

**DATA SUMMARY REPORT
FOR CY-1 and CY-3**

**MULTIPLE SITE SOURCE AREA REMEDIATION
AT
MASSACHUSETTS MILITARY RESERVATION
CAPE COD, MASSACHUSETTS**



Prepared for:

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ACRONYMS, ABBREVIATIONS AND QUALIFIERS

AFCEE	Air Force Center for Environmental Excellence
COC	chain-of-custody
%D	percent difference
DQO	data quality objective
EB	equipment blanks
ECC	Environmental Chemical Corporation
EPA	U. S. Environmental Protection Agency
FD	field duplicate
IDL	instrument detection limit
LCS	laboratory control sample
Loc ID	location identification
MDL	method detection limit
mg/kg	milligrams per kilogram
MMR	Massachusetts Military Reservation
MS	matrix spike
MSD	matrix spike duplicate
QC	quality control
QAPP	Quality Assurance Project Plan
QPP	<i>Quality Program Plan</i>
RL	reporting limits
RPD	relative percent difference
STCL	soil target cleanup level
SOP	standard operating procedure
TB	trip blanks

Qualifiers

- U – The analyte was not detected at the specified detection limit.
- J – The analyte was detected and the reported concentration is an estimated value.
- UJ – The analyte was not detected and the nondetect value is estimated due to QC noncompliance.
- R – The analyte value was rejected and the result is unusable.

1.0 SAMPLE COLLECTION

Environmental Chemical Corporation (ECC) collected 16 native soil samples to obtain sufficient data to meet the objectives of the draft *Streamlined Sampling and Analysis Plan for Coal Yard 1 (CY-1) and Coal Yard 3 (CY-3) Source Areas* (April 2001). Twelve native soil samples were collected at the Coal Yard 1 (CY-1) and four native soil samples were collected at the Coal Yard 3 (CY-3) site. Samples were collected between 21 June 2001 and 25 June 2001. Soil samples were submitted to COMPUCHEM Laboratory in Cary, NC for metals and pH analyses. Quality control (QC) samples were also collected and submitted for analyses at the frequency indicated in the Massachusetts Military Reservation (MMR) *Quality Program Plan (QPP)* [Air Force Center for Environmental Excellence (AFCEE) 2000] and included field duplicate samples, equipment blanks, matrix spike and matrix spike duplicate (MS/MSD) analyses.

This Data Summary Report (DSR) presents the results of environmental samples and QC samples validated according to Standard Operating Procedure (SOP) MMR Tech-055, Analytical Chemistry Data Review, and the reconciliation of the project data with the project's data quality objectives (DQO). MMR Tech-055, which summarizes Appendix 3A of the MMR QPP, lists the data validation review criteria. The data were validated by Data Validation Services in North Creek, NY, which was subcontracted with Environmental Chemical Corporation. The data were validated for a Level C data validation. A Level C validation does not require the review of the laboratory chromatograms.

2.0 SAMPLE IDENTIFICATION

Table 2-1 lists the native samples and associated field QC samples collected and submitted for analysis during this sampling event. Each unique ECC chain-of-custody (COC) control number is cross-referenced with location identification (Loc ID), sample number, date sampled, and the analyses performed on each sample. Data completeness (Loc ID and requested analyses) is verified against the COC forms during the data review process. The MMR data management group maintains all COC forms in project files.

Table 2-1
Sample Identification Cross-Reference and Analyses

AOC	Location	Sample Number	Sample Type	Matrix	Date Sampled	Metals	pH	Lab
CY-1	25BHD9200	25BHD9200002	N1	SO	06/22/2001	×	×	COMPUCHEM
CY-1	25BHD9200	25BHD9200002FD	FD1	SO	06/22/2001	×	×	COMPUCHEM
CY-1	25BHD9200	25BHD9200002MSMSD	MSMSD	SO	06/22/2001	×	×	COMPUCHEM
CY-1	25BHD9201	25BHD9201002	N1	SO	06/22/2001	×	×	COMPUCHEM
CY-1	25BHD9202	25BHD9202002	N1	SO	06/22/2001	×	×	COMPUCHEM
CY-1	25BHD9203	25BHD9203002	N1	SO	06/22/2001	×	×	COMPUCHEM
CY-1	25BHD9204	25BHD9204002	N1	SO	06/21/2001	×	×	COMPUCHEM
CY-1	25BHD9205	25BHD9205002	N1	SO	06/22/2001	×	×	COMPUCHEM
CY-1	25BHD9206	25BHD9206002	N1	SO	06/21/2001	×	×	COMPUCHEM
CY-1	25BHD9207	25BHD9207002	N1	SO	06/21/2001	×	×	COMPUCHEM
CY-1	25BHD9208	25BHD9208002	N1	SO	06/22/2001	×	×	COMPUCHEM
CY-1	25BHD9209	25BHD9209002	N1	SO	06/21/2001	×	×	COMPUCHEM
CY-1	25BHD9210	25BHD9210002	N1	SO	06/21/2001	×	×	COMPUCHEM
CY-1	25BHD9210	25BHD9210002FD	FD1	SO	06/21/2001	×	×	COMPUCHEM
CY-1	25BHD9211	25BHD9211002	N1	SO	06/21/2001	×	×	COMPUCHEM
CY-1	25BHD9211	25BHD9211002MSMSD	MSMSD	SO	06/21/2001	×	×	COMPUCHEM
CY-1	FIELDQC	25RBD2600	EB	WQ	06/21/2001	×		COMPUCHEM
CY-3	42BHD9300	42BHD9300002	N1	SO	06/22/2001	×	×	COMPUCHEM
CY-3	42BHD9300	42BHD9300002FD	FD1	SO	06/22/2001	×	×	COMPUCHEM
CY-3	42BHD9301	42BHD9301002	N1	SO	06/22/2001	×	×	COMPUCHEM
CY-3	42BHD9302	42BHD9302002	N1	SO	06/25/2001	×	×	COMPUCHEM
CY-3	42BHD9303	42BHD9303002	N1	SO	06/25/2001	×	×	COMPUCHEM
CY-3	FIELDQC	25RBD2601	EB	WQ	06/22/2001	×		COMPUCHEM
CY-3	FIELDQC	25RBD2602	EB	WQ	06/25/2001	×		COMPUCHEM

COMPUCHEM = COMPUCHEM Laboratory, Cary, North Carolina

EB = equipment blank

FD1 = field duplicate sample

MSMSD = matrix spike/matrix spike duplicate sample

N1 = native sample

SO = soil

WQ = water quality matrix

3.0 LABORATORY ANALYSES

COMPUCHEM analyzed soil samples for metals via EPA CLP (Contracting Laboratory Program) method ILM04.0 and for pH via SW-846 method 9045C. All analyses were performed according to the draft *Streamlined Sampling and Analysis Plan for Coal Yard 1 (CY-1) and Coal Yard 3 (CY-3) Source Areas* (April 2001).

4.0 DATA VALIDATION

All data is reviewed in accordance with MMR project-specific data review guidelines, defined in the MMR technical procedure TECH-055, Analytical Chemistry Data Review (AFCEE 2000).

The TECH-055 analytical data review yields the equivalent of a Tier II validation, which is

performed, at a minimum, for all samples included in this data set.

The following qualifiers are applied to the data during the review process:

- U – The analyte was not detected at the specified detection limit.
- J – The analyte was detected and the reported concentration is an estimated value.
- UJ – The analyte was not detected and the nondetect value is estimated due to QC noncompliance.
- R – The analyte value was rejected and the result is unusable.

EPA Contract Laboratory Program method-specific qualifiers, AFCEE Quality Assurance Project Plan (QAPP) 3.0, and other laboratory-specific qualifiers used to designate noncompliant values were either accepted or replaced with one of the data validation qualifiers. Data validation qualifiers were entered into the database from which the results of this sampling event were reported.

5.0 PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

Data quality is assessed in terms of precision, accuracy, representativeness, completeness, and comparability. The goals set for each of these parameters are referred to as data quality objectives (DQO). Actual sample and QC results are compared to project DQO to determine whether quality objectives were met for the sampling event.

5.1 PRECISION

Precision is defined as the degree to which two or more measurements are in agreement. Precision is measured by comparing duplicate sample results and is expressed as the relative percent difference (RPD) between native and field duplicate sample results and laboratory replicate sample results, matrix spike and matrix spike duplicate (MS/MSD) recoveries.

5.1.1 Field Precision

Field duplicates (FD) are collected by taking two aliquots of the same soil sample, containerizing the samples, and submitting them to the laboratory for analysis as two separate samples. The RPD criterion for inorganic parameters is 50 percent for soil samples when the concentrations in

the native sample and the FD sample are greater than five times the reporting limit (RL). For duplicate results exceeding these criteria, the native sample and the FD sample are qualified as estimated (coded J), indicating possible field sampling error and/or possible sample nonhomogeneity.

A total of three FD samples were collected with the native soil samples. The RPD exceeded the acceptance criteria for manganese (Mn) in one FD sample pair; these results were qualified as estimated (coded J). FD results for all detected target analytes are presented in Table 5-1. A high RPD is attributed to sample heterogeneity.

**Table 5-1
Field Duplicate Precision Results for Detected Analytes**

Location	Matrix	Analyte	Date Sampled	Native Sample Result	RL	Duplicate Sample Result	RL	Units	RPD(%)
25BHD9200	SO	Aluminum (Al)	06/22/2001	4240	43.3	4210	41.1	mg/kg	0.71
25BHD9200	SO	Antimony (Sb)	06/22/2001	ND	13.0	ND	12.3	mg/kg	NC
25BHD9200	SO	Arsenic (As)	06/22/2001	1.8	2.2	2.3	2.1	mg/kg	24.39
25BHD9200	SO	Barium (Ba)	06/22/2001	9.0	43.3	0.8	41.1	mg/kg	NC
25BHD9200	SO	Beryllium (Be)	06/22/2001	ND	1.1	0.13	1.0	mg/kg	NC
25BHD9200	SO	Cadmium (Cd)	06/22/2001	0.088	1.1	0.11	1.0	mg/kg	22.22
25BHD9200	SO	Calcium (Ca)	06/22/2001	359	1083.5	363	1027.5	mg/kg	1.11
25BHD9200	SO	Chromium (Cr)	06/22/2001	6.8	2.2	6.4	2.1	mg/kg	6.06
25BHD9200	SO	Cobalt (Co)	06/22/2001	0.95	10.8	0.77	10.3	mg/kg	20.93
25BHD9200	SO	Copper (Cu)	06/22/2001	12.6	5.4	11.3	5.1	mg/kg	10.88
25BHD9200	SO	Iron (Fe)	06/22/2001	6140	21.7	6500	20.6	mg/kg	5.70
25BHD9200	SO	Lead (Pb)	06/22/2001	10.6	0.65	10.3	0.6	mg/kg	2.87
25BHD9200	SO	Magnesium (Mg)	06/22/2001	547	1083.5	497	1027.5	mg/kg	9.58
25BHD9200	SO	Manganese (Mn)	06/22/2001	45.5	3.3	361	3.1	mg/kg	155.23
25BHD9200	SO	Mercury (Hg)	06/22/2001	ND	0.1	ND	0.1	mg/kg	NC
25BHD9200	SO	Nickel (Ni)	06/22/2001	2.5	8.7	2.3	8.2	mg/kg	8.33
25BHD9200	SO	Potassium (K)	06/22/2001	173	1083.5	170	1027.5	mg/kg	1.75
25BHD9200	SO	Selenium (Se)	06/22/2001	ND	1.1	ND	1.0	mg/kg	NC
25BHD9200	SO	Silver (Ag)	06/22/2001	ND	2.2	ND	2.1	mg/kg	NC
25BHD9200	SO	Sodium (Na)	06/22/2001	182	1083.5	150	1027.5	mg/kg	19.28
25BHD9200	SO	Thallium (Tl)	06/22/2001	1.2	2.2	1.4	2.1	mg/kg	15.38
25BHD9200	SO	Vanadium (V)	06/22/2001	9.2	10.8	9.4	10.3	mg/kg	2.15
25BHD9200	SO	Zinc (Zn)	06/22/2001	23	4.3	23.8	4.1	mg/kg	3.42
25BHD9200	SO	pH	06/22/2001	6.21	NA	6.15	NA	1/LOG	NC
25BHD9210	SO	Aluminum (Al)	06/21/2001	2030	40.9	1550	40.7	mg/kg	26.82
25BHD9210	SO	Antimony (Sb)	06/21/2001	ND	12.3	ND	12.2	mg/kg	NC
25BHD9210	SO	Arsenic (As)	06/21/2001	ND	2.0	ND	2.0	mg/kg	NC
25BHD9210	SO	Barium (Ba)	06/21/2001	4.8	40.9	4.3	40.7	mg/kg	10.99
25BHD9210	SO	Beryllium (Be)	06/21/2001	0.20	1.0	0.19	1.0	mg/kg	5.13
25BHD9210	SO	Cadmium (Cd)	06/21/2001	ND	1.0	ND	1.0	mg/kg	NC
25BHD9210	SO	Calcium (Ca)	06/21/2001	129	1022.5	146	1016.5	mg/kg	12.36
25BHD9210	SO	Chromium (Cr)	06/21/2001	3	2.0	2.4	2.0	mg/kg	22.22
25BHD9210	SO	Cobalt (Co)	06/21/2001	0.83	10.2	0.65	10.2	mg/kg	24.32
25BHD9210	SO	Copper (Cu)	06/21/2001	1.6	5.1	1.3	5.1	mg/kg	20.69
25BHD9210	SO	Iron (Fe)	06/21/2001	3620	20.5	3060	20.3	mg/kg	16.77

Location	Matrix	Analyte	Date Sampled	Native Sample Result	RL	Duplicate Sample Result	RL	Units	RPD(%)
25BHD9210	SO	Lead (Pb)	06/21/2001	2.3	0.6	2.8	0.6	mg/kg	19.6
25BHD9210	SO	Magnesium (Mg)	06/21/2001	423	1022.5	356	1016.5	mg/kg	17.2
25BHD9210	SO	Manganese (Mn)	06/21/2001	41.4	3.1	35.4	3.0	mg/kg	15.63
25BHD9210	SO	Mercury (Hg)	06/21/2001	ND	0.09	ND	0.09	mg/kg	NC
25BHD9210	SO	Nickel (Ni)	06/21/2001	1.8	8.2	1.2	8.1	mg/kg	40
25BHD9210	SO	Potassium (K)	06/21/2001	150	1022.5	148	1016.5	mg/kg	1.34
25BHD9210	SO	Selenium (Se)	06/21/2001	ND	1.0	ND	1.0	mg/kg	NC
25BHD9210	SO	Silver (Ag)	06/21/2001	ND	2.0	ND	2.0	mg/kg	NC
25BHD9210	SO	Sodium (Na)	06/21/2001	197	1022.5	173	1016.5	mg/kg	12.97
25BHD9210	SO	Thallium (Tl)	06/21/2001	ND	2.0	0.99	2.0	mg/kg	NC
25BHD9210	SO	Vanadium (V)	06/21/2001	5.1	10.2	4.5	10.2	mg/kg	12.5
25BHD9210	SO	Zinc (Zn)	06/21/2001	5.6	4.1	10.7	4.1	mg/kg	NC
25BHD9210	SO	pH	06/21/2001	6.53	NA	6.47	NA	1/LOG	NC
42BHD9300	SO	Aluminum (Al)	06/22/2001	2530	41.4	2290	41.2	mg/kg	9.96
42BHD9300	SO	Antimony (Sb)	06/22/2001	ND	12.4	ND	12.3	mg/kg	NC
42BHD9300	SO	Arsenic (As)	06/22/2001	0.64	2.1	0.44	2.1	mg/kg	37.04
42BHD9300	SO	Barium (Ba)	06/22/2001	4.7	41.4	4.5	41.2	mg/kg	4.35
42BHD9300	SO	Beryllium (Be)	06/22/2001	1.10	1.0	0.097	1.0	mg/kg	NC
42BHD9300	SO	Cadmium (Cd)	06/22/2001	ND	1.0	ND	1.0	mg/kg	NC
42BHD9300	SO	Calcium (Ca)	06/22/2001	69.3	1034.5	43.4	1029	mg/kg	45.96
42BHD9300	SO	Chromium (Cr)	06/22/2001	3.9	2.1	2.9	2.1	mg/kg	29.41
42BHD9300	SO	Cobalt (Co)	06/22/2001	0.80	10.3	0.62	10.3	mg/kg	25.35
42BHD9300	SO	Copper (Cu)	06/22/2001	2.8	5.2	2.2	5.1	mg/kg	24
42BHD9300	SO	Iron (Fe)	06/22/2001	5050	20.7	3860	20.6	mg/kg	26.71
42BHD9300	SO	Lead (Pb)	06/22/2001	34	0.6	27.2	0.6	mg/kg	22.22
42BHD9300	SO	Magnesium (Mg)	06/22/2001	406	1034.5	322	1029	mg/kg	23.08
42BHD9300	SO	Manganese (Mn)	06/22/2001	43.1	3.1	35.3	3.1	mg/kg	19.90
42BHD9300	SO	Mercury (Hg)	06/22/2001	ND	0.1	ND	0.1	mg/kg	NC
42BHD9300	SO	Nickel (Ni)	06/22/2001	2.4	8.3	1.5	8.2	mg/kg	46.15
42BHD9300	SO	Potassium (K)	06/22/2001	135	1034.5	127	1029	mg/kg	6.11
42BHD9300	SO	Selenium (Se)	06/22/2001	ND	1.0	ND	1.0	mg/kg	NC
42BHD9300	SO	Silver (Ag)	06/22/2001	ND	2.1	ND	2.1	mg/kg	NC
42BHD9300	SO	Sodium (Na)	06/22/2001	193	1034.5	170	1029	mg/kg	12.67
42BHD9300	SO	Thallium (Tl)	06/22/2001	0.83	2.1	0.86	2.1	mg/kg	3.55
42BHD9300	SO	Vanadium (V)	06/22/2001	5.4	10.3	4.7	10.3	mg/kg	13.86
42BHD9300	SO	Zinc (Zn)	06/22/2001	8.3	4.1	9.4	4.1	mg/kg	12.43
42BHD9300	SO	pH	06/22/2001	5.01	NA	5.09	NA	1/LOG	NC

J = estimated result

NC = not calculated

ND = nondetected result

RL = reporting limit

RPD = relative percent difference

SO = soil

mg/kg = milligrams per kilogram

5.1.2 Laboratory Precision

Laboratory precision is measured by the analysis MS/MSD samples, LCS/LCSDs, and/or laboratory replicate samples. Precision objectives for respective analyses are listed in Appendix 3-A of the MMR QPP (AFCEE 2000) for all methods. For MS/MSD and laboratory replicate RPDs exceeding these criteria, the result in the parent sample is qualified as estimated (coded UJ or J).

A total of two MS/MSD sample pairs were collected with the soil samples. The RPDs for the laboratory duplicate analysis for metals and pH were within the acceptance criteria; qualifications were not required.

A total of four laboratory control samples (LCS) were analyzed with the soil samples. The LCS recoveries were within acceptable parameters for all LCS samples. The RPD for the LCS/LCS duplicate analyses for metal and pH were not applicable for this sampling event.

5.2 ACCURACY

Accuracy is defined as the degree to which the detected value represents the true value. Accuracy is frequently used synonymously with bias. The term bias describes the systematic or persistent error associated with a measurement process. Accuracy is assessed through the collection and analysis of blanks (field and laboratory) and other QC samples or spikes.

5.2.1 Field Accuracy

Accuracy in the field is assessed through the collection and analysis of equipment blanks (EB) and trip blanks (TB). The procedures used to collect these blanks are described in the MMR QPP (AFCEE 2000).

Contamination in blanks indicates that false positive results or results that are biased high may exist for samples associated with the affected blanks. To address this type of result, action levels are established based on blank concentrations and compared to the sample results. During data review, sample data is qualified as nondetect (coded U) based on TB and EB results when the analyte result in the associated sample is less than five times the result in the TB and EB. Additional qualifiers due to other QC nonconformances are occasionally included, changing the nondetect (coded U) qualifier to, for example, an estimated nondetect (coded UJ) qualifier.

EB were collected at the frequency stated in the MMR QPP (AFCEE 2000) for all parameters per the requirements of the draft *Streamlined Sampling and Analysis Plan for Coal Yard 1 (CY-1) and Coal Yard 3 (CY-3) Source Areas* (April 2001).

The results for zinc (Zn) in all soil samples were qualified as nondetect (coded U) at the reported concentrations due to the level in the associated EB. The samples that were qualified based on EB contamination are summarized in Table 5-2.

**Table 5-2
Field Blank Sample Qualification**

Location	Affected Sample Number	Date Sampled	Matrix	Analyte	Qualifier
25BHD9200	25BHD9200002	06/22/2001	SO	Zinc	U
25BHD9200	25BHD9200002FD	06/22/2001	SO	Zinc	U
25BHD9201	25BHD9201002	06/22/2001	SO	Zinc	U
25BHD9202	25BHD9202002	06/22/2001	SO	Zinc	U
25BHD9203	25BHD9203002	06/22/2001	SO	Zinc	U
25BHD9204	25BHD9204002	06/21/2001	SO	Zinc	U
25BHD9205	25BHD9205002	06/22/2001	SO	Zinc	U
25BHD9206	25BHD9206002	06/21/2001	SO	Zinc	U
25BHD9207	25BHD9207002	06/21/2001	SO	Zinc	U
25BHD9208	25BHD9208002	06/22/2001	SO	Zinc	U
25BHD9209	25BHD9209002	06/21/2001	SO	Zinc	U
25BHD9210	25BHD9210002	06/21/2001	SO	Zinc	U
25BHD9210	25BHD9210002FD	06/21/2001	SO	Zinc	U
25BHD9211	25BHD9211002	06/21/2001	SO	Zinc	U
42BHD9300	42BHD9300002	06/22/2001	SO	Zinc	U
42BHD9300	42BHD9300002FD	06/22/2001	SO	Zinc	U
42BHD9301	42BHD9301002	06/22/2001	SO	Zinc	U
42BHD9302	42BHD9302002	06/25/2001	SO	Zinc	U
42BHD9303	42BHD9303002	06/25/2001	SO	Zinc	U

SO = soil

U = nondetect result

Based on the results of the EB, a systematic pattern of contamination indicative of improperly cleaned equipment or poor sampling technique appears to exist.

5.2.2 Laboratory Accuracy

Accuracy in the laboratory is measured by a variety of means, including the following: sample holding times and preservation; instrument calibration; analysis of QC samples such as laboratory blanks, MS, and LCS; internal standards; and surrogate spikes. Accuracy is quantitatively measured by calculating percent recoveries for MS, LCS and surrogates.

5.2.2.1 Sample Holding Times and Preservation

When samples are analyzed beyond their respective holding times or if the laboratory receives a cooler in which the temperature exceeds six degrees Celsius, positive results are suspected to be

biased low and nondetect results are suspected to be false negatives. Analytical results acquired from analyses performed after the method-specified holding times are rejected (coded R). If sample coolers are received at a temperature greater than six degrees Celsius, the results for these samples are qualified as estimated (coded J or UJ).

All samples collected as part of this sampling event met holding time and preservation requirements; qualifications were not required.

5.2.2.2 Instrument Calibration

Instrument calibration parameters are reviewed for conformance to method and data review criteria according to the technical procedure MMR TECH-055, Analytical Chemistry Data Review (AFCEE 2000).

Initial and continuing calibration criteria were acceptable for all metal analysis; qualifications were not required.

5.2.2.3 Laboratory Blanks

Laboratory blanks are prepared and/or analyzed along with each batch of field samples. Laboratory blanks are evaluated against their associated (same preparation and/or analytical batch) field samples to determine if a laboratory condition contributed to false positives or high bias in the field samples. Associated sample data is qualified in the same manner as field blanks.

All laboratory blanks were free of target analyte contamination; qualifications were not required.

5.2.2.4 Matrix Spikes

Accuracy objectives (as percent recoveries) for the analytes spiked into MS/MSD samples are included in the respective methods. For MS/MSD percent recoveries exceeding these criteria, the result in the parent sample is qualified as estimated (coded UJ or J). In cases where recoveries of spiked analytes are extremely low (less than ten percent for organic analyses and less than 30 percent for metals), the result in the parent sample is rejected (coded R).

MS (matrix spike) samples were analyzed at the frequency stated in the MMR QPP (AFCEE 2000) for metal soil samples. Site specific soils were used for the metal MS. The MS percent recovery in silver (Ag) exceeded the acceptance criteria; the results in the parent samples were qualified as estimated (coded J). The qualified results and affected samples are summarized in Table 5-3.

**Table 5-3
Matrix Spike Nonconformance Qualification Summary**

Location	Affected Sample Number	Date Sampled	Matrix	Analyte	Qualifier
25BHD9200	25BHD9200002	06/22/2001	SO	Silver	UJ
25BHD9200	25BHD9200002FD	06/22/2001	SO	Silver	UJ
25BHD9201	25BHD9201002	06/22/2001	SO	Silver	UJ
25BHD9202	25BHD9202002	06/22/2001	SO	Silver	UJ
25BHD9203	25BHD9203002	06/22/2001	SO	Silver	UJ
25BHD9204	25BHD9204002	06/21/2001	SO	Silver	UJ
25BHD9205	25BHD9205002	06/22/2001	SO	Silver	UJ
25BHD9206	25BHD9206002	06/21/2001	SO	Silver	UJ
25BHD9207	25BHD9207002	06/21/2001	SO	Silver	UJ
25BHD9208	25BHD9208002	06/22/2001	SO	Silver	UJ
25BHD9209	25BHD9209002	06/21/2001	SO	Silver	UJ
25BHD9210	25BHD9210002	06/21/2001	SO	Silver	UJ
25BHD9210	25BHD9210002FD	06/21/2001	SO	Silver	UJ
25BHD9211	25BHD9211002	06/21/2001	SO	Silver	UJ
42BHD9300	42BHD9300002	06/22/2001	SO	Silver	UJ
42BHD9300	42BHD9300002FD	06/22/2001	SO	Silver	UJ
42BHD9301	42BHD9301002	06/22/2001	SO	Silver	UJ
42BHD9302	42BHD9302002	06/25/2001	SO	Silver	UJ
42BHD9303	42BHD9303002	06/25/2001	SO	Silver	UJ

J = estimated result, R = rejected data point, SO = soil

5.2.2.5 Laboratory Control Samples

Accuracy objectives (as percent recoveries) for analytes spiked into LCS samples are included in the respective methods. For LCS percent recoveries exceeding these criteria, the results for the samples in the preparation/extraction batch or the analytical batch associated with the noncompliant LCS are qualified as estimated (coded UJ or J).

LCS percent recoveries for all analyses were within the acceptance criteria; qualifications were not required.

5.2.2.6 Surrogate Spikes

Surrogate spike compounds are added to each sample undergoing organic analyses to assess method performance and extraction efficiency. Accuracy objectives for surrogate spike compounds are listed in the respective methods. If surrogate recoveries do not meet the acceptance criteria, the sample results are qualified as estimated (coded UJ and J), indicating probable bias in the results.

Surrogate recoveries for all analyses were within the acceptance criteria; qualifications were not required.

5.2.2.7 ICP Serial dilution

An ICP serial dilution analysis for metals was performed on a sample from each Sample Delivery Group (SDG). If the %D (Difference) of the original determination after correction for dilution is higher than 15% and the result of the diluted sample is higher than that of the undiluted sample, the sample results are qualified as estimated (J and UJ). The qualified results and affected samples are summarized in Table 5-4.

**Table 5-4
ICP Serial Dilution Qualification**

Location	Affected Sample Number	Date Sampled	Matrix	Analyte	Qualifier
25BHD9200	25BHD9200002	06/22/2001	SO	Calcium	J
25BHD9200	25BHD9200002FD	06/22/2001	SO	Calcium	J
25BHD9201	25BHD9201002	06/22/2001	SO	Calcium	J
25BHD9202	25BHD9202002	06/22/2001	SO	Calcium	J
25BHD9203	25BHD9203002	06/22/2001	SO	Calcium	J
25BHD9204	25BHD9204002	06/21/2001	SO	Calcium	J
25BHD9205	25BHD9205002	06/22/2001	SO	Calcium	J
25BHD9206	25BHD9206002	06/21/2001	SO	Calcium	J
25BHD9207	25BHD9207002	06/21/2001	SO	Calcium	J
25BHD9208	25BHD9208002	06/22/2001	SO	Calcium	J
25BHD9209	25BHD9209002	06/21/2001	SO	Calcium	J
25BHD9210	25BHD9210002	06/21/2001	SO	Calcium	J
25BHD9210	25BHD9210002FD	06/21/2001	SO	Calcium	J
25BHD9211	25BHD9211002	06/21/2001	SO	Calcium	J
42BHD9302	42BHD9302002	06/25/2001	SO	Calcium	J
42BHD9303	42BHD9303002	06/25/2001	SO	Calcium	J

J = estimated result

SO = soil

5.3 REPRESENTATIVENESS

Representativeness expresses the degree to which data collected for a sample accurately and precisely represents the in situ conditions of the sample. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and proper laboratory protocol. Sampling plans are designed to provide data representative of the areas of investigation.

Representativeness was satisfied by ensuring that the draft *Streamlined Sampling and Analysis Plan for Coal Yard 1 (CY-1) and Coal Yard 3 (CY-3) Source Areas* (April 2001) was followed, proper sampling techniques were used, proper analytical procedures were followed, and holding times of the samples were not exceeded in the laboratory. Representativeness was ensured via laboratory method blanks, trip blanks, and equipment blanks. The laboratory method blanks do not yield indication of cross-contamination.

Equipment blanks (with the exception of zinc), showed that site representativeness was maintained by proper equipment decontamination. The equipment blank contamination of zinc was detected at very low levels below the site STCL. During this time period, solvents were used for equipment decontamination, in accordance with MMR Tech-036. Samples, which exceed allowable holding times and temperature, have been appropriately coded (R or J).

5.4 COMPLETENESS

Completeness is a measure of the amount of valid, usable data obtained compared to the amount of data that is expected under normal conditions. Completeness can be measured in the field and in the laboratory. The goals for field and laboratory completeness are 95 percent for aqueous samples and 90 percent for solid samples.

5.4.1 Field Completeness

Field completeness is a measure of the number of samples collected for a particular sampling event compared to the number of samples that were planned.

All field samples and field QC samples were collected and submitted for analysis in accordance

with the MMR QPP (AFCEE 2000) and the draft *Streamlined Sampling and Analysis Plan for Coal Yard 1 (CY-1) and Coal Yard 3 (CY-3) Source Areas* (April 2001).

5.4.2 Laboratory Completeness

Laboratory completeness is assessed by comparing the number of samples successfully analyzed to the number submitted, and the number of valid measurements (nonrejected results) to the number of measurements expected.

Table 5-5 is a summary of the laboratory completeness assessment.

**Table 5-5
Laboratory Completeness**

Analysis	Percent Completeness (%)
Metals	100 %
pH	100 %

Percent completeness is expressed as the number of samples successfully analyzed compared to the number submitted, and the number of valid measurements (nonrejected results) compared to the number of measurements expected, respectively.

5.5 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared to another. For this sampling event comparability was achieved through the use of proper sampling and analytical techniques, reporting data in standard units, normalizing results to standard conditions, and by using standard comprehensive reporting formats. For more information regarding comparability, refer to the main text of the draft *Streamlined Sampling and Analysis Plan for Coal Yard 1 (CY-1) and Coal Yard 3 (CY-3) Source Areas* (April 2001).

6.0 SENSITIVITY

Sensitivity is assessed by comparing the actual RL reported by the laboratory to those specified in the MMR QPP (AFCEE 2000) and project specific STCL. However, RL may be affected by numerous factors including percent moisture of solid samples, matrix interferences, blank

contamination, and sample dilutions. The laboratory practical quantitation limit was below the site specific STCL, so the required sensitivity was achieved.

If necessary, the RL were adjusted due to one or more of these factors as specified in the methods and MMR QPP (AFCEE 2000).

7.0 CORRECTIVE ACTION AND RESOLUTION

Corrective action in the laboratory may occur before, during, and after initial analyses. Conditions such as broken sample containers or low/high pH readings of preserved samples may be identified during sample log-in or just before analysis. The laboratory notifies the project chemist if conditions such as these are identified; the project chemist provides the laboratory with instructions for corrective action to address these conditions.

Conditions such as the need for dilution of samples for reinjection and/or reanalysis (when certain QC criteria are not met) are identified by the laboratory according to its standard operating procedures, as are corrective actions for these conditions.

Any corrective actions affecting the data from this sampling event were performed before release of the data by the laboratory. Corrective actions are documented in the laboratory's corrective action files and the narrative accompanying the hard-copy data package.

8.0 SUMMARY

In general, the data collected during this sampling event met the established DQO and can be considered valid for decision-making purposes. Data for specific samples were qualified as estimated (coded J or UJ) or rejected (coded R) for noncompliance with established criteria. The rejected data points were for compounds of concern in this investigation.

9.0 REFERENCES

AFCEE 2000. *Massachusetts Military Reservation Plume Response Program Quality Program Plan*. AFC-J23-35Q85101-M3-0001. Prepared by Jacobs Engineering Group Inc. for AFCEE/MMR, Installation Restoration Program, Otis Air National Guard Base, Massachusetts.

AFCEE 2001 (April). Streamlined Sampling and Analysis Plan for Coal Yard 1 (CY-1) and Coal Yard 3 (CY-3) Source Areas, Multiple Source Area Remediation. F41624-97-D-8009. Prepared by AFCEE/MMR, Installation Restoration Program, Otis Air National Guard Base, Massachusetts.