C9-C12 Aliphatic | 1 / 20 | 0.32 : 1 | 1.4 - 1.4 | 0.32 | 1000 | 1000 | No | | |
| | | | | | | | | | |

## Table 1
## Summary Statistics for Soil Samples (0-15 ft) and Identification of Potential Hot Spot OHM

### CPL Gordon Craig US Army Reserve Center
### Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix A.
Duplicate samples were averaged with their original samples prior to calculation of summary statistics.
The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[2] If maximum detected concentration exceeds Method 1 standard, then OHM is considered a potential hot spot OHM.
By definition, if the concentration is below the applicable Method 1 Standard, there cannot be a hot spot. The selection of potential hot spot OHM is first step of the hot spot identification process.

[3] Potential hot spot analytes are further reviewed by comparing the maximum and minimum detected concentrations (or the detected concentration to the lowest SQL). More than a 10-fold difference in concentrations is indicative of a potential hot spot. These OHM are further evaluated to determine if a hot spot is present.

[4] A hot spot is present if a potential hot spot OHM is detected in a discrete area at concentrations 100-times greater than concentrations in the surrounding area.
This is determined by reviewing the spatial distribution of the reported concentrations.

[5] Concentrations of these OHM in samples B5-SS1, BRSWSB15 and/or BRSWSB19 are more than 100-times greater than the concentrations in the surrounding samples.

OHM = Oil or Hazardous Material
SQL = Sample Quanitation Limit
NA = Not Available/Not Applicable

*Table 2*
**Summary Statistics for Groundwater and Identification of Potential Hot Spot OHM**

**CPL Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

| OHM of Concern | Frequency of Detection [1] | Range of SQLs | Range of Detected Concentrations | Arithmetic Mean | S1/GW-2 Standard | S-1/GW-3 Standard | Potential Hot Spot OHM?[2] | Maximum > 10x Minimum conc?[3] | Does a Hot Spot Exist? [4] |
|---|---|---|---|---|---|---|---|---|---|
| **VOCs (mg/L)** | | | | | | | | | |
| 1,2,4-Trimethylbenzene | 2 / 15 | 0.002 : 0.002 | 0.000635 - 0.001 | 0.00098 | | | Yes | No | No [5] |
| 1,3,5-Trimethylbenzene | 1 / 15 | 0.002 : 0.002 | 0.0006 - 0.0006 | 0.00097 | | | Yes | No | No [5] |
| 4-isopropyltoluene | 1 / 11 | 0.002 : 0.002 | 0.00092 - 0.00092 | 0.00099 | | | Yes | No | No [5] |
| Isopropylbenzene | 1 / 15 | 0.002 : 0.002 | 0.0003 - 0.0003 | 0.00095 | | | Yes | No | No [5] |
| m,p-Xylene | 1 / 15 | 0.002 : 0.002 | 0.0007 - 0.0007 | 0.00098 | 6 | 50 | No | | |
| Methyl tert-butyl ether (MTBE) | 1 / 11 | 0.002 : 0.002 | 0.00375 - 0.00375 | 0.0013 | 50 | 50 | No | | |
| n-Propylbenzene | 1 / 11 | 0.002 : 0.002 | 0.00054 - 0.00054 | 0.00096 | | | Yes | No | No [5] |
| sec-Butylbenzene | 2 / 15 | 0.002 : 0.002 | 0.0006 - 0.00835 | 0.0015 | | | Yes | No | No [5] |
| Toluene | 10 / 15 | 0.002 : 0.002 | 0.00054 - 0.00705 | 0.0023 | 6 | 50 | No | | |
| **SVOCs (mg/L)** | | | | | | | | | |
| Naphthalene | 1 / 15 | 0.002 : 0.002 | 0.003 - 0.003 | 0.0011 | 6 | 6 | No | | |
| Phenol | 7 / 15 | 0.01 : 0.01 | 0.0018 - 0.0385 | 0.0080 | 50 | 30 | No | | |
| **Inorganics (mg/L)** | | | | | | | | | |
| Barium, dissolved | 8 / 14 | 0.01 : 0.29 | 0.01 - 0.34 | 0.14 | | 30 | No | | |
| Chromium, dissolved | 3 / 14 | 0.001 : 0.01 | 0.0025 - 0.0036 | 0.0033 | | 2 | No | | |
| Thallium, dissolved | 1 / 4 | 0.001 : 0.001 | 0.002 - 0.002 | 0.00088 | | 0.4 | No | | |
| Zinc, dissolved | 3 / 4 | 0.01 : 0.01 | 0.01 - 0.018 | 0.011 | | 0.9 | No | | |
| **Other (mg/L)** | | | | | | | | | |
| Ammonia | 2 / 4 | 0.05 : 0.05 | 0.06 - 0.11 | 0.055 | | | Yes | No | No [5] |
| Nitrate-Nitrite-N | 3 / 4 | 0.05 : 0.05 | 0.08 - 0.52 | 0.24 | | | Yes | No | No [5] |
| C11-C22 Aromatic | 1 / 2 | 0.1 : 0.1 | 0.355 - 0.355 | 0.20 | 50 | 30 | No | | |
| C19-C36 Aliphatic | 2 / 2 | : | 0.1 - 0.145 | 0.12 | | 20 | No | | |
| C9-C18 Aliphatic | 1 / 2 | 0.1 : 0.1 | 0.535 - 0.535 | 0.29 | 1 | 20 | No | | |
| C9-C10 Aromatic | 1 / 2 | 0.025 : 0.025 | 0.053 - 0.053 | 0.033 | 5 | 4 | No | | |
| C9-C12 Aliphatic | 1 / 2 | 0.025 : 0.025 | 0.141 - 0.141 | 0.077 | 1 | 20 | No | | |
| | | | | | | | | | |

## Table 2
## Summary Statistics for Groundwater and Identification of Potential Hot Spot OHM

### CPL Gordon Craig US Army Reserve Center
### Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix A.
Duplicate samples were averaged with their original samples prior to calculation of summary statistics.
The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[2] If maximum detected concentration exceeds Method 1 standard, then OHM is considered a potential hot spot OHM.
By definition, if the concentration is below the applicable Method 1 Standard, there cannot be a hot spot. The selection of potential hot spot OHM is first step of the hot spot identification process.

[3] Potential hot spot analytes are further reviewed by comparing the maximum and minimum detected concentrations (or the detected concentration to the lowest SQL). More than a 10-fold difference in concentrations is indicative of a potential hot spot. These OHM are further evaluated to determine if a hot spot is present.

[4] A hot spot is present if a potential hot spot OHM is detected in a discrete area at concentrations 100-times greater than concentrations in the surrounding area.
This is determined by reviewing the spatial distribution of the reported concentrations.

[5] A hot spot is not present if the minimum and maximum detected concentrations differ by less than 10-fold.

OHM = Oil or Hazardous Material
SQL = Sample Quanitation Limit
NA = Not Available/Not Applicable

**Table 3**
**Summary Statistics for Surface Water and Identification of Potential Hot Spot OHM**

**CPL Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

| OHM of Concern | Frequency of Detection [1] | Range of SQLs | Range of Detected Concentrations | Arithmetic Mean | Maximum > 10x Minimum conc?[3] | Does a Hot Spot Exist? [4] |
|---|---|---|---|---|---|---|
| **VOCs (mg/L)** | | | | | | |
| Carbon disulfide | 1 / 4 | 0.002 : 0.002 | 0.00081 - 0.00081 | 0.00095 | No | |
| **SVOCs (mg/L)** | | | | | | |
| bis(2-ethylhexyl) phthalate | 2 / 6 | 0.01 : 10 | 0.0013 - 0.004 | 0.01 | Yes | No [5] |
| **Inorganics (mg/L)** | | | | | | |
| Antimony | 4 / 6 | 0.005 : 0.005 | 0.0025 - 0.013 | 0.0043 | No | |
| Arsenic | 1 / 6 | 0.005 : 0.025 | 0.01 - 0.01 | 0.010 | No | |
| Barium | 4 / 6 | 0.2 : 0.2 | 0.04 - 0.15 | 0.083 | No | |
| Cadmium | 2 / 6 | *0.0005* : *0.0025* | *0.00225* - *0.028* | *0.0054* | No | |
| Chromium | 3 / 6 | 0.001 : 0.01 | 0.0027 - 0.061 | 0.013 | Yes | No [5] |
| Copper | 2 / 2 | : | 0.02 - 0.33 | 0.18 | Yes | No [5] |
| Lead | 4 / 6 | 0.005 : 0.005 | 0.005 - 0.43 | 0.079 | Yes | No [5] |
| Mercury | 2 / 6 | 0.0002 : 0.0002 | 0.0002 - 0.0003 | 0.00015 | No | |
| Nickel | 1 / 2 | 0.05 : 0.05 | 0.05 - 0.05 | 0.038 | No | |
| Selenium | 1 / 6 | 0.001 : 0.04 | 0.0091 - 0.0091 | 0.012 | No | |
| Zinc | 2 / 2 | : | 0.16 - 0.56 | 0.36 | No | |
| **Other (mg/L)** | | | | | | |
| Ammonia | 2 / 2 | : | *0.14* - *1.2* | *0.67* | No | |
| Chloride | 2 / 2 | : | 4 - 22 | 13 | No | |
| Nitrate-Nitrite-N | 2 / 2 | : | 0.37 - 1.9 | 1.1 | No | |
| Sulfate | 2 / 2 | : | 7.4 - 8.5 | 8.0 | No | |
| C11-C22 Aromatic | 1 / 1 | : | 0.115 - 0.115 | 0.12 | No | |
| C19-C36 Aliphatic | 1 / 1 | : | 0.25 - 0.25 | 0.25 | No | |
| | | | | | | |

## Table 3
## Summary Statistics for Surface Water and Identification of Potential Hot Spot OHM

### CPL Gordon Craig US Army Reserve Center
### Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix A.
Duplicate samples were averaged with their original samples prior to calculation of summary statistics.
The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[2] If maximum detected concentration is greater than 10 times the minimum detected concentration, then OHM is considered a potential hot spot OHM. If analyte is detected with low frequency, maximum is compared to the minimum SQL.

[3] Potential hot spot analytes are further reviewed by comparing the maximum and minimum detected concentrations (or the detected concentration to the lowest SQL). More than a 10-fold difference in concentrations is indicative of a potential hot spot. These OHM are further evaluated to determine if a hot spot is present.

[4] A hot spot is present if a potential hot spot OHM is detected in a discrete area at concentrations 100-times greater than concentrations in the surrounding area. This is determined by reviewing the spatial distribution of the reported concentrations.

[5] Concentrations of these OHM are less than 100-times greater than the concentrations in the surrounding samples.

OHM = Oil or Hazardous Material
SQL = Sample Quanitation Limit
NA = Not Available/Not Applicable

Table 4
Summary Statistics for Sediment and Identification of Potential Hot Spot OHM

CPL Gordon Craig US Army Reserve Center
Brockton, Massachusetts

| OHM of Concern | Site Data/Concentration | | | | Maximum > 10x Minimum conc?[3] | Does a Hot Spot Exist? [4] |
|---|---|---|---|---|---|---|
| | Frequency of Detection [1] | Range of SQLs | Range of Detected Concentrations | Arithmetic Mean | | |
| **VOCs (mg/kg)** | | | | | | |
| Acetone | 2 / 4 | 0.028 : 0.028 | 0.018 - 0.089 | 0.030 | No | |
| **SVOCs (mg/kg)** | | | | | | |
| Benzo(a)anthracene | 2 / 4 | 0.3 : 0.45 | 0.088 - 0.19 | 0.16 | No | |
| Benzo(a)pyrene | 3 / 4 | 0.3 : 0.3 | 0.099 - 0.27 | 0.16 | No | |
| Benzo(b)fluoranthene | 4 / 4 | : | 0.089 - 0.43 | 0.21 | No | |
| Benzo(g,h,i)perylene | 3 / 4 | 0.3 : 0.3 | 0.086 - 0.26 | 0.15 | No | |
| Benzo(k)fluoranthene | 2 / 4 | 0.3 : 0.45 | 0.115 - 0.12 | 0.15 | No | |
| bis(2-ethylhexyl) phthalate | 2 / 4 | 0.3 : 0.45 | 0.25 - 0.48 | 0.28 | No | |
| Chrysene | 4 / 4 | : | 0.06 - 0.31 | 0.17 | No | |
| Fluoranthene | 4 / 4 | : | 0.06 - 0.57 | 0.24 | No | |
| Indeno(1,2,3-cd)pyrene | 3 / 4 | 0.3 : 0.3 | 0.076 - 0.28 | 0.15 | No | |
| Phenanthrene | 2 / 4 | 0.3 : 0.45 | 0.13 - 0.26 | 0.19 | No | |
| Pyrene | 3 / 4 | 0.3 : 0.3 | 0.18 - 0.48 | 0.25 | No | |
| **Inorganics (mg/kg)** | | | | | | |
| Antimony | 4 / 4 | : | 0.55 - 5.3 | 1.9 | No | |
| Arsenic | 5 / 6 | 7.4 : 7.4 | 1.5 - 11 | 5.5 | No | |
| Barium | 6 / 6 | : | 13 - 120 | 46 | No | |
| Cadmium | 4 / 6 | 0.25 : 0.74 | 0.22 - 20 | 4.2 | No | |
| Chromium | 6 / 6 | : | 7.8 - 65 | 23 | No | |
| Lead | 6 / 6 | : | 7.2 - 390 | 112 | Yes | No [5] |
| Mercury | 3 / 6 | 0.025 : 0.1 | 0.016 - 0.13 | 0.046 | No | |
| Silver | 1 / 6 | 0.5 : 2.15 | 3.1 - 3.1 | 1.1 | No | |
| **Other (mg/kg)** | | | | | | |
| Total Organic Carbon | 4 / 4 | : | 4380 - 36400 | 13944 | No | |
| TPH | 2 / 2 | : | 82 - 200 | 141 | No | |
| C19-C36 Aliphatic | 1 / 1 | : | 370 - 370 | 370 | No | |
| | | | | | | |

## Table 4
## Summary Statistics for Sediment and Identification of Potential Hot Spot OHM

### CPL Gordon Craig US Army Reserve Center
### Brockton, Massachusetts

Notes:

[1] Samples included in data set are listed in Appendix A.
Duplicate samples were averaged with their original samples prior to calculation of summary statistics.
The arithmetic mean represents the arithmetic average of all samples results, with one-half the SQL used as the value for non-detects.

[2] If maximum detected concentration is greater than 10 times the minimum detected concentration, then OHM is considered a potential hot spot OHM. If analyte is detected with low frequency, maximum is compared to the minimum SQL.

[3] Potential hot spot analytes are further reviewed by comparing the maximum and minimum detected concentrations (or the detected concentration to the lowest SQL). More than a 10-fold difference in concentrations is indicative of a potential hot spot. These OHM are further evaluated to determine if a hot spot is present.

[4] A hot spot is present if a potential hot spot OHM is detected in a discrete area at concentrations 100-times greater than concentrations in the surrounding area. This is determined by reviewing the spatial distribution of the reported concentrations.

[5] Concentrations of this OHM are less than 100-times greater than the concentrations in the surrounding samples.

OHM = Oil or Hazardous Material
SQL = Sample Quanitation Limit
NA = Not Available/Not Applicable

# APPENDIX Q

# HUMAN HEALTH RISK CALCULATIONS

TA
DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - Unfenced Unpaved Soils 0-3 ft bgs
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SOIL | [OHM]soil | chemical-specific | mg/kg | |
| SOIL INGESTION RATE | IR s | 50 | mg/day | |
| SKIN SURFACE AREA | SA | 5409 | cm2/day | MADEP, 1995 |
| ADHERENCE FACTOR | AF | 0.51 | mg/cm2 | MADEP, 1995 |
| RELATIVE ABSORPTION FACTOR - ORAL | RAF-O | chemical-specific | unitless | |
| RELATIVE ABSORPTION FACTOR - DERM | RAF-D | chemical-specific | unitless | |
| AREA WEIGHTING FACTOR | AWF | 1 | unitless | |
| BODY WEIGHT | BW | 42 | kg | MADEP, 1995 |
| EXPOSURE FREQUENCY | EF | 106 | day/yr | Assumption |
| EXPOSURE DURATION | ED | 12 | yr | Assumption |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 12 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = INTAKE x CANCER SLOPE FACTOR

$$\text{HAZARD QUOTIENT} = \frac{\text{INTAKE}}{\text{REFERENCE DOSE}}$$

$$\text{INTAKE-ING} = \frac{[\text{OHM}]\text{soil} \times IR_s \times RAF\text{-}O \times AWF \times EF \times ED \times CF1}{BW \times AT \times CF2}$$

$$\text{INTAKE-DERM} = \frac{[\text{OHM}]\text{soil} \times SA \times AF \times RAF\text{-}D \times AWF \times EF \times ED \times CF1}{BW \times AT \times CF2}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.

TAB.
DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - Unfenced Unpaved Soils 0-3 ft bgs
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | CARCINOGENIC RAF - *INGESTION [1]* | INTAKE - ING (mg/kg/day) | CARCINOGENIC RAF - *DERMAL [1]* | INTAKE - DERM (mg/kg/day) | CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$ | CANCER RISK - *INGESTION* | CANCER RISK - *DERMAL* | TOTAL CANCER RISK |
|---|---|---|---|---|---|---|---|---|---|
| Benzo(b)fluoranthene | 1.1E-01 | 1 | 6.0E-09 | 0.04 | 1.3E-08 | 0.73 | 4.4E-09 | 9.6E-09 | 1.4E-08 |
| Chrysene | 1.1E-01 | 1 | 6.2E-09 | 0.04 | 1.4E-08 | 0.0073 | 4.5E-11 | 1.0E-10 | 1.4E-10 |
| | | | | | | SUMMARY CANCER RISK: | 4E-09 | 1E-08 | 1E-08 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TA
DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - Unfenced Unpaved Soils 0-3 ft bgs
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | NONCARCINOGENIC CHRONIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | NONCARCINOGENIC CHRONIC RAF - DERMAL [1] | INTAKE - DERM (mg/kg/day) | CHRONIC REFERENCE DOSE (mg/kg/day) | HAZARD QUOTIENT - INGESTION | HAZARD QUOTIENT - DERMAL | TOTAL HAZARD QUOTIENT |
|---|---|---|---|---|---|---|---|---|---|
| Acetone | 3.3E-02 | 1 | 1.1E-08 | 0.1 | 6.3E-08 | 1.0E-01 | 1.1E-07 | 6.3E-07 | 7.4E-07 |
| Benzo(b)fluoranthene | 1.1E-01 | 0.91 | 3.4E-08 | 0.04 | 8.2E-08 | 3.0E-02 | 1.1E-06 | 2.7E-06 | 3.9E-06 |
| Chrysene | 1.1E-01 | 0.91 | 3.5E-08 | 0.04 | 8.5E-08 | 3.0E-02 | 1.2E-06 | 2.8E-06 | 4.0E-06 |
| Fluoranthene | 1.2E-01 | 1 | 4.0E-08 | 0.04 | 8.9E-08 | 4.0E-02 | 1.0E-06 | 2.2E-06 | 3.2E-06 |
| Phenanthrene | 7.7E-02 | 0.91 | 2.4E-08 | 0.04 | 5.9E-08 | 3.0E-02 | 8.1E-07 | 2.0E-06 | 2.8E-06 |
| Pyrene | 1.1E-01 | 1 | 3.8E-08 | 0.04 | 8.4E-08 | 3.0E-02 | 1.3E-06 | 2.8E-06 | 4.1E-06 |
| Antimony | 8.6E-01 | 1 | 3.0E-07 | 0.1 | 1.6E-06 | 4.0E-04 | 7.4E-04 | 4.1E-03 | 4.8E-03 |
| Chromium | 9.3E+00 | 1 | 3.2E-06 | 0.09 | 1.6E-05 | 3.0E-03 | 1.1E-03 | 5.3E-03 | 6.4E-03 |
| TPH | 2.0E+01 | 0.91 | 6.1E-06 | 0.18 | 6.7E-05 | 3.0E-02 | 2.0E-04 | 2.2E-03 | 2.4E-03 |
| | | | | | | SUMMARY HAZARD INDEX: | 0.002 | 0.01 | 0.01 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TA 12

**INHALATION OF SOIL PARTICULATES - Unfenced Unpaved Soils 0-3 ft bgs**
**RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE**
**Method 3 Risk Characterization**
**CPL Gordon Craig US Army Reserve Center**
**Brockton, MA**

*EXPOSURE PARAMETERS*

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SOIL | [OHM]soil | chemical-specific | mg/kg | |
| CONCENTRATION OF RP IN AIR | [RP]air | 32 | ug/m3 | MADEP, 1995 |
| *EXPOSURE TIME* | ET | 0.083 | day/*event* | |
| EXPOSURE FREQUENCY | EF | 106 | event/yr | Assumption |
| EXPOSURE DURATION | ED | 12 | yr | Assumption |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| *AVERAGING TIME NONCANCER* | AT | 12 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = AIR AVG. CONC. x CANCER UNIT RISK

$$\text{HAZARD QUOTIENT} = \frac{\text{AIR AVG.CONC.}}{\text{REFERENCE CONCENTRATION}}$$

$$\text{AIR AVG. CONC.} = \frac{\text{[OHM]soil x [RP]air x ET x EF x ED x CF1}}{\text{AT x CF2}}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.
ET = 2 hours / 24 hour day

RP = Respirable Particulates

.2
INHALATION OF SOIL PARTICULATES - Unfenced Unpaved Soils 0-3 ft bgs
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | AIR AVG. CONC. LIFETIME ($ug/m^3$) | INHALATION CANCER UNIT RISK $(ug/m^3)^{-1}$ | CANCER RISK-INHALATION |
|---|---|---|---|---|
| Chromium | 9.3E+00 | 1.1E-06 | 1.2E-02 | 1.4E-08 |
| | | | SUMMARY CANCER RISK: | 1E-08 |

Notes:
ND = no data available

TABLE 2
INHALATION OF SOIL PARTICULATES - Unfenced Unpaved Soils 0-3 ft bgs
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | AIR AVG. CONC. FOR TIME PERIOD ($ug/m^3$) | INHALATION CHRONIC REFERENCE CONCENTRATION | HAZARD QUOTIENT-INHALATION |
|---|---|---|---|---|
| Acetone | 3.3E-02 | 2.6E-08 | 8.0E+02 | 3.2E-11 |
| Benzo(b)fluoranthene | 1.1E-01 | 8.3E-08 | 7.1E+01 | 1.2E-09 |
| Chrysene | 1.1E-01 | 8.7E-08 | 7.1E+01 | 1.2E-09 |
| Fluoranthene | 1.2E-01 | 9.0E-08 | 7.1E+01 | 1.3E-09 |
| Phenanthrene | 7.7E-02 | 6.0E-08 | 7.1E+01 | 8.4E-10 |
| Pyrene | 1.1E-01 | 8.6E-08 | 7.1E+01 | 1.2E-09 |
| Antimony | 8.6E-01 | 6.6E-07 | 1.0E+01 | 6.6E-08 |
| Chromium | 9.3E+00 | 7.2E-06 | 1.0E-01 | 7.2E-05 |
| TPH | 2.0E+01 | 1.5E-05 | 7.1E+01 | 2.1E-07 |
| | | | SUMMARY HAZARD INDEX: | 0.00007 |

Notes:
ND = no data available

TABLE 3
DIRECT CONTACT AND INCIDENTAL INGESTION OF SURFACE WATER - On-Site Stream
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SURFACE WATER | [OHM]gw | chemical-specific | mg/l | |
| SURFACE WATER INGESTION RATE | IR gw | 0.05 | l/day | Assumption |
| SKIN SURFACE AREA | SA | 3290 | cm2 | MADEP, 1995 |
| PERMEABILITY CONSTANT | Kp | chemical-specific | cm/hr | |
| RELATIVE ABSORPTION FACTOR - ORAL | RAF-O | chemical-specific | unitless | |
| RELATIVE ABSORPTION FACTOR - DERM | RAF-D | chemical-specific | unitless | |
| BODY WEIGHT | BW | 42 | kg | MADEP, 1995 |
| EXPOSURE TIME | ET | 2 | hr/event | Assumption |
| EXPOSURE FREQUENCY [1] | EF | 39 | event/yr | Assumption |
| EXPOSURE DURATION | ED | 12 | yr | Assumption |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 12 | yr | Assumption |
| CONVERSION FACTOR 1 | CF1 | 0.001 | l/cm3 | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = INTAKE x CANCER SLOPE FACTOR

$$\text{HAZARD QUOTIENT} = \frac{\text{INTAKE}}{\text{REFERENCE DOSE}}$$

$$\text{INTAKE-ING} = \frac{[\text{OHM}]gw \times IR\ s \times RAF\text{-}O \times EF \times ED}{BW \times AT \times CF2}$$

$$\text{INTAKE-DERM} = \frac{[\text{OHM}]gw \times SA \times Kp \times RAF\text{-}D \times ET \times EF \times ED \times CF1}{BW \times AT \times CF2}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.

[1] Units for Exposure Frequency are day/yr for ingestion exposures and event/yr for dermal exposures.

TABLE 3
DIRECT CONTACT AND INCIDENTAL INGESTION OF SURFACE WATER - On-Site Stream
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SURFACE WATER CONCENTRATION (mg/l) | CARCINOGENIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | CARCINOGENIC RAF - DERMAL [1] | PERMEABILITY CONSTANT (cm/hr) | INTAKE - DERM (mg/kg/day) | CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$ | CANCER RISK - INGESTION | CANCER RISK - DERMAL | TOTAL CANCER RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| bis(2-ethylhexyl) phthalate | 4.0E-03 | 1 | 8.1E-08 | 1.05 | 0.033 | 3.7E-07 | 0.014 | 1.1E-09 | 5.2E-09 | 6.3E-09 |
| Arsenic | 1.0E-02 | 1 | 2.1E-07 | 1.82 | 0.001 | 5.1E-08 | 1.5 | 3.2E-07 | 7.6E-08 | 3.9E-07 |
| Cadmium | 5.3E-03 | | | | 0.001 | | ND | | | |
| Lead | 4.3E-01 | | | | 0.001 | | ND | | | |
| Mercury | 1.5E-04 | | | | 0.001 | | ND | | | |
| | | | | | | | SUMMARY CANCER RISK: | 3E-07 | 8E-08 | 4E-07 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TABLE 3
DIRECT CONTACT AND INCIDENTAL INGESTION OF SURFACE WATER - On-Site Stream
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SURFACE WATER CONCENTRATION (mg/l) | NONCARCINOGENIC CHRONIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | NONCARCINOGENIC CHRONIC RAF - DERMAL [1] | PERMEABILITY CONSTANT (cm/hr) | INTAKE - DERM (mg/kg/day) | CHRONIC REFERENCE DOSE | HAZARD QUOTIENT - INGESTION | HAZARD QUOTIENT - DERMAL | TOTAL HAZARD QUOTIENT |
|---|---|---|---|---|---|---|---|---|---|---|
| Carbon disulfide | 8.1E-04 | 1.09 | 1.1E-07 | 1.1 | 0.024 | 3.6E-07 | 1.0E-01 | 1.1E-06 | 3.6E-06 | 4.7E-06 |
| bis(2-ethylhexyl) phthalate | 4.0E-03 | 1 | 5.1E-07 | 1.05 | 0.033 | 2.3E-06 | 2.0E-02 | 2.5E-05 | 1.2E-04 | 1.4E-04 |
| Antimony | 4.3E-03 | 1 | 5.5E-07 | 1.82 | 0.001 | 1.3E-07 | 4.0E-04 | 1.4E-03 | 3.3E-04 | 1.7E-03 |
| Arsenic | 1.0E-02 | 1 | 1.3E-06 | 1.82 | 0.001 | 3.2E-07 | 3.0E-04 | 4.4E-03 | 1.1E-03 | 5.5E-03 |
| Barium | 8.3E-02 | 0.73 | 7.7E-06 | 1.82 | 0.001 | 2.5E-06 | 7.0E-02 | 1.1E-04 | 3.6E-05 | 1.5E-04 |
| Cadmium | 5.3E-03 | 1 | 6.8E-07 | 1.82 | 0.001 | 1.6E-07 | 5.0E-04 | 1.4E-03 | 3.3E-04 | 1.7E-03 |
| Chromium | 6.1E-02 | 1 | 7.8E-06 | 1.82 | 0.001 | 1.9E-06 | 3.0E-03 | 2.6E-03 | 6.2E-04 | 3.2E-03 |
| Copper | 3.3E-01 | 1 | 4.2E-05 | 1.82 | 0.001 | 1.0E-05 | 4.0E-02 | 1.0E-03 | 2.5E-04 | 1.3E-03 |
| Lead | 4.3E-01 | 0.5 | 2.7E-05 | 2 | 0.001 | 1.4E-05 | 7.5E-04 | 3.6E-02 | 1.9E-02 | 5.6E-02 |
| Mercury | 1.5E-04 | 1 | 1.9E-08 | 4.76 | 0.001 | 1.2E-08 | 3.0E-04 | 6.4E-05 | 4.0E-05 | 1.0E-04 |
| Nickel | 5.0E-02 | 1 | 6.4E-06 | 4.76 | 0.001 | 4.0E-06 | 2.0E-02 | 3.2E-04 | 2.0E-04 | 5.2E-04 |
| Selenium | 9.1E-03 | 1 | 1.2E-06 | 4.76 | 0.001 | 7.3E-07 | 5.0E-03 | 2.3E-04 | 1.5E-04 | 3.8E-04 |
| Zinc | 3.6E-01 | 1 | 4.6E-05 | 4.76 | 0.001 | 2.9E-05 | 3.0E-01 | 1.5E-04 | 9.6E-05 | 2.5E-04 |
| Ammonia | 6.7E-01 | 1 | 8.5E-05 | 1.82 | 0.001 | 2.0E-05 | 9.7E-01 | 8.8E-05 | 2.1E-05 | 1.1E-04 |
| Nitrate-Nitrite-N | 1.1E+00 | 1 | 1.4E-04 | 1.82 | 0.001 | 3.5E-05 | 1.0E-01 | 1.4E-03 | 3.5E-04 | 1.8E-03 |
| C11-C22 Aromatic | 1.2E-01 | 0.91 | 1.3E-05 | 1.1 | 0.23 | 4.9E-04 | 3.0E-02 | 4.4E-04 | 1.6E-02 | 1.7E-02 |
| C19-C36 Aliphatic | 2.5E-01 | 1 | 3.2E-05 | 1 | 0.23 | 9.6E-04 | 6.0E+00 | 5.3E-06 | 1.6E-04 | 1.7E-04 |
| | | | | | | | SUMMARY HAZARD INDEX: | 0.05 | 0.04 | 0.09 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TABL.
DIRECT CONTACT AND INCIDENTAL INGESTION OF SEDIMENT - On-Site Stream
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SEDIMENT | [OHM]sed | chemical-specific | mg/kg | |
| SEDIMENT INGESTION RATE | IR s | 25 | mg/day | Assumption |
| SKIN SURFACE AREA | SA | 3290 | cm2/day | MADEP, 1995 |
| ADHERENCE FACTOR | AF | 0.51 | mg/cm2 | MADEP, 1995 |
| RELATIVE ABSORPTION FACTOR - ORAL | RAF-O | chemical-specific | unitless | |
| RELATIVE ABSORPTION FACTOR - DERM | RAF-D | chemical-specific | unitless | |
| AREA WEIGHTING FACTOR | AWF | 1 | unitless | |
| BODY WEIGHT | BW | 42 | kg | MADEP, 1995 |
| EXPOSURE FREQUENCY | EF | 39 | day/yr | Assumption |
| EXPOSURE DURATION | ED | 12 | yr | Assumption |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 12 | yr | Assumption |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = INTAKE x CANCER SLOPE FACTOR

$$\text{HAZARD QUOTIENT} = \frac{\text{INTAKE}}{\text{REFERENCE DOSE}}$$

$$\text{INTAKE-ING} = \frac{[\text{OHM}]\text{sed} \times \text{IR s} \times \text{RAF-O} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

$$\text{INTAKE-DERM} = \frac{[\text{OHM}]\text{sed} \times \text{SA} \times \text{AF} \times \text{RAF-D} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.

TA
DIRECT CONTACT AND INCIDENTAL INGESTION OF SEDIMENT - On-Site Stream
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SEDIMENT CONCENTRATION (mg/kg) | CARCINOGENIC RAF - INGESTION [1] (unitless) | INTAKE - ING (mg/kg/day) | CARCINOGENIC RAF - DERMAL [1] (unitless) | INTAKE-DERM (mg/kg/day) | CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$ | CANCER RISK - INGESTION | CANCER RISK - DERMAL | TOTAL CANCER RISK |
|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 1.6E-01 | 1 | 1.7E-09 | 0.04 | 4.5E-09 | 0.73 | 1.2E-09 | 3.3E-09 | 4.5E-09 |
| Benzo(a)pyrene | 1.6E-01 | 1 | 1.6E-09 | 0.04 | 4.2E-09 | 7.3 | 1.2E-08 | 3.1E-08 | 4.2E-08 |
| Benzo(b)fluoranthene | 2.1E-01 | 1 | 2.1E-09 | 0.04 | 5.8E-09 | 0.73 | 1.6E-09 | 4.2E-09 | 5.8E-09 |
| Benzo(k)fluoranthene | 1.2E-01 | 1 | 1.2E-09 | 0.04 | 3.3E-09 | 0.073 | 8.9E-11 | 2.4E-10 | 3.3E-10 |
| bis(2-ethylhexyl) phthalate | 2.8E-01 | 1 | 2.8E-09 | 0.02 | 3.8E-09 | 0.014 | 3.9E-11 | 5.3E-11 | 9.2E-11 |
| Chrysene | 1.7E-01 | 1 | 1.8E-09 | 0.04 | 4.7E-09 | 0.0073 | 1.3E-11 | 3.5E-11 | 4.7E-11 |
| Indeno(1,2,3-cd)pyrene | 1.5E-01 | 1 | 1.6E-09 | 0.04 | 4.2E-09 | 0.73 | 1.1E-09 | 3.1E-09 | 4.2E-09 |
| Arsenic | 5.5E+00 | 1 | 5.6E-08 | 0.03 | 1.1E-07 | 1.5 | 8.4E-08 | 1.7E-07 | 2.5E-07 |
| Cadmium | 4.2E+00 | | | | | ND | | | |
| Lead | 3.9E+02 | | | | | ND | | | |
| Mercury | 4.6E-02 | | | | | ND | | | |
| | | | | | | SUMMARY CANCER RISK: | 1E-07 | 2E-07 | 3E-07 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TAB.
DIRECT CONTACT AND INCIDENTAL INGESTION OF SEDIMENT - On-Site Stream
RECEPTOR: CHILD TRESPASSER - CURRENT LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SEDIMENT CONCENTRATION (mg/kg) | NONCARCINOGENIC CHRONIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | NONCARCINOGENIC CHRONIC RAF - DERMAL [1] | INTAKE - DERM (mg/kg/day) | CHRONIC REFERENCE DOSE (mg/kg/day) | HAZARD QUOTIENT - INGESTION | HAZARD QUOTIENT - DERMAL | TOTAL HAZARD QUOTIENT |
|---|---|---|---|---|---|---|---|---|---|
| Acetone | 3.0E-02 | 1 | 1.9E-09 | 0.1 | 1.3E-08 | 1.0E-01 | 1.9E-08 | 1.3E-07 | 1.5E-07 |
| Benzo(a)anthracene | 1.6E-01 | 0.91 | 9.4E-09 | 0.04 | 2.8E-08 | 3.0E-02 | 3.1E-07 | 9.3E-07 | 1.2E-06 |
| Benzo(a)pyrene | 1.6E-01 | 0.91 | 9.0E-09 | 0.04 | 2.7E-08 | 3.0E-02 | 3.0E-07 | 8.8E-07 | 1.2E-06 |
| Benzo(b)fluoranthene | 2.1E-01 | 0.91 | 1.2E-08 | 0.04 | 3.6E-08 | 3.0E-02 | 4.1E-07 | 1.2E-06 | 1.6E-06 |
| Benzo(g,h,i)perylene | 1.5E-01 | 0.91 | 8.8E-09 | 0.04 | 2.6E-08 | 3.0E-02 | 2.9E-07 | 8.6E-07 | 1.2E-06 |
| Benzo(k)fluoranthene | 1.2E-01 | 0.91 | 6.9E-09 | 0.04 | 2.0E-08 | 3.0E-02 | 2.3E-07 | 6.8E-07 | 9.1E-07 |
| bis(2-ethylhexyl) phthalate | 2.8E-01 | 1 | 1.8E-08 | 0.02 | 2.4E-08 | 2.0E-02 | 8.8E-07 | 1.2E-06 | 2.1E-06 |
| Chrysene | 1.7E-01 | 0.91 | 1.0E-08 | 0.04 | 3.0E-08 | 3.0E-02 | 3.3E-07 | 9.8E-07 | 1.3E-06 |
| Fluoranthene | 2.4E-01 | 1 | 1.5E-08 | 0.04 | 4.1E-08 | 4.0E-02 | 3.9E-07 | 1.0E-06 | 1.4E-06 |
| Indeno(1,2,3-cd)pyrene | 1.5E-01 | 0.91 | 8.9E-09 | 0.04 | 2.6E-08 | 3.0E-02 | 3.0E-07 | 8.8E-07 | 1.2E-06 |
| Phenanthrene | 1.9E-01 | 0.91 | 1.1E-08 | 0.04 | 3.3E-08 | 3.0E-02 | 3.7E-07 | 1.1E-06 | 1.5E-06 |
| Pyrene | 2.5E-01 | 1 | 1.6E-08 | 0.04 | 4.3E-08 | 3.0E-02 | 5.4E-07 | 1.4E-06 | 2.0E-06 |
| Antimony | 1.9E+00 | 1 | 1.2E-07 | 0.1 | 8.0E-07 | 4.0E-04 | 3.0E-04 | 2.0E-03 | 2.3E-03 |
| Arsenic | 5.5E+00 | 1 | 3.5E-07 | 0.03 | 7.1E-07 | 3.0E-04 | 1.2E-03 | 2.4E-03 | 3.5E-03 |
| Barium | 4.6E+01 | 0.71 | 2.1E-06 | 0.05 | 9.8E-06 | 7.0E-02 | 3.0E-05 | 1.4E-04 | 1.7E-04 |
| Cadmium | 4.2E+00 | 1.86 | 5.0E-07 | 0.14 | 2.5E-06 | 1.0E-03 | 5.0E-04 | 2.5E-03 | 3.0E-03 |
| Chromium | 2.3E+01 | 1 | 1.5E-06 | 0.09 | 9.0E-06 | 3.0E-03 | 5.0E-04 | 3.0E-03 | 3.5E-03 |
| Lead | 3.9E+02 | 0.5 | 1.2E-05 | 0.006 | 1.0E-05 | 7.5E-04 | 1.7E-02 | 1.3E-02 | 3.0E-02 |
| Mercury | 4.6E-02 | 1 | 2.9E-09 | 0.05 | 9.9E-09 | 3.0E-04 | 9.8E-06 | 3.3E-05 | 4.3E-05 |
| Silver | 3.1E+00 | 1 | 2.0E-07 | 0.25 | 3.3E-06 | 5.0E-03 | 3.9E-05 | 6.6E-04 | 7.0E-04 |
| TPH | 1.4E+02 | 0.91 | 8.2E-06 | 0.18 | 1.1E-04 | 3.0E-02 | 2.7E-04 | 3.6E-03 | 3.9E-03 |
| C19-C36 Aliphatic | 3.7E+02 | 0.91 | 2.1E-05 | 0.1 | 1.6E-04 | 6.0E+00 | 3.6E-06 | 2.6E-05 | 3.0E-05 |
| | | | | | | SUMMARY HAZARD INDEX: | 0.02 | 0.03 | 0.05 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TABLE 5
INHALATION EXPOSURE TO VOLATILE OHM IN INDOOR AIR (MIGRATION FROM GROUNDWATER)
INDOOR WORKER AT ARMY RESERVE CENTER - CURRENT LAND USE
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION IN GROUNDWATER | [OHM]gw | Calculated | ug/L | |
| CONVERSION FACTOR 1 | CF1 | 24 | hours/day | |
| EXPOSURE TIME DAILY | ET | 8 | hours/day | Assumption |
| EXPOSURE FREQUENCY | EF | 236 | days/year | MADEP, 1996 |
| EXPOSURE DURATION | ED | 27 | years | MADEP, 1996 |
| CONVERSION FACTOR 2 | CF2 | 365 | days/year | |
| CONVERSION FACTOR 3 | CF3 | 1000 | $L/m^3$ | |
| AVERAGING TIME CANCER | AT | 75 | years | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 27 | years | MADEP, 1996 |


MADEP, 1994. Background Documentation for the Development of the MCP Numerical Standards. April.
MADEP, 1995. Guidance for Disposal Site Risk Characterization, Interim Final Policy WSC/ORS-95-141. July.
MADEP, 1996. Commercial/Industrial Short Form Exposure Scenarios. Draft.


EQUATIONS

CANCER RISK = AVG. CONC. (ug/m3) * CANCER UNIT RISK (ug/m3)^-1
HAZARD QUOTIENT = AVG.CONC.(ug/m3)/REF. CONC. (ug/m3)

$$\text{AVG. EXPOSURE CONC.} = \frac{[\text{OHM}]\text{air} * EF * ET * ED}{AT * CF1 * CF2}$$

OHM AIR CONC. = [OHM]gw * H * d * alpha * CF3 (MADEP, 1994)

Note:

alpha = 5E-04 (dimensionless) (MADEP, 1994)
d = 0.1 (dimensionless) (MADEP, 1994)
*For noncarcinogenic effects: AT = ED

**TABLE 5**
**INHALATION EXPOSURE TO VOLATILE OHM IN INDOOR AIR (MIGRATION FROM GROUNDWATER)**
**INDOOR WORKER AT ARMY RESERVE CENTER - CURRENT LAND USE**
***CPL GORDON CRAIG US ARMY RESERVE CENTER***
**BROCKTON, MA**

CARCINOGENIC EFFECTS

| COMPOUND | [OHM]GW (ug/L) | H | OHM AIR CONCENTRATION (ug/m³) | AVERAGE AIR CONCENTRATION LIFETIME (ug/m3) | INHALATION CANCER UNIT RISK (ug/m3)^-1 | CANCER RISK |
|---|---|---|---|---|---|---|
| Naphthalene | 3 | 2.0E-02 | 2.97E-03 | 2.3E-04 | ND | |
| | | | | SUMMARY CANCER RISK | | 0E+00 |

NONCARCINOGENIC EFFECTS

| COMPOUND | [OHM]GW (ug/L) | H* | OHM AIR CONCENTRATION (ug/m³) | AVERAGE AIR CONCENTRATION FOR TIME PERIOD (ug/m3) | CHRONIC INHALATION RfC [1] (ug/m3) | HAZARD QUOTIENT |
|---|---|---|---|---|---|---|
| *4-isopropyltoluene[c]* | *0.92* | *6.2E-01* | *2.85E-02* | *6.1E-03* | *4.00E+02* | *1.5E-05* |
| Isopropylbenzene | 0.3 | 6.2E-01 | 9.30E-03 | 2.0E-03 | 4.00E+02 | 5.0E-06 |
| m,p-Xylenes | 0.7 | 3.0E-01 | 1.05E-02 | 2.3E-03 | 3.00E+02 | 7.6E-06 |
| n-Propylbenzene[c] | 0.54 | 6.2E-01 | 1.67E-02 | 3.6E-03 | 4.00E+02 | 9.0E-06 |
| sec-Butylbenzene[c] | *8* | *6.2E-01* | *2.48E-01* | *5.3E-02* | *4.00E+02* | *1.3E-04* |
| Methyl tert butyl ether | 3.8 | 1.0E+00 | 1.90E-01 | 4.1E-02 | 3.00E+03 | 1.4E-05 |
| 1,2,4-Trimethylbenzene | 0.98 | 2.3E-01 | 1.13E-02 | 2.4E-03 | 3.00E+02 | 8.1E-06 |
| 1,3,5-Trimethylbenzene | 0.6 | 3.2E-01 | 9.60E-03 | 2.1E-03 | 3.00E+02 | 6.9E-06 |
| *Toluene* | 7 | 2.7E-01 | 9.52E-02 | 2.1E-02 | 4.00E+02 | 5.1E-05 |
| Naphthalene | 3 | 2.0E-02 | 2.97E-03 | 6.4E-04 | 3.00E+00 | 2.1E-04 |
| C11-C22 aromatic EPH | 355 | 3.0E-04 | 5.33E-03 | 1.1E-03 | 7.10E+01 | 1.6E-05 |
| C9-C18 aliphatic EPH | 535 | 6.9E-01 | 1.85E+01 | 4.0E+00 | 2.00E+03 | 2.0E-03 |
| *C9-C10 Aromatic VPH* | 53 | 3.3E-03 | 8.75E-03 | 1.9E-03 | 6.00E+01 | 3.1E-05 |
| C9-C12 aromatic VPH | 141 | 6.5E-01 | 4.58E+00 | 9.9E-01 | 2.00E+03 | 4.9E-04 |
| | | | | | | 3E-03 |

Notes:
ND = No data available.
* Source of H is Soil Screening Guidance: User's Guide (EPA, 1996), unless otherwise indicated.
From Lyman et al. (1990): H' (unitless) = H(atm-m3/mol)/RT (RT = 0.024 at 20 degrees C);
[c] H for isopropylbenzene used as a surrogate.

TABLE 6
DI[illegible]ONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)
RE[illegible]R: ADULT RESIDENT - FUTURE LAND USE
Metho[illegible] Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SOIL | [OHM]soil | chemical-specific | mg/kg | |
| SOIL INGESTION RATE | IR s | 50 | mg/day | MADEP, 1995 |
| SKIN SURFACE AREA | SA | 6372 | cm2/day | MADEP, 1995 |
| ADHERENCE FACTOR | AF | 0.51 | mg/cm2 | MADEP, 1995 |
| RELATIVE ABSORPTION FACTOR - ORAL | RAF-O | chemical-specific | unitless | |
| RELATIVE ABSORPTION FACTOR - DERM | RAF-D | chemical-specific | unitless | |
| AREA WEIGHTING FACTOR | AWF | 1 | unitless | |
| BODY WEIGHT | BW | 59 | kg | MADEP, 1995 |
| EXPOSURE FREQUENCY | EF | 153 | day/yr | MADEP, 1995 |
| EXPOSURE DURATION | ED | 25 | yr | MADEP, 1995 |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 25 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = INTAKE x CANCER SLOPE FACTOR

$$\text{HAZARD QUOTIENT} = \frac{\text{INTAKE}}{\text{REFERENCE DOSE}}$$

$$\text{INTAKE-ING} = \frac{[\text{OHM}]\text{soil} \times \text{IR s} \times \text{RAF-O} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

$$\text{INTAKE-DERM} = \frac{[\text{OHM}]\text{soil} \times \text{SA} \times \text{AF} \times \text{RAF-D} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.

TABLE
DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)
RECEPTOR: ADULT RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | CARCINOGENIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | CARCINOGENIC RAF - DERMAL [1] | INTAKE - DERM (mg/kg/day) | CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$ | CANCER RISK - INGESTION | CANCER RISK - DERMAL | TOTAL CANCER RISK |
|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride | 1.5E-02 | 1 | 1.8E-09 | 0.1 | 1.2E-08 | 0.0075 | 1.3E-11 | 8.7E-11 | 1.0E-10 |
| Benzo(b)fluoranthene | 1.3E-01 | 1 | 1.6E-08 | 0.04 | 4.1E-08 | 0.73 | 1.1E-08 | 3.0E-08 | 4.1E-08 |
| Chrysene | 1.1E-01 | 1 | 1.3E-08 | 0.04 | 3.4E-08 | 0.0073 | 9.5E-11 | 2.5E-10 | 3.4E-10 |
| Naphthalene | 1.9E-01 | | | 0.04 | 5.8E-08 | ND | | | |
| | | | | | | SUMMARY CANCER RISK: | 1E-08 | 3E-08 | 4E-08 |

*Notes:*
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.
ND = no data available
NA = *not applicable*

TABLE 6
DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)
RECEPTOR: ADULT RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | NONCARCINOGENIC CHRONIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | NONCARCINOGENIC CHRONIC RAF - DERMAL [1] | INTAKE - DERM (mg/kg/day) | CHRONIC REFERENCE DOSE (mg/kg/day) | HAZARD QUOTIENT - INGESTION | HAZARD QUOTIENT - DERMAL | TOTAL HAZARD QUOTIENT |
|---|---|---|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 2.3E-01 | 1 | 8.2E-08 | 0.12 | 6.4E-07 | 5.0E-02 | 1.6E-06 | 1.3E-05 | 1.4E-05 |
| 1,3,5-Trimethylbenzene | 3.8E-02 | 1 | 1.3E-08 | 0.12 | 1.1E-07 | 5.0E-02 | 2.7E-07 | 2.1E-06 | 2.4E-06 |
| 4-isopropyltoluene | 4.4E-02 | 1 | 1.6E-08 | 0.11 | 1.1E-07 | 1.0E-01 | 1.6E-07 | 1.1E-06 | 1.3E-06 |
| Acetone | 2.0E-01 | 1 | 7.1E-08 | 0.1 | 4.6E-07 | 1.0E-01 | 7.1E-07 | 4.6E-06 | 5.3E-06 |
| Ethylbenzene | 2.1E-03 | 1 | 7.5E-10 | 0.2 | 9.7E-09 | 1.0E-01 | 7.5E-09 | 9.7E-08 | 1.0E-07 |
| Isopropylbenzene | 3.6E-02 | 0.99 | 1.3E-08 | 0.11 | 9.1E-08 | 1.0E-01 | 1.3E-07 | 9.1E-07 | 1.0E-06 |
| m,p-Xylene | 1.9E-02 | 1 | 6.7E-09 | 0.12 | 5.3E-08 | 2.0E+00 | 3.4E-09 | 2.6E-08 | 3.0E-08 |
| Methylene Chloride | 1.5E-02 | 1 | 5.3E-09 | 0.1 | 3.5E-08 | 6.0E-02 | 8.9E-08 | 5.8E-07 | 6.7E-07 |
| n-Propylbenzene | 6.9E-02 | 0.99 | 2.4E-08 | 0.11 | 1.8E-07 | 1.0E-01 | 2.4E-07 | 1.8E-06 | 2.0E-06 |
| o-Xylene | 4.6E-03 | 1 | 1.6E-09 | 0.12 | 1.3E-08 | 2.0E+00 | 8.2E-10 | 6.4E-09 | 7.2E-09 |
| sec-Butylbenzene | 7.5E-02 | 1 | 2.7E-08 | 0.1 | 1.7E-07 | 1.0E-02 | 2.7E-06 | 1.7E-05 | 2.0E-05 |
| Toluene | 2.1E-02 | 1 | 7.5E-09 | 0.12 | 5.8E-08 | 2.0E-01 | 3.7E-08 | 2.9E-07 | 3.3E-07 |
| Benzo(b)fluoranthene | 1.3E-01 | 0.91 | 4.3E-08 | 0.04 | 1.2E-07 | 3.0E-02 | 1.4E-06 | 4.1E-06 | 5.5E-06 |
| Chrysene | 1.1E-01 | 0.91 | 3.6E-08 | 0.04 | 1.0E-07 | 3.0E-02 | 1.2E-06 | 3.4E-06 | 4.6E-06 |
| Fluoranthene | 1.3E-01 | 1 | 4.7E-08 | 0.04 | 1.2E-07 | 4.0E-02 | 1.2E-06 | 3.1E-06 | 4.2E-06 |
| Naphthalene | 1.9E-01 | 1 | 6.7E-08 | 0.04 | 1.8E-07 | 2.0E-02 | 3.4E-06 | 8.8E-06 | 1.2E-05 |
| Phenanthrene | 1.4E-01 | 0.91 | 4.5E-08 | 0.04 | 1.3E-07 | 3.0E-02 | 1.5E-06 | 4.3E-06 | 5.7E-06 |
| Pyrene | 1.3E-01 | 1 | 4.7E-08 | 0.04 | 1.2E-07 | 3.0E-02 | 1.6E-06 | 4.0E-06 | 5.6E-06 |
| Antimony | 2.0E+01 | 1 | 7.1E-06 | 0.1 | 4.6E-05 | 4.0E-04 | 1.8E-02 | 1.2E-01 | 1.3E-01 |
| Chromium | 1.0E+01 | 1 | 3.6E-06 | 0.09 | 2.1E-05 | 3.0E-03 | 1.2E-03 | 6.9E-03 | 8.1E-03 |
| TPH | 1.8E+03 | 0.91 | 5.8E-04 | 0.18 | 7.5E-03 | 3.0E-02 | 1.9E-02 | 2.5E-01 | 2.7E-01 |
| C11-C22 Aromatic | 4.6E+01 | 0.91 | 1.5E-05 | 0.18 | 1.9E-04 | 3.0E-02 | 4.9E-04 | 6.3E-03 | 6.8E-03 |
| C19-C36 Aliphatic | 7.1E+01 | 0.91 | 2.3E-05 | 0.1 | 1.6E-04 | 6.0E+00 | 3.8E-06 | 2.7E-05 | 3.1E-05 |
| C9-C10 Aromatic | 1.7E+00 | 0.91 | 5.5E-07 | 0.18 | 7.1E-06 | 3.0E-02 | 1.8E-05 | 2.4E-04 | 2.5E-04 |
| C9-C12 Aliphatic | 1.4E+00 | 0.91 | 4.5E-07 | 0.2 | 6.5E-06 | 6.0E-01 | 7.5E-07 | 1.1E-05 | 1.2E-05 |
| | | | | | | SUMMARY HAZARD INDEX: | 0.04 | 0.4 | 0.4 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.
ND = no data available
NA = not applicable

TA[illegible]
I[illegible]TION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
RE[illegible]FOR: ADULT RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| *CONCENTRATION OF CPC IN SOIL* | *[OHM]soil* | *chemical-specific* | *mg/kg* | |
| CONCENTRATION OF RP IN AIR | [RP]air | 32 | ug/m3 | MADEP, 1995 |
| EXPOSURE TIME | ET | 1 | day/event | |
| EXPOSURE FREQUENCY | EF | 153 | event/yr | MADEP, 1995 |
| *EXPOSURE DURATION* | ED | 25 | yr | MADEP, 1995 |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 25 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

*CANCER RISK = AIR AVG. CONC. x CANCER UNIT RISK*

HAZARD QUOTIENT = $\frac{\text{AIR AVG.CONC.}}{\text{REFERENCE CONCENTRATION}}$

AIR AVG. CONC. = $\frac{\text{[OHM]soil x [RP]air x ET x EF x ED x CF1}}{\text{AT x CF2}}$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.
ET = 24 hours / 24 hours

RP = Respirable Particulates

TABLE 7
ATION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
TOR: ADULT RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | AIR AVG. CONC. LIFETIME ($\mu g/m^3$) | INHALATION CANCER UNIT RISK $(\mu g/m^3)^{-1}$ | CANCER RISK-INHALATION |
|---|---|---|---|---|
| Chromium | 1.0E+01 | 4.5E-05 | 1.2E-02 | 5.4E-07 |
| Methylene Chloride | 1.5E-02 | 6.7E-08 | 0.00000047 | 3.2E-14 |
| Benzo(b)fluoranthene | 1.3E-01 | 5.9E-07 | 0.00011 | 6.5E-11 |
| Chrysene | 1.1E-01 | 4.9E-07 | 0.0000011 | 5.4E-13 |
| Naphthalene | 1.9E-01 | 8.5E-07 | ND | |
| | | | SUMMARY CANCER RISK: | 5E-07 |

Notes:
ND = no data available
NA = not applicable

TA[illegible]7
I[illegible]TION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
R[illegible]FOR: ADULT RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
*CPL Gordon Craig US Army Reserve Center*
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | AIR AVG. CONC. FOR TIME PERIOD ($\mu g/m^3$) | INHALATION CHRONIC REFERENCE CONCENTRATION | HAZARD QUOTIENT-INHALATION |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 2.3E-01 | 3.1E-06 | 3.0E+02 | 1.0E-08 |
| 1,3,5-Trimethylbenzene | 3.8E-02 | 5.1E-07 | 3.0E+02 | 1.7E-09 |
| 4-isopropyltoluene | 4.4E-02 | 5.9E-07 | ND | |
| Acetone | 2.0E-01 | 2.7E-06 | 8.0E+02 | 3.4E-09 |
| Ethylbenzene | 2.1E-03 | 2.8E-08 | 4.0E+02 | 7.0E-11 |
| Isopropylbenzene | 3.6E-02 | 4.8E-07 | 4.0E+02 | 1.2E-09 |
| m,p-Xylene | 1.9E-02 | 2.5E-07 | 3.0E+02 | 8.5E-10 |
| Methylene Chloride | 1.5E-02 | 2.0E-07 | 3.0E+03 | 6.7E-11 |
| n-Propylbenzene | 6.9E-02 | 9.3E-07 | 4.0E+02 | 2.3E-09 |
| o-Xylene | 4.6E-03 | 6.2E-08 | 3.0E+02 | 2.1E-10 |
| sec-Butylbenzene | 7.5E-02 | 1.0E-06 | 4.0E+02 | 2.5E-09 |
| Toluene | 2.1E-02 | 2.8E-07 | 4.0E+02 | 7.0E-10 |
| Benzo(b)fluoranthene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Chrysene | 1.1E-01 | 1.5E-06 | 7.1E+01 | 2.1E-08 |
| Fluoranthene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Naphthalene | 1.9E-01 | 2.5E-06 | 3.0E+00 | 8.5E-07 |
| Phenanthrene | 1.4E-01 | 1.9E-06 | 7.1E+01 | 2.6E-08 |
| Pyrene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Antimony | 2.0E+01 | 2.7E-04 | 1.0E+01 | 2.7E-05 |
| Chromium | 1.0E+01 | 1.3E-04 | 1.0E-01 | 1.3E-03 |
| TPH | 1.8E+03 | 2.4E-02 | 7.1E+01 | 3.4E-04 |
| C11-C22 Aromatic | 4.6E+01 | 6.1E-04 | 7.1E+01 | 8.6E-06 |
| C19-C36 Aliphatic | 7.1E+01 | 9.5E-04 | ND | |
| C9-C10 Aromatic | 1.7E+00 | 2.3E-05 | 6.0E+01 | 3.8E-07 |
| C9-C12 Aliphatic | 1.4E+00 | 1.9E-05 | 2.0E+03 | 9.4E-09 |
| | | | SUMMARY HAZARD INDEX: | 0.002 |

Notes:
ND = no data available
NA = not applicable

TABLE 8
INHALATION EXPOSURE TO VOLATILE OHM IN INDOOR AIR (MIGRATION FROM GROUNDWATER)
ADULT RESIDENT - FUTURE LAND USE
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION IN GROUNDWATER | [OHM]gw | Calculated | ug/L | |
| CONVERSION FACTOR 1 | CF1 | 24 | hours/day | |
| EXPOSURE TIME DAILY | ET | 24 | hours/day | Assumption |
| EXPOSURE FREQUENCY | EF | 350 | days/year | MADEP, 1995 |
| EXPOSURE DURATION | ED | 25 | years | MADEP, 1995 |
| CONVERSION FACTOR 2 | CF2 | 365 | days/year | |
| CONVERSION FACTOR 3 | CF3 | 1000 | $L/m^3$ | |
| AVERAGING TIME CANCER | AT | 75 | years | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 25 | years | MADEP, 1995 |

MADEP, 1995. Guidance for Disposal Site Risk Characterization, Interim Final Policy WSC/ORS-95-141. July.

EQUATIONS

CANCER RISK = AVG. CONC. (ug/m3) * CANCER UNIT RISK (ug/m3)^-1
HAZARD QUOTIENT = AVG.CONC.(ug/m3)/REF. CONC. (ug/m3)

$$\text{AVG. EXPOSURE CONC.} = \frac{[OHM]air * EF * ET * ED}{AT * CF1 * CF2}$$

OHM AIR CONC. = [OHM]gw * H * d * alpha * CF3 (MADEP, 1994)

Note:

alpha = 5E-04 (dimensionless) (MADEP, 1994)
d = 0.1 (dimensionless) (MADEP, 1994)
*For noncarcinogenic effects: AT = ED

TABLE 8
INHALATION EXPOSURE TO VOLATILE OHM IN INDOOR AIR (MIGRATION FROM GROUNDWATER)
ADULT RESIDENT - FUTURE LAND USE
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MA

CARCINOGENIC EFFECTS

| COMPOUND | [OHM]GW (ug/L) | H | OHM AIR CONCENTRATION (ug/m³) | AVERAGE AIR CONCENTRATION LIFETIME (ug/m3) | INHALATION CANCER UNIT RISK (ug/m3)^-1 | CANCER RISK |
|---|---|---|---|---|---|---|
| Naphthalene | 3 | 2.0E-02 | 2.97E-03 | 9.5E-04 | ND | |
| | | | | SUMMARY CANCER RISK | | 0E+00 |

*NONCARCINOGENIC EFFECTS*

| COMPOUND | [OHM]GW (ug/L) | H* | OHM AIR CONCENTRATION (ug/m³) | AVERAGE AIR CONCENTRATION FOR TIME PERIOD (ug/m3) | CHRONIC INHALATION RfC [1] (ug/m3) | HAZARD QUOTIENT |
|---|---|---|---|---|---|---|
| 4-isopropyltoluene[c] | 0.92 | 6.2E-01 | 2.85E-02 | 2.7E-02 | 4.00E+02 | 6.8E-05 |
| Isopropylbenzene | 0.3 | 6.2E-01 | 9.30E-03 | 8.9E-03 | 4.00E+02 | 2.2E-05 |
| m,p-Xylenes | 0.7 | 3.0E-01 | 1.05E-02 | 1.0E-02 | 3.00E+02 | 3.4E-05 |
| n-Propylbenzene[c] | 0.54 | 6.2E-01 | 1.67E-02 | 1.6E-02 | 4.00E+02 | 4.0E-05 |
| sec-Butylbenzene[c] | 8 | 6.2E-01 | 2.48E-01 | 2.4E-01 | 4.00E+02 | 5.9E-04 |
| Methyl tert butyl ether | 3.8 | 1.0E+00 | 1.90E-01 | 1.8E-01 | 3.00E+03 | 6.1E-05 |
| 1,2,4-Trimethylbenzene | 0.98 | 2.3E-01 | 1.13E-02 | 1.1E-02 | 3.00E+02 | 3.6E-05 |
| 1,3,5-Trimethylbenzene | 0.6 | 3.2E-01 | 9.60E-03 | 9.2E-03 | 3.00E+02 | 3.1E-05 |
| Toluene | 7 | 2.7E-01 | 9.52E-02 | 9.1E-02 | 4.00E+02 | 2.3E-04 |
| Naphthalene | 3 | 2.0E-02 | 2.97E-03 | 2.8E-03 | 3.00E+00 | 9.5E-04 |
| C11-C22 aromatic EPH | 355 | 3.0E-04 | 5.33E-03 | 5.1E-03 | 7.10E+01 | 7.2E-05 |
| C9-C18 aliphatic EPH | 535 | 6.9E-01 | 1.85E+01 | 1.8E+01 | 2.00E+03 | 8.8E-03 |
| C9-C10 Aromatic VPH | 53 | 3.3E-03 | 8.75E-03 | 8.4E-03 | 6.00E+01 | 1.4E-04 |
| C9-C12 aromatic VPH | 141 | 6.5E-01 | 4.58E+00 | 4.4E+00 | 2.00E+03 | 2.2E-03 |
| | | | | | | 1E-02 |

*Notes:*
ND = No data available.
* Source of H is Soil Screening Guidance: User's Guide (EPA, 1996), unless otherwise indicated.
From Lyman et al. (1990): H' (unitless) = H(atm-m3/mol)/RT (RT = 0.024 at 20 degrees C).
[c] H for isopropylbenzene used as a surrogate.

TA
DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SOIL | [OHM]soil | chemical-specific | mg/kg | |
| SOIL INGESTION RATE | IR s | 100 | mg/day | MADEP, 1995 |
| SKIN SURFACE AREA | SA | 3472 | cm2/day | MADEP, 1995 |
| ADHERENCE FACTOR | AF | 0.51 | mg/cm2 | MADEP, 1995 |
| RELATIVE ABSORPTION FACTOR - ORAL | RAF-O | chemical-specific | unitless | |
| RELATIVE ABSORPTION FACTOR - DERM | RAF-D | chemical-specific | unitless | |
| AREA WEIGHTING FACTOR | AWF | 1 | unitless | |
| BODY WEIGHT | BW | 15 | kg | MADEP, 1995 |
| EXPOSURE FREQUENCY | EF | 153 | day/yr | MADEP, 1995 |
| EXPOSURE DURATION | ED | 5 | yr | MADEP, 1995 |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 5 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = INTAKE x CANCER SLOPE FACTOR

$$\text{HAZARD QUOTIENT} = \frac{\text{INTAKE}}{\text{REFERENCE DOSE}}$$

$$\text{INTAKE-ING} = \frac{[\text{OHM}]\text{soil} \times \text{IR s} \times \text{RAF-O} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

$$\text{INTAKE-DERM} = \frac{[\text{OHM}]\text{soil} \times \text{SA} \times \text{AF} \times \text{RAF-D} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.

TABLE
DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
*Method 3 Risk Characterization*
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | *CARCINOGENIC RAF - INGESTION [1]* | *INTAKE - ING (mg/kg/day)* | *CARCINOGENIC RAF - DERMAL [1]* | *INTAKE - DERM (mg/kg/day)* | CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$ | *CANCER RISK - INGESTION* | *CANCER RISK - DERMAL* | TOTAL CANCER RISK |
|---|---|---|---|---|---|---|---|---|---|
| *Methylene Chloride* | 1.5E-02 | 1 | 2.8E-09 | 0.1 | 4.9E-09 | 0.0075 | 2.1E-11 | 3.7E-11 | 5.8E-11 |
| Benzo(b)fluoranthene | 1.3E-01 | 1 | 2.5E-08 | 0.04 | 1.8E-08 | 0.73 | 1.8E-08 | 1.3E-08 | 3.1E-08 |
| Chrysene | 1.1E-01 | 1 | 2.0E-08 | 0.04 | 1.5E-08 | 0.0073 | 1.5E-10 | 1.1E-10 | 2.6E-10 |
| *Naphthalene* | *1.9E-01* | | | *0.04* | *2.5E-08* | *ND* | | | |
| | | | | | | SUMMARY CANCER RISK: | 2E-08 | 1E-08 | 3E-08 |

Notes:
*[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.*

TA
DIRE. T CONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | NONCARCINOGENIC CHRONIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | NONCARCINOGENIC CHRONIC RAF - DERMAL [1] | INTAKE - DERM (mg/kg/day) | CHRONIC REFERENCE DOSE (mg/kg/day) | HAZARD QUOTIENT - INGESTION | HAZARD QUOTIENT - DERMAL | TOTAL HAZARD QUOTIENT |
|---|---|---|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 2.3E-01 | 1 | 6.4E-07 | 0.12 | 1.4E-06 | 5.0E-02 | 1.3E-05 | 2.7E-05 | 4.0E-05 |
| 1,3,5-Trimethylbenzene | 3.8E-02 | 1 | 1.1E-07 | 0.12 | 2.3E-07 | 5.0E-02 | 2.1E-06 | 4.5E-06 | 6.6E-06 |
| 4-isopropyltoluene | 4.4E-02 | 1 | 1.2E-07 | 0.11 | 2.4E-07 | 1.0E-01 | 1.2E-06 | 2.4E-06 | 3.6E-06 |
| Acetone | 2.0E-01 | 1 | 5.6E-07 | 0.1 | 9.9E-07 | 1.0E-01 | 5.6E-06 | 9.9E-06 | 1.5E-05 |
| Ethylbenzene | 2.1E-03 | 1 | 5.9E-09 | 0.2 | 2.1E-08 | 1.0E-01 | 5.9E-08 | 2.1E-07 | 2.7E-07 |
| Isopropylbenzene | 3.6E-02 | 0.99 | 1.0E-07 | 0.11 | 2.0E-07 | 1.0E-01 | 1.0E-06 | 2.0E-06 | 3.0E-06 |
| m,p-Xylene | 1.9E-02 | 1 | 5.3E-08 | 0.12 | 1.1E-07 | 2.0E+00 | 2.7E-08 | 5.6E-08 | 8.3E-08 |
| Methylene Chloride | 1.5E-02 | 1 | 4.2E-08 | 0.1 | 7.4E-08 | 6.0E-02 | 7.0E-07 | 1.2E-06 | 1.9E-06 |
| n-Propylbenzene | 6.9E-02 | 0.99 | 1.9E-07 | 0.11 | 3.8E-07 | 1.0E-01 | 1.9E-06 | 3.8E-06 | 5.7E-06 |
| o-Xylene | 4.6E-03 | 1 | 1.3E-08 | 0.12 | 2.7E-08 | 2.0E+00 | 6.4E-09 | 1.4E-08 | 2.0E-08 |
| sec-Butylbenzene | 7.5E-02 | 1 | 2.1E-07 | 0.1 | 3.7E-07 | 1.0E-02 | 2.1E-05 | 3.7E-05 | 5.8E-05 |
| Toluene | 2.1E-02 | 1 | 5.9E-08 | 0.12 | 1.2E-07 | 2.0E-01 | 2.9E-07 | 6.2E-07 | 9.2E-07 |
| Benzo(b)fluoranthene | 1.3E-01 | 0.91 | 3.4E-07 | 0.04 | 2.6E-07 | 3.0E-02 | 1.1E-05 | 8.8E-06 | 2.0E-05 |
| Chrysene | 1.1E-01 | 0.91 | 2.8E-07 | 0.04 | 2.2E-07 | 3.0E-02 | 9.3E-06 | 7.3E-06 | 1.7E-05 |
| Fluoranthene | 1.3E-01 | 1 | 3.7E-07 | 0.04 | 2.6E-07 | 4.0E-02 | 9.3E-06 | 6.6E-06 | 1.6E-05 |
| Naphthalene | 1.9E-01 | 1 | 5.3E-07 | 0.04 | 3.8E-07 | 2.0E-02 | 2.7E-05 | 1.9E-05 | 4.5E-05 |
| Phenanthrene | 1.4E-01 | 0.91 | 3.5E-07 | 0.04 | 2.7E-07 | 3.0E-02 | 1.2E-05 | 9.1E-06 | 2.1E-05 |
| Pyrene | 1.3E-01 | 1 | 3.7E-07 | 0.04 | 2.6E-07 | 3.0E-02 | 1.2E-05 | 8.6E-06 | 2.1E-05 |
| Antimony | 2.0E+01 | 1 | 5.6E-05 | 0.1 | 9.9E-05 | 4.0E-04 | 1.4E-01 | 2.5E-01 | 3.9E-01 |
| Chromium | 1.0E+01 | 1 | 2.8E-05 | 0.09 | 4.5E-05 | 3.0E-03 | 9.3E-03 | 1.5E-02 | 2.4E-02 |
| TPH | 1.8E+03 | 0.91 | 4.6E-03 | 0.18 | 1.6E-02 | 3.0E-02 | 1.5E-01 | 5.3E-01 | 6.9E-01 |
| C11-C22 Aromatic | 4.6E+01 | 0.91 | 1.2E-04 | 0.18 | 4.1E-04 | 3.0E-02 | 3.9E-03 | 1.4E-02 | 1.7E-02 |
| C19-C36 Aliphatic | 7.1E+01 | 0.91 | 1.8E-04 | 0.1 | 3.5E-04 | 6.0E+00 | 3.0E-05 | 5.9E-05 | 8.9E-05 |
| C9-C10 Aromatic | 1.7E+00 | 0.91 | 4.3E-06 | 0.18 | 1.5E-05 | 3.0E-02 | 1.4E-04 | 5.0E-04 | 6.5E-04 |
| C9-C12 Aliphatic | 1.4E+00 | 0.91 | 3.6E-06 | 0.2 | 1.4E-05 | 6.0E-01 | 5.9E-06 | 2.3E-05 | 2.9E-05 |
| | | | | | | SUMMARY HAZARD INDEX: | 0.3 | 0.8 | 1 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TA. 0
INHALATION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SOIL | {OHM]soil | chemical-specific | mg/kg | |
| CONCENTRATION OF RP IN AIR | [RP]air | 32 | ug/m3 | MADEP, 1995 |
| EXPOSURE TIME | ET | 1 | day/event | |
| EXPOSURE FREQUENCY | EF | 153 | event/yr | MADEP, 1995 |
| EXPOSURE DURATION | ED | 5 | yr | MADEP, 1995 |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 5 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = AIR AVG. CONC. x CANCER UNIT RISK

$$\text{HAZARD QUOTIENT} = \frac{\text{AIR AVG.CONC.}}{\text{REFERENCE CONCENTRATION}}$$

$$\text{AIR AVG. CONC.} = \frac{\text{\{OHM]soil x [RP]air x ET x EF x ED x CF1}}{\text{AT x CF2}}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995, Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.
*ET = 24 hours / 24 hours*

RP = Respirable Particulates

INHALATION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | AIR AVG. CONC. LIFETIME ($ug/m^3$) | INHALATION CANCER UNIT RISK $(ug/m^3)^{-1}$ | CANCER RISK-INHALATION |
|---|---|---|---|---|
| Chromium | 1.0E+01 | 9.0E-06 | 1.2E-02 | 1.1E-07 |
| Methylene Chloride | 1.5E-02 | 1.3E-08 | 0.00000047 | 6.3E-15 |
| Benzo(b)fluoranthene | 1.3E-01 | 1.2E-07 | 0.00011 | 1.3E-11 |
| Chrysene | 1.1E-01 | 9.8E-08 | 0.0000011 | 1.1E-13 |
| Naphthalene | 1.9E-01 | 1.7E-07 | ND | |
| | | | SUMMARY CANCER RISK: | 1E-07 |

Notes:
ND = no data available

T, .. 10
INHALATION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | AIR AVG. CONC. FOR TIME PERIOD ($\mu g/m^3$) | INHALATION CHRONIC REFERENCE CONCENTRATION ($\mu g/m^3$) | HAZARD QUOTIENT-INHALATION |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 2.3E-01 | 3.1E-06 | 3.0E+02 | 1.0E-08 |
| 1,3,5-Trimethylbenzene | 3.8E-02 | 5.1E-07 | 3.0E+02 | 1.7E-09 |
| 4-isopropyltoluene | 4.4E-02 | 5.9E-07 | ND | |
| Acetone | 2.0E-01 | 2.7E-06 | 8.0E+02 | 3.4E-09 |
| Ethylbenzene | 2.1E-03 | 2.8E-08 | 4.0E+02 | 7.0E-11 |
| Isopropylbenzene | 3.6E-02 | 4.8E-07 | 4.0E+02 | 1.2E-09 |
| m,p-Xylene | 1.9E-02 | 2.5E-07 | 3.0E+02 | 8.5E-10 |
| Methylene Chloride | 1.5E-02 | 2.0E-07 | 3.0E+03 | 6.7E-11 |
| n-Propylbenzene | 6.9E-02 | 9.3E-07 | 4.0E+02 | 2.3E-09 |
| o-Xylene | 4.6E-03 | 6.2E-08 | 3.0E+02 | 2.1E-10 |
| sec-Butylbenzene | 7.5E-02 | 1.0E-06 | 4.0E+02 | 2.5E-09 |
| Toluene | 2.1E-02 | 2.8E-07 | 4.0E+02 | 7.0E-10 |
| Benzo(b)fluoranthene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Chrysene | 1.1E-01 | 1.5E-06 | 7.1E+01 | 2.1E-08 |
| Fluoranthene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Naphthalene | 1.9E-01 | 2.5E-06 | 3.0E+00 | 8.5E-07 |
| Phenanthrene | 1.4E-01 | 1.9E-06 | 7.1E+01 | 2.6E-08 |
| Pyrene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Antimony | 2.0E+01 | 2.7E-04 | 1.0E+01 | 2.7E-05 |
| Chromium | 1.0E+01 | 1.3E-04 | 1.0E-01 | 1.3E-03 |
| TPH | 1.8E+03 | 2.4E-02 | 7.1E+01 | 3.4E-04 |
| C11-C22 Aromatic | 4.6E+01 | 6.1E-04 | 7.1E+01 | 8.6E-06 |
| C19-C36 Aliphatic | 7.1E+01 | 9.5E-04 | ND | |
| C9-C10 Aromatic | 1.7E+00 | 2.3E-05 | 6.0E+01 | 3.8E-07 |
| C9-C12 Aliphatic | 1.4E+00 | 1.9E-05 | 2.0E+03 | 9.4E-09 |
| | | | SUMMARY HAZARD INDEX: | 0.002 |

Notes:
ND = no data available

TABLE 11
INHALATION EXPOSURE TO VOLATILE OHM IN INDOOR AIR (MIGRATION FROM GROUNDWATER)
CHILD RESIDENT - FUTURE LAND USE
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MA

**EXPOSURE PARAMETERS**

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION IN GROUNDWATER | [OHM]gw | Calculated | ug/L | |
| CONVERSION FACTOR 1 | CF1 | 24 | hours/day | |
| EXPOSURE TIME DAILY | ET | 24 | hours/day | Assumption |
| EXPOSURE FREQUENCY | EF | 350 | days/year | MADEP, 1995 |
| EXPOSURE DURATION | ED | 5 | years | MADEP, 1995 |
| CONVERSION FACTOR 2 | CF2 | 365 | days/year | |
| CONVERSION FACTOR 3 | CF3 | 1000 | L/m$^3$ | |
| AVERAGING TIME CANCER | AT | 75 | years | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 5 | years | MADEP, 1995 |

MADEP, 1995. Guidance for Disposal Site Risk Characterization, Interim Final Policy WSC/ORS-95-141. July.

**EQUATIONS**

CANCER RISK = AVG. CONC. (ug/m3) * CANCER UNIT RISK (ug/m3)^-1
HAZARD QUOTIENT = AVG.CONC.(ug/m3)/REF. CONC. (ug/m3)

$$\text{AVG. EXPOSURE CONC.} = \frac{[\text{OHM}]\text{air} * EF * ET * ED}{AT * CF1 * CF2}$$

OHM AIR CONC. = [OHM]gw * H * d * alpha * CF3 (MADEP, 1994)

Note:

alpha = 5E-04 (dimensionless) (MADEP, 1994)
d = 0.1 (dimensionless) (MADEP, 1994)
*For noncarcinogenic effects: AT = ED

TABLE 11
INHALATION EXPOSURE TO VOLATILE OHM IN INDOOR AIR (MIGRATION FROM GROUNDWATER)
CHILD RESIDENT - FUTURE LAND USE
CPL GORDON CRAIG US ARMY RESERVE CENTER
BROCKTON, MA

CARCINOGENIC EFFECTS

| COMPOUND | [OHM]GW (ug/L) | H | OHM AIR CONCENTRATION (ug/m³) | AVERAGE AIR CONCENTRATION LIFETIME (ug/m3) | INHALATION CANCER UNIT RISK (ug/m3)^-1 | CANCER RISK |
|---|---|---|---|---|---|---|
| Naphthalene | 3 | 2.0E-02 | 2.97E-03 | 1.9E-04 | ND | |
| | | | | SUMMARY CANCER RISK | | 0E+00 |

NONCARCINOGENIC EFFECTS

| COMPOUND | [OHM]GW (ug/L) | H* | OHM AIR CONCENTRATION (ug/m³) | AVERAGE AIR CONCENTRATION FOR TIME PERIOD (ug/m3) | CHRONIC INHALATION RIC [1] (ug/m3) | HAZARD QUOTIENT |
|---|---|---|---|---|---|---|
| 4-isopropyltoluene[c] | 0.92 | 6.2E-01 | 2.85E-02 | 2.7E-02 | 4.00E+02 | 6.8E-05 |
| Isopropylbenzene | 0.3 | 6.2E-01 | 9.30E-03 | 8.9E-03 | 4.00E+02 | 2.2E-05 |
| m,p-Xylenes | 0.7 | 3.0E-01 | 1.05E-02 | 1.0E-02 | 3.00E+02 | 3.4E-05 |
| n-Propylbenzene[c] | 0.54 | 6.2E-01 | 1.67E-02 | 1.6E-02 | 4.00E+02 | 4.0E-05 |
| sec-Butylbenzene[c] | 8 | 6.2E-01 | 2.48E-01 | 2.4E-01 | 4.00E+02 | 5.9E-04 |
| Methyl tert butyl ether | 3.8 | 1.0E+00 | 1.90E-01 | 1.8E-01 | 3.00E+03 | 6.1E-05 |
| 1,2,4-Trimethylbenzene | 0.98 | 2.3E-01 | 1.13E-02 | 1.1E-02 | 3.00E+02 | 3.6E-05 |
| 1,3,5-Trimethylbenzene | 0.6 | 3.2E-01 | 9.60E-03 | 9.2E-03 | 3.00E+02 | 3.1E-05 |
| Toluene | 7 | 2.7E-01 | 9.52E-02 | 9.1E-02 | 4.00E+02 | 2.3E-04 |
| Naphthalene | 3 | 2.0E-02 | 2.97E-03 | 2.8E-03 | 3.00E+00 | 9.5E-04 |
| C11-C22 aromatic EPH | 355 | 3.0E-04 | 5.33E-03 | 5.1E-03 | 7.10E+01 | 7.2E-05 |
| C9-C18 aliphatic EPH | 535 | 6.9E-01 | 1.85E+01 | 1.8E+01 | 2.00E+03 | 8.8E-03 |
| C9-C10 Aromatic VPH | 53 | 3.3E-03 | 8.75E-03 | 8.4E-03 | 6.00E+01 | 1.4E-04 |
| C9-C12 aromatic VPH | 141 | 6.5E-01 | 4.58E+00 | 4.4E+00 | 2.00E+03 | 2.2E-03 |
| | | | | | | 3E-02 |

Notes:
ND = No data available.
* Source of H is Soil Screening Guidance: User's Guide (EPA, 1996), unless otherwise indicated.
From Lyman et al. (1990): H' (unitless) = H(atm-m3/mol)/RT (RT = 0.024 at 20 degrees C);
[c] H for isopropylbenzene used as a surrogate.

TABLE 12
DIRECT CONTACT AND INCIDENTAL INGESTION OF SURFACE WATER - On-Site Stream
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SURFACE WATER | [OHM]gw | chemical-specific | mg/l | |
| SURFACE WATER INGESTION RATE | IR gw | 0.05 | l/day | Assumption |
| SKIN SURFACE AREA | SA | 1542 | cm2 | MADEP, 1995 |
| PERMEABILITY CONSTANT | Kp | chemical-specific | cm/hr | |
| RELATIVE ABSORPTION FACTOR - ORAL | RAF-O | chemical-specific | unitless | |
| RELATIVE ABSORPTION FACTOR - DERM | RAF-D | chemical-specific | unitless | |
| BODY WEIGHT | BW | 15 | kg | MADEP, 1995 |
| EXPOSURE TIME | ET | 2 | hr/event | Assumption |
| EXPOSURE FREQUENCY [1] | EF | 39 | event/yr | MADEP, 1995 |
| EXPOSURE DURATION | ED | 5 | yr | MADEP, 1995 |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 5 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 0.001 | l/cm3 | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = INTAKE x CANCER SLOPE FACTOR

$$\text{HAZARD QUOTIENT} = \frac{\text{INTAKE}}{\text{REFERENCE DOSE}}$$

$$\text{INTAKE-ING} = \frac{[\text{OHM}]gw \times IR\,s \times RAF\text{-}O \times EF \times ED}{BW \times AT \times CF2}$$

$$\text{INTAKE-DERM} = \frac{[\text{OHM}]gw \times SA \times Kp \times RAF\text{-}D \times ET \times EF \times ED \times CF1}{BW \times AT \times CF2}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.

[1] Units for Exposure Frequency are day/yr for ingestion exposures and event/yr for dermal exposures.

TABLE 12
DIRECT CONTACT AND INCIDENTAL INGESTION OF SURFACE WATER - On-Site Stream
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve
Brockton, MA

*CARCINOGENIC EFFECTS*

| CHEMICALS OF POTENTIAL CONCERN | SURFACE WATER CONCENTRATION (mg/l) | CARCINOGENIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | CARCINOGENIC RAF - DERMAL [1] | PERMEABILITY CONSTANT (cm/hr) | INTAKE - DERM (mg/kg/day) | CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$ | CANCER RISK - INGESTION | CANCER RISK - DERMAL | TOTAL CANCER RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| bis(2-ethylhexyl) phthalate | 4.0E-03 | 1 | 9.5E-08 | 1.05 | 0.033 | 2.0E-07 | 0.014 | 1.3E-09 | 2.8E-09 | 4.2E-09 |
| Arsenic | 1.0E-02 | 1 | 2.5E-07 | 1.82 | 0.001 | 2.8E-08 | 1.5 | 3.7E-07 | 4.2E-08 | 4.1E-07 |
| Cadmium | 5.3E-03 | | | | 0.001 | | ND | | | |
| Lead | 4.3E-01 | | | | 0.001 | | ND | | | |
| Mercury | 1.5E-04 | | | | 0.001 | | ND | | | |
| | | | | | | | SUMMARY CANCER RISK: | 4E-07 | 4E-08 | 4E-07 |

*Notes:*
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TABLE 12
DIRECT CONTACT AND INCIDENTAL INGESTION OF SURFACE WATER - On-Site Stream
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SURFACE WATER CONCENTRATION (mg/l) | NONCARCINOGENIC CHRONIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | NONCARCINOGENIC CHRONIC RAF - DERMAL [1] | PERMEABILITY CONSTANT (cm/hr) | INTAKE - DERM (mg/kg/day) | CHRONIC REFERENCE DOSE | HAZARD QUOTIENT - INGESTION | HAZARD QUOTIENT - DERMAL | TOTAL HAZARD QUOTIENT |
|---|---|---|---|---|---|---|---|---|---|---|
| Carbon disulfide | 8.1E-04 | 1.09 | 3.1E-07 | 1.1 | 0.024 | 4.7E-07 | 1.0E-01 | 3.1E-06 | 4.7E-06 | 7.8E-06 |
| bis(2-ethylhexyl) phthalate | 4.0E-03 | 1 | 1.4E-06 | 1.05 | 0.033 | 3.0E-06 | 2.0E-02 | 7.1E-05 | 1.5E-04 | 2.2E-04 |
| Antimony | 4.3E-03 | 1 | 1.5E-06 | 1.82 | 0.001 | 1.7E-07 | 4.0E-04 | 3.8E-03 | 4.3E-04 | 4.3E-03 |
| Arsenic | 1.0E-02 | 1 | 3.7E-06 | 1.82 | 0.001 | 4.2E-07 | 3.0E-04 | 1.2E-02 | 1.4E-03 | 1.4E-02 |
| Barium | 8.3E-02 | 0.73 | 2.1E-05 | 1.82 | 0.001 | 3.3E-06 | 7.0E-02 | 3.1E-04 | 4.7E-05 | 3.5E-04 |
| Cadmium | 5.3E-03 | 1 | 1.9E-06 | 1.82 | 0.001 | 2.1E-07 | 5.0E-04 | 3.8E-03 | 4.3E-04 | 4.2E-03 |
| Chromium | 6.1E-02 | 1 | 2.2E-05 | 1.82 | 0.001 | 2.4E-06 | 3.0E-03 | 7.2E-03 | 8.1E-04 | 8.1E-03 |
| Copper | 3.3E-01 | 1 | 1.2E-04 | 1.82 | 0.001 | 1.3E-05 | 4.0E-02 | 2.9E-03 | 3.3E-04 | 3.3E-03 |
| Lead | 4.3E-01 | 0.5 | 7.7E-05 | 2 | 0.001 | 1.9E-05 | 7.5E-04 | 1.0E-01 | 2.5E-02 | 1.3E-01 |
| Mercury | 1.5E-04 | 1 | 5.3E-08 | 4.76 | 0.001 | 1.6E-08 | 3.0E-04 | 1.8E-04 | 5.2E-05 | 2.3E-04 |
| Nickel | 5.0E-02 | 1 | 1.8E-05 | 4.76 | 0.001 | 5.2E-06 | 2.0E-02 | 8.9E-04 | 2.6E-04 | 1.2E-03 |
| Selenium | 9.1E-03 | 1 | 3.2E-06 | 4.76 | 0.001 | 9.5E-07 | 5.0E-03 | 6.5E-04 | 1.9E-04 | 8.4E-04 |
| Zinc | 3.6E-01 | 1 | 1.3E-04 | 4.76 | 0.001 | 3.8E-05 | 3.0E-01 | 4.3E-04 | 1.3E-04 | 5.5E-04 |
| Ammonia | 6.7E-01 | 1 | 2.4E-04 | 1.82 | 0.001 | 2.7E-05 | 9.7E-01 | 2.5E-04 | 2.8E-05 | 2.7E-04 |
| Nitrate-Nitrite-N | 1.1E+00 | 1 | 4.0E-04 | 1.82 | 0.001 | 4.5E-05 | 1.0E-01 | 4.0E-03 | 4.5E-04 | 4.5E-03 |
| C11-C22 Aromatic | 1.2E-01 | 0.91 | 3.7E-05 | 1.1 | 0.23 | 6.4E-04 | 3.0E-02 | 1.2E-03 | 2.1E-02 | 2.3E-02 |
| C19-C36 Aliphatic | 2.5E-01 | 1 | 8.9E-05 | 1 | 0.23 | 1.3E-03 | 6.0E+00 | 1.5E-05 | 2.1E-04 | 2.3E-04 |
| | | | | | | | SUMMARY HAZARD INDEX: | 0.1 | 0.05 | 0.2 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TABLE
DIRECT CONTACT AND INCIDENTAL INGESTION OF SEDIMENT - On-Site Stream
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SEDIMENT | [OHM]sed | chemical-specific | mg/kg | |
| SEDIMENT INGESTION RATE | IR s | 50 | mg/day | Assumption |
| SKIN SURFACE AREA | SA | 1542 | cm2/day | MADEP, 1995 |
| ADHERENCE FACTOR | AF | 0.51 | mg/cm2 | MADEP, 1995 |
| RELATIVE ABSORPTION FACTOR - ORAL | RAF-O | chemical-specific | unitless | |
| RELATIVE ABSORPTION FACTOR - DERM | RAF-D | chemical-specific | unitless | |
| AREA WEIGHTING FACTOR | AWF | 1 | unitless | |
| BODY WEIGHT | BW | 15 | kg | MADEP, 1995 |
| EXPOSURE FREQUENCY | EF | 39 | day/yr | Assumption |
| EXPOSURE DURATION | ED | 5 | yr | MADEP, 1995 |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 5 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = INTAKE x CANCER SLOPE FACTOR

$$\text{HAZARD QUOTIENT} = \frac{\text{INTAKE}}{\text{REFERENCE DOSE}}$$

$$\text{INTAKE-ING} = \frac{[\text{OHM}]\text{sed} \times \text{IR s} \times \text{RAF-O} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

$$\text{INTAKE-DERM} = \frac{[\text{OHM}]\text{sed} \times \text{SA} \times \text{AF} \times \text{RAF-D} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. *Guidance for Disposal Site Risk Characterization.* Interim Final Policy WSC/ORS-95-141. July 1995.

TA

DIRECT CONTACT AND INCIDENTAL INGESTION OF SEDIMENT - On-Site Stream
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SEDIMENT CONCENTRATION (mg/kg) | CARCINOGENIC RAF - INGESTION [1] (unitless) | INTAKE - ING (mg/kg/day) | CARCINOGENIC RAF - DERMAL [1] (unitless) | INTAKE-DERM (mg/kg/day) | CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$ | CANCER RISK - INGESTION | CANCER RISK - DERMAL | TOTAL CANCER RISK |
|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 1.6E-01 | 1 | 3.9E-09 | 0.04 | 2.4E-09 | 0.73 | 2.8E-09 | 1.8E-09 | 4.6E-09 |
| Benzo(a)pyrene | 1.6E-01 | 1 | 3.7E-09 | 0.04 | 2.3E-09 | 7.3 | 2.7E-08 | 1.7E-08 | 4.4E-08 |
| Benzo(b)fluoranthene | 2.1E-01 | 1 | 5.0E-09 | 0.04 | 3.1E-09 | 0.73 | 3.7E-09 | 2.3E-09 | 6.0E-09 |
| Benzo(k)fluoranthene | 1.2E-01 | 1 | 2.8E-09 | 0.04 | 1.8E-09 | 0.073 | 2.1E-10 | 1.3E-10 | 3.4E-10 |
| bis(2-ethylhexyl) phthalate | 2.8E-01 | 1 | 6.6E-09 | 0.02 | 2.1E-09 | 0.014 | 9.2E-11 | 2.9E-11 | 1.2E-10 |
| Chrysene | 1.7E-01 | 1 | 4.1E-09 | 0.04 | 2.6E-09 | 0.0073 | 3.0E-11 | 1.9E-11 | 4.9E-11 |
| Indeno(1,2,3-cd)pyrene | 1.5E-01 | 1 | 3.7E-09 | 0.04 | 2.3E-09 | 0.73 | 2.7E-09 | 1.7E-09 | 4.3E-09 |
| Arsenic | 5.5E+00 | 1 | 1.3E-07 | 0.03 | 6.2E-08 | 1.5 | 2.0E-07 | 9.3E-08 | 2.9E-07 |
| Cadmium | 4.2E+00 | | | | | ND | | | |
| Lead | 3.9E+02 | | | | | ND | | | |
| Mercury | 4.6E-02 | | | | | ND | | | |
| | | | | | | SUMMARY CANCER RISK: | 2E-07 | 1E-07 | 3E-07 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TABLE ...
DIRECT CONTACT AND INCIDENTAL INGESTION OF SEDIMENT - On-Site Stream
RECEPTOR: CHILD RESIDENT - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SEDIMENT CONCENTRATION (mg/kg) | NONCARCINOGENIC CHRONIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | NONCARCINOGENIC CHRONIC RAF - DERMAL [1] | INTAKE - DERM (mg/kg/day) | CHRONIC REFERENCE DOSE (mg/kg/day) | HAZARD QUOTIENT - INGESTION | HAZARD QUOTIENT - DERMAL | TOTAL HAZARD QUOTIENT |
|---|---|---|---|---|---|---|---|---|---|
| Acetone | 3.0E-02 | 1 | 1.1E-08 | 0.1 | 1.7E-08 | 1.0E-01 | 1.1E-07 | 1.7E-07 | 2.8E-07 |
| Benzo(a)anthracene | 1.6E-01 | 0.91 | 5.3E-08 | 0.04 | 3.7E-08 | 3.0E-02 | 1.8E-06 | 1.2E-06 | 3.0E-06 |
| Benzo(a)pyrene | 1.6E-01 | 0.91 | 5.0E-08 | 0.04 | 3.5E-08 | 3.0E-02 | 1.7E-06 | 1.2E-06 | 2.8E-06 |
| Benzo(b)fluoranthene | 2.1E-01 | 0.91 | 6.8E-08 | 0.04 | 4.7E-08 | 3.0E-02 | 2.3E-06 | 1.6E-06 | 3.9E-06 |
| Benzo(g,h,i)perylene | 1.5E-01 | 0.91 | 4.9E-08 | 0.04 | 3.4E-08 | 3.0E-02 | 1.6E-06 | 1.1E-06 | 2.8E-06 |
| Benzo(k)fluoranthene | 1.2E-01 | 0.91 | 3.9E-08 | 0.04 | 2.7E-08 | 3.0E-02 | 1.3E-06 | 9.0E-07 | 2.2E-06 |
| bis(2-ethylhexyl) phthalate | 2.8E-01 | 1 | 9.8E-08 | 0.02 | 3.1E-08 | 2.0E-02 | 4.9E-06 | 1.5E-06 | 6.5E-06 |
| Chrysene | 1.7E-01 | 0.91 | 5.6E-08 | 0.04 | 3.9E-08 | 3.0E-02 | 1.9E-06 | 1.3E-06 | 3.2E-06 |
| Fluoranthene | 2.4E-01 | 1 | 8.6E-08 | 0.04 | 5.4E-08 | 4.0E-02 | 2.2E-06 | 1.4E-06 | 3.5E-06 |
| Indeno(1,2,3-cd)pyrene | 1.5E-01 | 0.91 | 5.0E-08 | 0.04 | 3.5E-08 | 3.0E-02 | 1.7E-06 | 1.2E-06 | 2.8E-06 |
| Phenanthrene | 1.9E-01 | 0.91 | 6.2E-08 | 0.04 | 4.3E-08 | 3.0E-02 | 2.1E-06 | 1.4E-06 | 3.5E-06 |
| Pyrene | 2.5E-01 | 1 | 9.0E-08 | 0.04 | 5.7E-08 | 3.0E-02 | 3.0E-06 | 1.9E-06 | 4.9E-06 |
| Antimony | 1.9E+00 | 1 | 6.7E-07 | 0.1 | 1.1E-06 | 4.0E-04 | 1.7E-03 | 2.6E-03 | 4.3E-03 |
| Arsenic | 5.5E+00 | 1 | 2.0E-06 | 0.03 | 9.3E-07 | 3.0E-04 | 6.6E-03 | 3.1E-03 | 9.7E-03 |
| Barium | 4.6E+01 | 0.71 | 1.2E-05 | 0.05 | 1.3E-05 | 7.0E-02 | 1.7E-04 | 1.8E-04 | 3.5E-04 |
| Cadmium | 4.2E+00 | 1.86 | 2.8E-06 | 0.14 | 3.3E-06 | 1.0E-03 | 2.8E-03 | 3.3E-03 | 6.1E-03 |
| Chromium | 2.3E+01 | 1 | 8.3E-06 | 0.09 | 1.2E-05 | 3.0E-03 | 2.8E-03 | 3.9E-03 | 6.7E-03 |
| Lead | 3.9E+02 | 0.5 | 6.9E-05 | 0.006 | 1.3E-05 | 7.5E-04 | 9.3E-02 | 1.7E-02 | 1.1E-01 |
| Mercury | 4.6E-02 | 1 | 1.6E-08 | 0.05 | 1.3E-08 | 3.0E-04 | 5.5E-05 | 4.3E-05 | 9.8E-05 |
| Silver | 3.1E+00 | 1 | 1.1E-06 | 0.25 | 4.3E-06 | 5.0E-03 | 2.2E-04 | 8.7E-04 | 1.1E-03 |
| TPH | 1.4E+02 | 0.91 | 4.6E-05 | 0.18 | 1.4E-04 | 3.0E-02 | 1.5E-03 | 4.7E-03 | 6.3E-03 |
| C19-C36 Aliphatic | 3.7E+02 | 0.91 | 1.2E-04 | 0.1 | 2.1E-04 | 6.0E+00 | 2.0E-05 | 3.5E-05 | 5.5E-05 |
| | | | | | | SUMMARY HAZARD INDEX: | 0.1 | 0.04 | 0.1 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TA
DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)
RECEPTOR: CONSTRUCTION WORKER - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SOIL | [OHM]soil | chemical-specific | mg/kg | |
| SOIL INGESTION RATE | IR s | 500 | mg/day | MADEP, 1995 |
| SKIN SURFACE AREA | SA | 5834 | cm2/day | MADEP, 1996 |
| ADHERENCE FACTOR | AF | 0.51 | mg/cm2 | MADEP, 1995 |
| RELATIVE ABSORPTION FACTOR - ORAL | RAF-O | chemical-specific | unitless | |
| RELATIVE ABSORPTION FACTOR - DERM | RAF-D | chemical-specific | unitless | |
| AREA WEIGHTING FACTOR | AWF | 1 | unitless | Assumption |
| BODY WEIGHT | BW | 70 | kg | MADEP, 1995 |
| EXPOSURE FREQUENCY | EF | 250 | day/yr | MADEP, 1996 |
| EXPOSURE DURATION | ED | 0.5 | yr | MADEP, 1996 |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| AVERAGING TIME NONCANCER | AT | 0.5 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = INTAKE x CANCER SLOPE FACTOR

$$\text{HAZARD QUOTIENT} = \frac{\text{INTAKE}}{\text{REFERENCE DOSE}}$$

$$\text{INTAKE-ING} = \frac{[\text{OHM}]\text{soil} \times \text{IR s} \times \text{RAF-O} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

$$\text{INTAKE-DERM} = \frac{[\text{OHM}]\text{soil} \times \text{SA} \times \text{AF} \times \text{RAF-D} \times \text{AWF} \times \text{EF} \times \text{ED} \times \text{CF1}}{\text{BW} \times \text{AT} \times \text{CF2}}$$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. Guidance for Disposal Site Risk Characterization. Interim Final Policy WSC/ORS-95-141. July 1995.
MADEP, 1996. Draft Commercial/Industrial Shortform.

TABL..

*DIRECT CONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)*
RECEPTOR: CONSTRUCTION WORKER - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | CARCINOGENIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | CARCINOGENIC RAF - DERMAL [1] | INTAKE - DERM (mg/kg/day) | CANCER SLOPE FACTOR $(mg/kg/day)^{-1}$ | CANCER RISK - INGESTION | CANCER RISK - DERMAL | TOTAL CANCER RISK |
|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride | 1.5E-02 | 1 | 4.9E-10 | 0.1 | 2.9E-10 | 0.0075 | 3.7E-12 | 2.2E-12 | 5.9E-12 |
| Benzo(b)fluoranthene | 1.3E-01 | 1 | 4.3E-09 | 0.04 | 1.0E-09 | 0.73 | 3.2E-09 | 7.5E-10 | 3.9E-09 |
| Chrysene | 1.1E-01 | 1 | 3.6E-09 | 0.04 | 8.5E-10 | 0.0073 | 2.6E-11 | 6.2E-12 | 3.2E-11 |
| Naphthalene | 1.9E-01 | | | 0.04 | 1.5E-09 | ND | | | |
| | | | | | | SUMMARY CANCER RISK: | 3E-09 | 8E-10 | 4E-09 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TA
DIRE. CONTACT AND INCIDENTAL INGESTION OF SOIL - All Soils (0-15 ft bgs)
RECEPTOR: CONSTRUCTION WORKER - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | NONCARCINOGENIC SUBCHRONIC RAF - INGESTION [1] | INTAKE - ING (mg/kg/day) | NONCARCINOGENIC SUBCHRONIC RAF - DERMAL [1] | INTAKE - DERM (mg/kg/day) | SUBCHRONIC REFERENCE DOSE (mg/kg/day) | HAZARD QUOTIENT - INGESTION | HAZARD QUOTIENT - DERMAL | TOTAL HAZARD QUOTIENT |
|---|---|---|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 2.3E-01 | 1 | 1.1E-06 | 0.12 | 8.0E-07 | 5.0E-02 | 2.3E-05 | 1.6E-05 | 3.9E-05 |
| 1,3,5-Trimethylbenzene | 3.8E-02 | 1 | 1.9E-07 | 0.12 | 1.3E-07 | 5.0E-02 | 3.7E-06 | 2.7E-06 | 6.4E-06 |
| 4-isopropyltoluene | 4.4E-02 | 1 | 2.2E-07 | 0.11 | 1.4E-07 | 1.0E-01 | 2.2E-06 | 1.4E-06 | 3.6E-06 |
| Acetone | 2.0E-01 | 1 | 9.8E-07 | 0.1 | 5.8E-07 | 1.0E+00 | 9.8E-07 | 5.8E-07 | 1.6E-06 |
| Ethylbenzene | 2.1E-03 | 1 | 1.0E-08 | 0.2 | 1.2E-08 | 1.0E+00 | 1.0E-08 | 1.2E-08 | 2.3E-08 |
| Isopropylbenzene | 3.6E-02 | 0.99 | 1.7E-07 | 0.11 | 1.2E-07 | 1.0E-01 | 1.7E-06 | 1.2E-06 | 2.9E-06 |
| m,p-Xylene | 1.9E-02 | 1 | 9.3E-08 | 0.12 | 6.6E-08 | 4.0E+00 | 2.3E-08 | 1.7E-08 | 4.0E-08 |
| Methylene Chloride | 1.5E-02 | 1 | 7.3E-08 | 0.1 | 4.4E-08 | 6.0E-02 | 1.2E-06 | 7.3E-07 | 2.0E-06 |
| n-Propylbenzene | 6.9E-02 | 0.99 | 3.3E-07 | 0.11 | 2.2E-07 | 1.0E-01 | 3.3E-06 | 2.2E-06 | 5.6E-06 |
| o-Xylene | 4.6E-03 | 1 | 2.3E-08 | 0.12 | 1.6E-08 | 4.0E+00 | 5.6E-09 | 4.0E-09 | 9.6E-09 |
| sec-Butylbenzene | 7.5E-02 | 1 | 3.7E-07 | 0.1 | 2.2E-07 | 1.0E-02 | 3.7E-05 | 2.2E-05 | 5.9E-05 |
| Toluene | 2.1E-02 | 1 | 1.0E-07 | 0.12 | 7.3E-08 | 2.0E+00 | 5.1E-08 | 3.7E-08 | 8.8E-08 |
| Benzo(b)fluoranthene | 1.3E-01 | 0.91 | 5.9E-07 | 0.04 | 1.5E-07 | 3.0E-01 | 2.0E-06 | 5.2E-07 | 2.5E-06 |
| Chrysene | 1.1E-01 | 0.91 | 4.9E-07 | 0.04 | 1.3E-07 | 3.0E-01 | 1.6E-06 | 4.3E-07 | 2.1E-06 |
| Fluoranthene | 1.3E-01 | 1 | 6.5E-07 | 0.04 | 1.5E-07 | 4.0E-01 | 1.6E-06 | 3.9E-07 | 2.0E-06 |
| Naphthalene | 1.9E-01 | 1 | 9.3E-07 | 0.04 | 2.2E-07 | 2.0E-02 | 4.6E-05 | 1.1E-05 | 5.8E-05 |
| Phenanthrene | 1.4E-01 | 0.91 | 6.2E-07 | 0.04 | 1.6E-07 | 3.0E-01 | 2.1E-06 | 5.4E-07 | 2.6E-06 |
| Pyrene | 1.3E-01 | 1 | 6.4E-07 | 0.04 | 1.5E-07 | 3.0E-01 | 2.1E-06 | 5.1E-07 | 2.6E-06 |
| Antimony | 2.0E+01 | 1 | 9.8E-05 | 0.1 | 5.8E-05 | 4.0E-04 | 2.4E-01 | 1.5E-01 | 3.9E-01 |
| Chromium | 1.0E+01 | 1 | 4.9E-05 | 0.09 | 2.6E-05 | 2.0E-02 | 2.4E-03 | 1.3E-03 | 3.8E-03 |
| TPH | 1.8E+03 | 0.91 | 8.0E-03 | 0.18 | 9.4E-03 | 3.0E-01 | 2.7E-02 | 3.1E-02 | 5.8E-02 |
| C11-C22 Aromatic | 4.6E+01 | 0.91 | 2.0E-04 | 0.18 | 2.4E-04 | 3.0E-01 | 6.8E-04 | 7.9E-04 | 1.5E-03 |
| C19-C36 Aliphatic | 7.1E+01 | 0.91 | 3.2E-04 | 0.1 | 2.1E-04 | 6.0E+01 | 5.3E-06 | 3.4E-06 | 8.7E-06 |
| C9-C10 Aromatic | 1.7E+00 | 0.91 | 7.6E-06 | 0.18 | 8.9E-06 | 3.0E-01 | 2.5E-05 | 3.0E-05 | 5.5E-05 |
| C9-C12 Aliphatic | 1.4E+00 | 0.91 | 6.2E-06 | 0.2 | 8.2E-06 | 6.0E+00 | 1.0E-06 | 1.4E-06 | 2.4E-06 |
| | | | | | | SUMMARY HAZARD INDEX: | 0.3 | 0.2 | 0.5 |

Notes:
[1] MADEP, 1994. Background Documentation for the Development of MCP Numerical Standards. April 1994.

TAb[illegible]S

INHALATION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
RECEPTOR: CONSTRUCTION WORKER - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

*EXPOSURE PARAMETERS*

| PARAMETER | SYMBOL | VALUE | UNITS | SOURCE |
|---|---|---|---|---|
| CONCENTRATION OF CPC IN SOIL | [OHM]soil | chemical-specific | mg/kg | |
| CONCENTRATION OF RP IN AIR | [RP]air | 60 | ug/m3 | MADEP, 1995 |
| *EXPOSURE TIME* | ET | 0.33 | day/event | |
| EXPOSURE FREQUENCY | EF | 250 | event/yr | MADEP, 1996 |
| EXPOSURE DURATION | ED | 0.5 | yr | MADEP, 1996 |
| AVERAGING TIME CANCER | AT | 75 | yr | MADEP, 1995 |
| *AVERAGING TIME NONCANCER* | AT | 0.5 | yr | MADEP, 1995 |
| CONVERSION FACTOR 1 | CF1 | 1.E-06 | kg/mg | |
| CONVERSION FACTOR 2 | CF2 | 365 | day/yr | |

EQUATIONS

CANCER RISK = AIR AVG. CONC. x CANCER UNIT RISK

HAZARD QUOTIENT = $\frac{\text{AIR AVG.CONC.}}{\text{REFERENCE CONCENTRATION}}$

AIR AVG. CONC. = $\frac{\text{[OHM]soil x [RP]air x ET x EF x ED x CF1}}{\text{AT x CF2}}$

NOTE: FOR NONCARCINOGENIC EFFECTS, AT = ED

MADEP, 1995. *Guidance for Disposal Site Risk Characterization.* Interim Final Policy WSC/ORS-95-141. July 1995.
MADEP, 1996. Draft Commercial/Industrial Shortform.
ET = 8 hours / 24 hours

RP = Respirable Particulates

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INHALATION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
RECEPTOR: CONSTRUCTION WORKER - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

CARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | AIR AVG. CONC. LIFETIME ($ug/m^3$) | INHALATION CANCER UNIT RISK $(ug/m^3)^{-1}$ | CANCER RISK-INHALATION |
|---|---|---|---|---|
| Chromium | 1.0E+01 | 9.1E-07 | 1.2E-02 | 1.1E-08 |
| Methylene Chloride | 1.5E-02 | 1.4E-09 | 0.00000047 | 6.4E-16 |
| Benzo(b)fluoranthene | 1.3E-01 | 1.2E-08 | 0.00011 | 1.3E-12 |
| Chrysene | 1.1E-01 | 9.9E-09 | 0.0000011 | 1.1E-14 |
| Naphthalene | 1.9E-01 | 1.7E-08 | ND | |
| | | | SUMMARY CANCER RISK: | 1E-08 |

Notes:
ND = no data available

TAB. 25
INHALATION OF SOIL PARTICULATES - All Soils (0-15 ft bgs)
RECEPTOR: CONSTRUCTION WORKER - FUTURE LAND USE
Method 3 Risk Characterization
CPL Gordon Craig US Army Reserve Center
Brockton, MA

NONCARCINOGENIC EFFECTS

| CHEMICALS OF POTENTIAL CONCERN | SOIL CONCENTRATION (mg/kg) | AIR AVG. CONC. FOR TIME PERIOD ($\mu g/m^3$) | INHALATION SUBCHRONIC REFERENCE CONCENTRATION ($\mu g/m^3$) | HAZARD QUOTIENT-INHALATION |
|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | 2.3E-01 | 3.1E-06 | 3.0E+02 | 1.0E-08 |
| 1,3,5-Trimethylbenzene | 3.8E-02 | 5.2E-07 | 3.0E+02 | 1.7E-09 |
| 4-isopropyltoluene | 4.4E-02 | 6.0E-07 | ND | |
| Acetone | 2.0E-01 | 2.7E-06 | 8.0E+02 | 3.4E-09 |
| Ethylbenzene | 2.1E-03 | 2.8E-08 | 4.0E+02 | 7.1E-11 |
| Isopropylbenzene | 3.6E-02 | 4.9E-07 | 4.0E+02 | 1.2E-09 |
| m,p-Xylene | 1.9E-02 | 2.6E-07 | 3.0E+02 | 8.6E-10 |
| Methylene Chloride | 1.5E-02 | 2.0E-07 | 3.0E+03 | 6.8E-11 |
| n-Propylbenzene | 6.9E-02 | 9.4E-07 | 4.0E+02 | 2.3E-09 |
| o-Xylene | 4.6E-03 | 6.2E-08 | 3.0E+02 | 2.1E-10 |
| sec-Butylbenzene | 7.5E-02 | 1.0E-06 | 4.0E+02 | 2.5E-09 |
| Toluene | 2.1E-02 | 2.8E-07 | 4.0E+02 | 7.1E-10 |
| Benzo(b)fluoranthene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Chrysene | 1.1E-01 | 1.5E-06 | 7.1E+01 | 2.1E-08 |
| Fluoranthene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Naphthalene | 1.9E-01 | 2.6E-06 | 3.0E+00 | 8.6E-07 |
| Phenanthrene | 1.4E-01 | 1.9E-06 | 7.1E+01 | 2.6E-08 |
| Pyrene | 1.3E-01 | 1.8E-06 | 7.1E+01 | 2.5E-08 |
| Antimony | 2.0E+01 | 2.7E-04 | 1.0E+01 | 2.7E-05 |
| Chromium | 1.0E+01 | 1.4E-04 | 1.0E-01 | 1.4E-03 |
| TPH | 1.8E+03 | 2.4E-02 | 7.1E+01 | 3.4E-04 |
| C11-C22 Aromatic | 4.6E+01 | 6.2E-04 | 7.1E+01 | 8.7E-06 |
| C19-C36 Aliphatic | 7.1E+01 | 9.6E-04 | ND | |
| C9-C10 Aromatic | 1.7E+00 | 2.3E-05 | 6.0E+01 | 3.8E-07 |
| C9-C12 Aliphatic | 1.4E+00 | 1.9E-05 | 2.0E+03 | 9.5E-09 |
| | | | SUMMARY HAZARD INDEX: | 0.002 |

Notes:
ND = no data available

# APPENDIX R

# ENVIRONMENTAL TOXICITY PROFILES

**ENVIRONMENTAL TOXICITY PROFILES**

**Cpl. Gordon Craig US Army Reserve Center**
**Brockton, Massachusetts**

## INORGANICS

**Antimony**. Antimony is a naturally occurring metal that is used in various manufacturing processes. Antimony is a common urban air pollutant. Acute oral exposure of humans and animals to high doses of antimony or antimony-containing compounds (antimonials) may cause gastrointestinal disorders (vomiting, diarrhea), respiratory difficulties, and death at extremely high doses. Subchronic and chronic oral exposure may affect hematologic parameters. Long-term exposure to high doses of antimony or antimonials has been shown to adversely affect longevity in animals. Limited data suggest that prenatal and postnatal exposure of rats to antimony interferes with vasomotor responses.

Exposure of animals to high concentrations of antimony and antimonials (especially stibine gas) may result in pulmonary edema and death. Reproductive dysfunction has been demonstrated in rats exposed to antimony trioxide. Dermal application of high doses of antimony oxide resulted in the death of rabbits within one day. Decreased longevity and alteration of blood chemistry has been shown in rats chronically exposed to potassium antimony tartrate in the drinking water.

Some data indicate that long-term exposure of rats to antimony trioxide and trisulfide increased the incidence of lung tumors.

Reference:
Prepared by Robert A. Young, Ph.D., D.A.B.T., Chemical Hazard Evaluation and Communication Group, Biomedical and Environmental Information Analysis Section, Health and Safety Research Division, Oak Ridge, Tennessee. Prepared for: Oak Ridge Reservation Environmental Restoration Program. December 1992.

**Arsenic**. Arsenic has been used in pesticide formulations and has industrial uses in tanneries, as well as the glass and wine making industries. The toxicity of inorganic arsenic depends on its valence state (-3, +3, or +5), and also on the physical and chemical properties of the compound in which it occurs. Trivalent ($As^{+3}$) compounds are generally more toxic than pentavalent ($As^{+5}$) compounds, and the more water soluble compounds are usually more toxic and more likely to have systemic effects than the less soluble compounds, which are more likely to cause chronic pulmonary effects if inhaled.

In animals, acute oral exposures can cause gastrointestinal and neurological effects. Low subchronic doses can result in immunosuppression, and hepato-renal effects. Chronic exposures have also resulted in mild hyperkeratosis and bile duct enlargement with hyperplasia, focal necrosis, and fibrosis. Reduction in litter size, high male/female birth ratios, and fetotoxicity without significant fetal abnormalities occur following oral exposures; however, parenteral dosing has resulted in exencephaly, encephaloceles, skeletal defects, and urogenital system abnormalities.

Animal studies have shown that inorganic arsenic, by intratracheal instillation, can cause pulmonary inflammation and hyperplasia, lung lesions, and immunosuppression. Long-term inhalation exposures have resulted in altered conditioned reflexes and central nervous system damage. Reductions in fetal weight and in the number of live fetuses, and increases in fetal abnormalities due to retarded osteogenesis have been observed following inhalation exposures.

Reference:

Dennis M. Opresko, Ph.D., Chemical Hazard Evaluation and Communication Group, Biomedical and Environmental Information Analysis Section, Health and Safety Research Division, Oak Ridge, Tennessee. Prepared for Oak Ridge Reservation Environmental Restoration Program. April 1992.

**Barium**. Barium is used in paints, soap, paper, rubber, and in the manufacture of glass. Some compounds of barium have been used as insecticides.

Exposure to barium carbonate in air has been reported to result in elevated blood pressure and decreased body weight gain in rats. Reproduction and developmental effects were also observed. Increased fetal mortality was seen after untreated females were mated with males exposed to barium carbonate. Similar results were obtained with female rats.

Reference:
A. A. Francis, M.S., D.A.B.T., and Carol S. Forsyth, Ph.D., Chemical Hazard Evaluation Group in the Biomedical and Environmental Information Analysis Section, Health Sciences Research Division, Oak Ridge, Tennessee. Prepared for Oak Ridge Reservation Environmental Restoration Program.

**Cadmium**. Cadmium is a naturally occurring metal that is used in various chemical forms in metallurgical and other industrial processes, and in the production of pigments.

In animals studies, mice or hamsters that breathed in cadmium did not get lung cancer, but rats that breathed in cadmium did develop lung cancer. Female rats and mice that breathed high levels of cadmium had fewer litters, and their babies may have had more birth defects than usual. Breathing cadmium has also been shown to cause liver damage and changes in the immune system in rats and mice.

Animals eating or drinking cadmium sometimes get high blood pressure, iron-poor blood, liver disease, and nerve or brain damage. Studies of animals that eat or drink cadmium have not found increases in cancer. Skin contact with cadmium is not known to affect the health of animals because virtually no cadmium can enter the body through the skin under normal circumstances (i.e., without exposure to very high concentrations for long times or exposure to skin that was not damaged).

Reference: Agency for Toxic Substances and Disease Registry. Public Health Statement for Cadmium. July 1999.

**Chromium**. Elemental chromium (Cr) does not occur in nature, but is present in ores, primarily chromite. Chromium has been used in plating for corrosion resistance and decorative purposes, in the manufacture of alloys and chemicals, and in printing, dying, and photography. The toxicity of chromium depends upon its valence state. Only two of the several oxidation states of chromium, Cr(III) and Cr(VI), are reviewed here based on their predominance and stability in the ambient environment and their toxicity in humans and animals. Chromium plays a role in glucose and cholesterol metabolism and is thus an essential element to man and animals.

Chromium(III) is poorly absorbed, regardless of the route of exposure, whereas chromium(VI) is more readily absorbed. Humans and animals localize chromium in the lung, liver, kidney, spleen, adrenals, plasma, bone marrow, and red blood cells.

Animal studies show that Cr(VI) is generally more toxic than Cr(III), but neither oxidation state is very toxic by the oral route. In long-term studies, rats were not adversely affected by ~1.9 g/kg/day of chromic oxide [Cr(III)] (diet), 2.4 mg/kg/day of Cr(III) as chromic chloride (drinking water), or 2.4 mg/kg/day of Cr(VI) as potassium dichromate (drinking water). Compounds of both Cr(VI) and Cr(III) have induced developmental effects in experimental animals that include neural tube defects, malformations, and fetal deaths. The results of inhalation studies in animals have been equivocal or negative.

Reference:
Mary Lou Daugherty, M.S., Chemical Hazard Evaluation and Communication Group, Biomedical and Environmental Information Analysis Section, Health and Safety Research Division, Oak Ridge, Tennessee. Prepared for Oak Ridge Reservation Environmental Restoration Program. September 1992.

**Lead.** Lead is used as a component in storage batteries and was widely used in gasoline and paints. It is the most ubiquitous toxic metal in the environment.

Acute oral lethal doses of lead in animals depend upon chemical form, but generally range from 500 to 30,000 mg/kg. Several reproduction studies on the effects of subchronic oral exposure to lead in rats have been conducted. These studies report that lead acetate administered in drinking water at various concentrations caused depressed body weights, histological changes in the kidneys of offspring, cytokaryomegaly of the tubular epithelial cells of the inner cortex, and postnatal developmental delays. Higher oral doses of lead may result in decreased fertility and fetotoxic effects in a variety of species.

Reference:
Agency for Toxic Substances and Disease Registry. Toxicological profile for lead. 1990.

**Silver.** Silver is a relatively rare metal that occurs naturally in the earth's crust and is released to the environment from various industrial sources.

In long-term oral studies with experimental animals, silver compounds have produced slight thickening of the basement membranes of the renal glomeruli, growth depression, shortened lifespan, and granular silver-containing deposits in skin, eyes, and internal organs. Hypoactivity was seen in rats subchronically exposed to silver nitrate in drinking water.

Reference:
Rosmarie A. Faust, Ph.D., Chemical Hazard Evaluation and Communication Group, Biomedical and Environmental Information Analysis Section, Health and Safety Research Division, Oak Ridge, Tennessee. Prepared for Oak Ridge Reservation Environmental Restoration Program. December 1992.

# APPENDIX S

# ENVIRONMENTAL RISK CALCULATIONS

TABLE 1A
POTENTIAL RISK TO THE STAR-NOSED MOLE- MEAN EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Mean Sediment Compound Concentration (mg/kg) | BSAF | Invertebrate Prey Compound Concentration (mg/kg) | Fraction of Diet as Invertebrates | Food Ingestion Rate (kg/day) | AUF | ED | Body Weight (kg) | Invertebrate Prey Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | | | |
| Antimony | 1.90E+00 | 0.9 | 1.71E+00 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 1.01E-02 |
| Arsenic | 5.20E+00 | 0.9 | 4.68E+00 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 2.76E-02 |
| Barium | 3.53E+01 | 0.9 | 3.18E+01 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 1.87E-01 |
| Cadmium | 1.30E+00 | 3.4 | 4.42E+00 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 2.61E-02 |
| Chromium | 1.63E+01 | 0.39 | 6.36E+00 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 3.75E-02 |
| Lead | 6.44E+01 | 0.63 | 4.06E+01 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 2.39E-01 |
| Silver | 1.50E+00 | 0.9 | 1.35E+00 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 7.97E-03 |

TA[illegible] 1A

**POTENTIAL RISK TO THE STAR-NOSED MOLE - MEAN EXPOSURE**
**PHASE II COMPREHENSIVE SITE ASSESSMENT**
**CPL. GORDON CRAIG U.S. ARMY RESERE CENTER**
**BROCKTON, MA**

| Chemical | Mean Surface Water Concentration (mg/L) | Surface Water Ingestion Rate (L/day) | AUF | ED | Body Weight (kg) | Surface Water Compound Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | |
| Antimony* | | 0.0067 | 0.06 | 1 | 0.05 | 0.00E+00 |
| Arsenic* | | 0.0067 | 0.06 | 1 | 0.05 | 0.00E+00 |
| Barium | 5.25E-02 | 0.0067 | 0.06 | 1 | 0.05 | 3.91E-04 |
| Cadmium | 3.70E-04 | 0.0067 | 0.06 | 1 | 0.05 | 2.75E-06 |
| Chromium* | | 0.0067 | 0.06 | 1 | 0.05 | 0.00E+00 |
| Lead | 2.40E-03 | 0.0067 | 0.06 | 1 | 0.05 | 1.79E-05 |
| Silver* | | 0.0067 | 0.06 | 1 | 0.05 | 0.00E+00 |

*These chemicals are not surface water COPCs, therefore they are not included in surface water compound exposure.

TABLE 1A
POTENTIAL RISK TO THE STAR-NOSED MOLE - MEAN EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Mean Sediment Concentration (mg/kg) | Fraction of Diet as Sediment | Food Ingestion Rate (kg/day) | AUF | ED | Body Weight (kg) | Sediment Compound Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | |
| Antimony | 1.90E+00 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 1.25E-03 |
| Arsenic | 5.20E+00 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 3.41E-03 |
| Barium | 3.53E+01 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 2.31E-02 |
| Cadmium | 1.30E+00 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 8.52E-04 |
| Chromium | 1.63E+01 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 1.07E-02 |
| Lead | 6.44E+01 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 4.22E-02 |
| Silver | 1.50E+00 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 9.83E-04 |

TABLE 1A

**POTENTIAL RISK TO THE STAR-NOSED MOLE - MEAN EXPOSURE**
**PHASE II COMPREHENSIVE SITE ASSESSMENT**
**CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER**
**BROCKTON, MA**

| Chemical | Invertebrate Prey Exposure (mg/kg/day) | Surface Water Exposure (mg/kg/day) | Sediment Exposure (mg/kg/day) | Total Potential Dietary Exposure (mg/kg/day) | TRV (mg/kg/day) | Hazard Quotient |
|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | |
| Antimony | 1.01E-02 | 0.00E+00 | 1.25E-03 | 1.13E-02 | 1.10E-01 | 1.03E-01 |
| Arsenic | 2.76E-02 | 0.00E+00 | 3.41E-03 | 3.10E-02 | 8.10E-01 | 3.83E-02 |
| Barium | 1.87E-01 | 3.91E-04 | 2.31E-02 | 2.11E-01 | 8.69E+00 | 2.43E-02 |
| Cadmium | 2.61E-02 | 2.75E-06 | 8.52E-04 | 2.69E-02 | 2.03E+01 | 1.32E-03 |
| Chromium | 3.75E-02 | 0.00E+00 | 1.07E-02 | 4.82E-02 | 4.45E+03 | 1.08E-05 |
| Lead | 2.39E-01 | 1.79E-05 | 4.22E-02 | 2.82E-01 | 1.30E+01 | 2.16E-02 |
| Silver | 7.97E-03 | 0.00E+00 | 9.83E-04 | 8.95E-03 | 2.94E+01 | 3.04E-04 |

TABLE 1A
POTENTIAL RISK TO THE STAR-NOSED MOLE - MEAN EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| | |
|---|---|
| Fraction of diet as invertebrates: | 0.9 |
| Fraction of diet as sediment | 0.1 |
| Food ingestion rate | 0.0059 |
| Surface water ingestion rate | 0.0067 |
| Area Use Factor | 0.06 |
| Exposure Duration | 1 |
| Body weight | 0.05 |

TABLE 1B
POTENTIAL RISK TO THE STAR-NOSED MOLE- MAXIMUM EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Maximum Sediment Compound Concentration (mg/kg) | BSAF | Invertebrate Prey Compound Concentration (mg/kg) | Fraction of Diet as Invertebrates | Food Ingestion Rate (kg/day) | AUF | ED | Body Weight (kg) | Invertebrate Prey Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | | | |
| Antimony | 5.30E+00 | 0.9 | 4.77E+00 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 2.81E-02 |
| Arsenic | 7.50E+00 | 0.9 | 6.75E+00 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 3.98E-02 |
| Barium | 8.40E+01 | 0.9 | 7.56E+01 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 4.46E-01 |
| Cadmium | 3.20E+00 | 3.4 | 1.09E+01 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 6.42E-02 |
| Chromium | 2.90E+01 | 0.39 | 1.13E+01 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 6.67E-02 |
| Lead | 1.70E+02 | 0.63 | 1.07E+02 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 6.32E-01 |
| Silver | 3.10E+00 | 0.9 | 2.79E+00 | 0.9 | 0.0059 | 0.06 | 1 | 0.05 | 1.65E-02 |

TABLE 1B
POTENTIAL RISK TO THE STAR-NOSED MOLE - MAXIMUM EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERE CENTER
BROCKTON, MA

| Chemical | Maximum Surface Water Concentration (mg/L) | Surface Water Ingestion Rate (L/day) | AUF | ED | Body Weight (kg) | Surface Water Compound Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | |
| Antimony* | | 0.0067 | 0.06 | 1 | 0.05 | 0.00E+00 |
| Arsenic* | | 0.0067 | 0.06 | 1 | 0.05 | 0.00E+00 |
| Barium | 6.00E-02 | 0.0067 | 0.06 | 1 | 0.05 | 4.47E-04 |
| Cadmium | 5.80E-04 | 0.0067 | 0.06 | 1 | 0.05 | 4.32E-06 |
| Chromium* | | 0.0067 | 0.06 | 1 | 0.05 | 0.00E+00 |
| Lead | 4.00E-03 | 0.0067 | 0.06 | 1 | 0.05 | 2.98E-05 |
| Silver* | | 0.0067 | 0.06 | 1 | 0.05 | 0.00E+00 |

*These chemicals are not surface water COPCs, therefore they are not included in surface water compound exposure.

TABLE 1B

**POTENTIAL RISK TO THE STAR-NOSED MOLE - MAXIMUM EXPOSURE**
**PHASE II COMPREHENSIVE SITE ASSESSMENT**
**CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER**
**BROCKTON, MA**

| Chemical | Maximum Sediment Concentration (mg/kg) | Fraction of Diet as Sediment | Food Ingestion Rate (kg/day) | AUF | ED | Body Weight (kg) | Sediment Compound Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | |
| Antimony | 5.30E+00 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 3.47E-03 |
| Arsenic | 7.50E+00 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 4.92E-03 |
| Barium | 8.40E+01 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 5.51E-02 |
| Cadmium | 3.20E+00 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 2.10E-03 |
| Chromium | 2.90E+01 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 1.90E-02 |
| Lead | 1.70E+02 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 1.11E-01 |
| Silver | 3.10E+00 | 0.1 | 0.0059 | 0.06 | 1 | 0.05 | 2.03E-03 |

TABLE 1B
POTENTIAL RISK TO THE STAR-NOSED MOLE - MAXIMUM EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Invertebrate Prey Exposure (mg/kg/day) | Surface Water Exposure (mg/kg/day) | Sediment Exposure (mg/kg/day) | Total Potential Dietary Exposure (mg/kg/day) | TRV (mg/kg/day) | Hazard Quotient |
|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | |
| Antimony | 2.81E-02 | 0.00E+00 | 3.47E-03 | 3.16E-02 | 1.10E-01 | 2.87E-01 |
| Arsenic | 3.98E-02 | 0.00E+00 | 4.92E-03 | 4.47E-02 | 8.10E-01 | 5.53E-02 |
| Barium | 4.46E-01 | 4.47E-04 | 5.51E-02 | 5.02E-01 | 8.69E+00 | 5.77E-02 |
| Cadmium | 6.42E-02 | 4.32E-06 | 2.10E-03 | 6.63E-02 | 2.03E+01 | 3.26E-03 |
| Chromium | 6.67E-02 | 0.00E+00 | 1.90E-02 | 8.57E-02 | 4.45E+03 | 1.93E-05 |
| Lead | 6.32E-01 | 2.98E-05 | 1.11E-01 | 7.43E-01 | 1.30E+01 | 5.71E-02 |
| Silver | 1.65E-02 | 0.00E+00 | 2.03E-03 | 1.85E-02 | 2.94E+01 | 6.28E-04 |

**TABLE 1B**
**POTENTIAL RISK TO THE STAR-NOSED MOLE - MAXIMUM EXPOSURE**
**PHASE II COMPREHENSIVE SITE ASSESSMENT**
**CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER**
**BROCKTON, MA**

| | |
|---|---|
| Fraction of diet as invertebrates: | 0.9 |
| Fraction of diet as sediment | 0.1 |
| Food ingestion rate | 0.0059 |
| Surface water ingestion rate | 0.0067 |
| Area Use Factor | 0.06 |
| Exposure Duration | 1 |
| Body weight | 0.05 |

TABLE 2A
POTENTIAL RISK TO THE MARSH WREN - MEAN EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Mean Sediment Compound Concentration (mg/kg) | BAF | Invertebrate Prey Compound Concentration (mg/kg) | Fraction of Diet as Invertebrates | Food Ingestion Rate (kg/day) | AUF | ED | Body Weight (kg) | Invertebrate Prey Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | | | |
| Antimony | 1.90E+00 | 0.9 | 1.71E+00 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 5.71E-02 |
| Arsenic | 5.20E+00 | 0.9 | 4.68E+00 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.56E-01 |
| Barium | 3.53E+01 | 0.9 | 3.18E+01 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.06E+00 |
| Cadmium | 1.30E+00 | 3.4 | 4.42E+00 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.48E-01 |
| Chromium | 1.63E+01 | 0.39 | 6.36E+00 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 2.12E-01 |
| Lead | 6.44E+01 | 0.63 | 4.06E+01 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.35E+00 |
| Silver | 1.50E+00 | 0.9 | 1.35E+00 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 4.51E-02 |

TABLE 2A
POTENTIAL RISK TO THE MARSH WREN - MEAN EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Mean Surface Water Concentration (mg/L) | Surface Water Ingestion Rate (L/day) | AUF | ED | Body Weight (kg) | Surface Water Compound Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | |
| Antimony* | | 0.0028 | 0.16 | 0.75 | 0.0106 | 0.00E+00 |
| Arsenic* | | 0.0028 | 0.16 | 0.75 | 0.0106 | 0.00E+00 |
| Barium | 5.25E-02 | 0.0028 | 0.16 | 0.75 | 0.0106 | 1.68E-03 |
| Cadmium | 3.70E-04 | 0.0028 | 0.16 | 0.75 | 0.0106 | 1.18E-05 |
| Chromium* | | 0.0028 | 0.16 | 0.75 | 0.0106 | 0.00E+00 |
| Lead | 2.40E-03 | 0.0028 | 0.16 | 0.75 | 0.0106 | 7.67E-05 |
| Silver* | | 0.0028 | 0.16 | 0.75 | 0.0106 | 0.00E+00 |

*These chemicals are not surface water COPCs, therefore they are not included in surface water compound exposure.

TABLE 2A
POTENTIAL RISK TO THE MARSH WREN - MEAN EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Mean Sediment Concentration (mg/kg) | Fraction of Diet as Sediment | Food Ingestion Rate (kg/day) | AUF | ED | Body Weight (kg) | Sediment Compound Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | |
| Antimony | 1.90E+00 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.63E-03 |
| Arsenic | 5.20E+00 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 4.45E-03 |
| Barium | 3.53E+01 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 3.02E-02 |
| Cadmium | 1.30E+00 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.11E-03 |
| Chromium | 1.63E+01 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.40E-02 |
| Lead | 6.44E+01 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 5.51E-02 |
| Silver | 1.50E+00 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.28E-03 |

TABLE 2A
POTENTIAL RISK TO THE MARSH WREN - MEAN EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Invertebrate Prey Exposure (mg/kg/day) | Surface Water Exposure (mg/kg/day) | Sediment Exposure (mg/kg/day) | Total Potential Dietary Exposure (mg/kg/day) | TRV (mg/kg/day) | Hazard Quotient |
|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | |
| Antimony | 5.71E-02 | 0.00E+00 | 1.63E-03 | 5.87E-02 | -- | NC |
| Arsenic | 1.56E-01 | 0.00E+00 | 4.45E-03 | 1.61E-01 | 2.46E+00 | 6.53E-02 |
| Barium | 1.06E+00 | 1.68E-03 | 3.02E-02 | 1.09E+00 | 2.08E+01 | 5.25E-02 |
| Cadmium | 1.48E-01 | 1.18E-05 | 1.11E-03 | 1.49E-01 | 1.45E+00 | 1.03E-01 |
| Chromium | 2.12E-01 | 0.00E+00 | 1.40E-02 | 2.26E-01 | 1.00E+00 | 2.26E-01 |
| Lead | 1.35E+00 | 7.67E-05 | 5.51E-02 | 1.41E+00 | 3.85E+00 | 3.66E-01 |
| Silver | 4.51E-02 | 0.00E+00 | 1.28E-03 | 4.64E-02 | 2.29E+00 | 2.02E-02 |

**TABLE 2A**
**POTENTIAL RISK TO THE MARSH WREN - MEAN EXPOSURE**
**PHASE II COMPREHANSIVE SITE ASSESSMENT**
**CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER**
**BROCKTON, MA**

| | |
|---|---|
| Fraction of diet as invertebrates: | 0.975 |
| Fraction of diet as sediment | 0.025 |
| Food ingestion rate | 0.003 |
| Surface water ingestion rate | 0.0028 |
| Area Use Factor | 0.16 |
| Exposure Duration | 0.75 |
| Body weight | 0.0106 |

TABLE 2B

**POTENTIAL RISK TO THE MARSH WREN - MAXIMUM EXPOSURE**
**PHASE II COMPREHENSIVE SITE ASSESSMENT**
**CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER**
**BROCKTON, MA**

| Chemical | Maximum Sediment Compound Concentration (mg/kg) | BSAF | Invertebrate Prey Compound Concentration (mg/kg) | Fraction of Diet as Invertebrates | Food Ingestion Rate (kg/day) | AUF | ED | Body Weight (kg) | Invertebrate Prey Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | | | |
| Antimony | 5.30E+00 | 0.9 | 4.77E+00 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.59E-01 |
| Arsenic | 7.50E+00 | 0.9 | 6.75E+00 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 2.25E-01 |
| Barium | 8.40E+01 | 0.9 | 7.56E+01 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 2.52E+00 |
| Cadmium | 3.20E+00 | 3.4 | 1.09E+01 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 3.63E-01 |
| Chromium | 2.90E+01 | 0.39 | 1.13E+01 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 3.78E-01 |
| Lead | 1.70E+02 | 0.63 | 1.07E+02 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 3.58E+00 |
| Silver | 3.10E+00 | 0.9 | 2.79E+00 | 0.975 | 0.003 | 0.16 | 0.75 | 0.0106 | 9.32E-02 |

TABLE 2B
POTENTIAL RISK TO THE MARSH WREN - MAXIMUM EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Maximum Surface Water Concentration (mg/L) | Surface Water Ingestion Rate (L/day) | AUF | ED | Body Weight (kg) | Surface Water Compound Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | |
| Antimony* | | 0.0028 | 0.16 | 0.75 | 0.0106 | 0.00E+00 |
| Arsenic* | | 0.0028 | 0.16 | 0.75 | 0.0106 | 0.00E+00 |
| Barium | 6.00E-02 | 0.0028 | 0.16 | 0.75 | 0.0106 | 1.92E-03 |
| Cadmium | 5.80E-04 | 0.0028 | 0.16 | 0.75 | 0.0106 | 1.85E-05 |
| Chromium* | | 0.0028 | 0.16 | 0.75 | 0.0106 | 0.00E+00 |
| Lead | 4.00E-03 | 0.0028 | 0.16 | 0.75 | 0.0106 | 1.28E-04 |
| Silver* | | 0.0028 | 0.16 | 0.75 | 0.0106 | 0.00E+00 |

*These chemicals are not surface water COPCs, therefore they are not included in surface water compound exposure.

TABLE 2B
POTENTIAL RISK TO THE MARSH WREN - MAXIMUM EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Maximum Sediment Concentration (mg/kg) | Fraction of Diet as Sediment | Food Ingestion Rate (kg/day) | AUF | ED | Body Weight (kg) | Sediment Compound Exposure (mg/kg/day) |
|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | |
| Antimony | 5.30E+00 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 4.54E-03 |
| Arsenic | 7.50E+00 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 6.42E-03 |
| Barium | 8.40E+01 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 7.19E-02 |
| Cadmium | 3.20E+00 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 2.74E-03 |
| Chromium | 2.90E+01 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 2.48E-02 |
| Lead | 1.70E+02 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 1.46E-01 |
| Silver | 3.10E+00 | 0.025 | 0.003 | 0.16 | 0.75 | 0.0106 | 2.65E-03 |

TABLE 2B
POTENTIAL RISK TO THE MARSH WREN - MAXIMUM EXPOSURE
PHASE II COMPREHENSIVE SITE ASSESSMENT
CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER
BROCKTON, MA

| Chemical | Invertebrate Prey Exposure (mg/kg/day) | Surface Water Exposure (mg/kg/day) | Sediment Exposure (mg/kg/day) | Total Potential Dietary Exposure (mg/kg/day) | TRV (mg/kg/day) | Hazard Quotient |
|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | |
| Antimony | 1.59E-01 | 0.00E+00 | 4.54E-03 | 1.64E-01 | -- | NC |
| Arsenic | 2.25E-01 | 0.00E+00 | 6.42E-03 | 2.32E-01 | 2.46E+00 | 9.42E-02 |
| Barium | 2.52E+00 | 1.92E-03 | 7.19E-02 | 2.60E+00 | 2.08E+01 | 1.25E-01 |
| Cadmium | 3.63E-01 | 1.85E-05 | 2.74E-03 | 3.66E-01 | 1.45E+00 | 2.52E-01 |
| Chromium | 3.78E-01 | 0.00E+00 | 2.48E-02 | 4.02E-01 | 1.00E+00 | 4.02E-01 |
| Lead | 3.58E+00 | 1.28E-04 | 1.46E-01 | 3.72E+00 | 3.85E+00 | 9.67E-01 |
| Silver | 9.32E-02 | 0.00E+00 | 2.65E-03 | 9.58E-02 | 2.29E+00 | 4.18E-02 |

**TABLE 2B**
**POTENTIAL RISK TO THE MARSH WREN - MAXIMUM EXPOSURE**
**PHASE II COMPRHENSIVE SITE ASSESSMENT**
**CPL. GORDON CRAIG U.S. ARMY RESERVE CENTER**
**BROCKTON, MA**

| | |
|---|---|
| Fraction of diet as invertebrates: | 0.975 |
| Fraction of diet as sediment | 0.025 |
| Food ingestion rate | 0.003 |
| Surface water ingestion rate | 0.0028 |
| Area Use Factor | 0.16 |
| Exposure Duration | 0.75 |
| Body weight | 0.0106 |