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Data Summary Report for the 1998 Semiannual Tritium Surveys for Fourmile Branch and the F- and H-Area Seeplines

by

J. Koch

Westinghouse Savannah River Company

Savannah River Site

Aiken, South Carolina 29808

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**Data Summary Report for the
1998 Semiannual Tritium Surveys
for Fourmile Branch and the
F- and H-Area Seeplines**
(U)

Prepared by:

Environmental Protection Department
Environmental Geochemistry Group
Westinghouse Savannah River Company
Aiken, SC

and

Exploration Resources, Inc.
Athens, GA

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ADC &
Reviewing
Official:

Thomas S. Gledhill
(Name and Title)

Date: Nov. 12/10/98

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List of Acronyms and Abbreviations

The following acronyms and abbreviations may appear in this Data Summary Report:

°C	degrees Celsius
µg	microgram(s)
µL	microliter
µS	microSiemens
AA	atomic absorption
AQ	analysis qualifier
ASTM	American Society for Testing and Materials
BAT	BAT Associates, Inc.
bls	below land surface
BNA	base/neutral/acid extractables
B	bias qualifier
CCB	continuing calibration blank sample
CCV	continuing calibration verification sample
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
cm	centimeter(s)
COC	chain of custody; chain-of-custody form
CPT	cone penetrometer test
CRDL	contract-required detection limit
CRQL	contract-required quantitation limit
CSDL	contract-specified detection limit
CV	coefficient of variation
CVAA	cold vapor atomic absorption analysis
DI	deionized (water)

DOE	United States Department of Energy
dpm	disintegrations per minute
DPT	direct push technology
DQOs	data quality objectives
EAS	Environmental Analysis Section
EDD	electronic data deliverable
EGG	Environmental Geochemistry Group
Eh	oxidation-reduction potential
EM-PPM	parts per million methane equivalent
EMSL	EPA's Environmental Monitoring and Support Laboratory
EP	Environmental Physics, Inc.
EPA	United States Environmental Protection Agency
EPD/EMS	Environmental Protection Department/Environmental Monitoring Section
EQL	estimated quantitation limit (for non-radiochemistry analyses)
ERA	Environmental Resource Associates
ERD	Environmental Restoration Department
ESC	expedited site characterization
ExR	Exploration Resources, Inc.
FID	flame ionization detector
ft	feet
g	gram(s)
FHST5	Fifth sampling event at the F- and H-Area Seeplines (first quarter 1998)
FHST6	Sixth sampling event at the F- and H-Area Seeplines (third quarter 1998)
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
GE	General Engineering Laboratories, Inc.
GFAA	graphite furnace atomic absorption (metals analysis)
GIMS	Geochemical Information Management System

GMP	Groundwater Monitoring Program
GPC	gel permeation chromatography
GPR	ground penetrating radar
ICB	initial calibration blank
ICP	inductively coupled plasma (metals analysis)
ICS	interference check sample
ICV	initial calibration verification
ID	identification
IDL	instrument detection limit
ISA	ICP interference check sample -- interferents only
ISB	ICP interference check sample -- interferents plus analytes
kg	kilogram
km	kilometer
L	liter
LCS	laboratory control sample(s)
LDRR	laboratory data records review
LIMS	laboratory information management system
LPQL	lowest practical quantitation limit
max.	maximum
MCL	maximum contaminant level
MDA	minimum detectable activity
MDL	method detection limit
meq	milliequivalents
mg	milligram(s)
min.	minimum
mL	milliliter(s)
MRD	mean relative difference
MS	matrix spike

MSD	matrix spike duplicate
MSL	mean sea level
NA	not applicable
NAPL	non-aqueous phase liquid
ng	nanogram(s)
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity unit
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbons
PAL	performance acceptance limit
PCB	polychlorinated biphenyl
pCi	picoCurie
PE	performance evaluation
PHA	pulse-height analysis; e.g., gamma PHA
PID	photoionization detector
ppb	parts per billion
ppm	parts per million
QA/QC	quality assurance/quality control
r	correlation coefficient
RCO	Radiological Control Officer
RCRA	Resource Conservation and Recovery Act
Recra	Recra LabNet Philadelphia (formerly Roy F. Weston, Inc., Analytics Division)
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RPD	relative percent difference
RQ	result qualifier
RRT	relative retention time
RSD	relative standard deviation
RTW	retention time window

RTW	retention time window
SAIC	Science Applications International Corporation
SCDHEC	South Carolina Department of Health and Environmental Control
SGS	Site Geotechnical Services
SMC	sample/method combination
SOP	standard operating procedure
SOW	statement of work
SQL	sample quantitation limit
SRS	Savannah River Site
SRTC	Savannah River Technology Center
SSC	site-specific contaminant
ssEQL	sample-specific estimated quantitation limit
std. dev.	standard deviation
SW-846	EPA's Test Methods for Evaluating Solid Waste
TAL	target analyte list
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TIC	tentatively identified compound
TNU	Thermo NUtech
U	unclassified
USEPA	see EPA
UTM	Universal Transverse Mercator Zone 17 Coordinate System
VOA	volatile organic analyses
VOC	volatile organic compound
WHC	Westinghouse Hanford Company
WSRC	Westinghouse Savannah River Company

Figure

Figure 1. Sampling Locations for Fourmile Branch and the F- and H-Area Seepages

Executive Summary

Purpose

This report presents a summary of the definitive data validation and verification for the 1998 semiannual tritium surveys for Fourmile Branch and the F- and H-Area Seeplines. The project was performed under the direction of WSRC¹ EAS/Ecology. This report was prepared under the direction of EPD/EMS.

Scope of the Project

ExR of Athens, GA, validated and verified sample collection, shipping, and laboratory information compiled for this project. The information compiled, reviewed, and maintained includes the following:

- sample documentation
- COC forms
- sample holding times
- initial and continuing instrument calibration
- analyte identification
- analyte quantitation
- analytical error
- analysis of blanks
- laboratory performance evaluations
- quantitation limits

The validation process began with project mobilization and continued through the delivery of EDDs and this report.

Process and Documentation

Sample documentation and maintenance of COC were examined by reviewing the field logs and COC forms. See section 3.1.2, *Production of Chain-of-Custody Forms*, of this report for more information about the COC forms.

¹ All acronyms and abbreviations used in this report are defined in the *List of Acronyms and Abbreviations* (pp. vii-xi).

Sample holding times were checked by comparing the time between sample collection and analysis with a look-up table of maximum holding times. Analytical instrument calibration was reviewed as part of the LDRR. See section 3.4.2, *Laboratory Data Records Review*, of this report for more information about the LDRR.

Analyte identification and analyte quantitation were verified as part of the computerized checking of the EDDs, during review of the analytical narratives, and as part of the LDRR. Anomalies were clarified with the laboratories wherever possible, and records not meeting criteria were qualified. See section 3.4, *Verification and Validation Issues*, of this report for further information.

In evaluating analytical error, percent recoveries for QC samples were reviewed, and the QC sample and associated project sample data were qualified where necessary. Relative percent differences between duplicate sample analyses were calculated. The criteria for qualification are described in section 3.4.3, *Qualification of the Data*, of this report.

Field-generated blanks (i.e., field blanks, rinsate blanks, and trip blanks) and laboratory-generated blanks (i.e., method blanks) were examined if included in the sampling plan. See section 3.1, *Planning*, of this report for an overview of the sampling plan. Laboratory-generated blanks were analyzed in ratios of more than one for every 20 samples.

Laboratory performance evaluations are detailed in *Appendix B* of this report.

Affiliates for the 1998 Semiannual Tritium Surveys for Fourmile Branch and the F- and H-Area Seeplines

The project was completed by the following persons and/or organizations:

- Jim Koch, WSRC-EAS/Ecology, Aiken, SC, was the project manager.
- C. Dan Rogers, WSRC-EPD/EMS, Aiken, SC, was the project technical lead.
- Jim Koch, WSRC-EAS/Ecology, Aiken, SC, collected the water samples.
- EP of Charleston, SC, and WSRC's EM Laboratory of Aiken, SC, prepared the definitive-level analytical data.
- ExR of Athens, GA, validated the data and prepared this report.

1.0 Summary of the Project

1.1 Objective

The objective of this project is to provide validated data for the 1998 semiannual tritium sampling events in Fourmile Branch and the F- and H-Area Seeplines.

1.2 Overview

Seepage basins in the F and H areas received low-level radioactive waste effluent from the chemical separation processes in the General Separations Area. The basins retained the effluent to delay its release to the environment. The waste effluent consisted principally of sodium hydroxide, nitric acid, low levels of various radionuclides, and some metals. Discharges of tritiated water to the seepage basins account for most of the radioactivity.

In 1988 and 1989, the Savannah River Laboratory (now the Savannah River Technology Center) conducted an extensive study aimed at characterizing the shallow groundwater outcropping into Fourmile Branch and its associated seeplines. Researchers measured low pH values, elevated conductivity, and tritium along the seeplines and determined that contaminants leaching from the F- and H-Area seepage basins were impacting the area.

Discharges to the seepage basins were stopped in 1988, and the basins were capped and sealed in 1990 to minimize the release of contaminants to the environment. Scientists hypothesized that after eliminating the contaminant source, annual rainfall amounts and natural groundwater flow would, over time, dilute and flush the remaining contaminant plume out of the shallow groundwater, which would allow recovery of the wetland systems below the basins.

Quarterly sampling of Fourmile Branch and the F- and H-Area seeplines began in May 1992. Results from the quarterly tritium surveys, in which pH, specific conductance, and tritium are measured, have shown a significant decrease in tritium activities and specific conductance values, and pH values have increased to more natural ranges (pH 5-6) when compared with 1989.

Prior to 1996, the tritium analyses were conducted by the EMS laboratory. Data validation was required, so the tritium analyses began to be performed by an independent outside laboratory on a semiannual basis.

1.3 Planning

Sampling took place on March 16, 17, 18, and 23, 1998, and on August 4, 5, and 6, 1998. One hundred twenty-three samples were collected, including duplicates. Concurrent with the sample collection, pH, specific conductance, and water temperatures were measured in the field and recorded in the sample logbooks.

1.4 Field Sampling

During the first sampling event, a total of 67 samples, splits, and duplicates were collected. Sixty-two samples were collected during the second sampling event, including duplicates and splits.

1.5 Analysis

The samples were analyzed for tritium to meet the requirements for definitive-level data.

1.6 Validation

Validation and verification activities, using definitive data requirements (EPA, 1993), assessed the quality of the definitive level data for the following issues:

- sample documentation
- maintenance of chain of custody
- adherence to sample holding time requirements
- achievement of contract-required quantitation limits
- analytical instrument calibration
- analyte identification
- analyte quantitation

Evaluation of each laboratory's performance in analyte identification and quantitation included examination of the following:

- analytical error
- contamination of blanks
- laboratory performance evaluation samples
- quantitation limit determination, if applicable

2.0 Data Quality Issues Overview

This section provides a summary of the major points affecting the quality of the data for this project.

2.1 Vital Statistics

For the FHST5 sampling event, 64 COCs were received from GE. COC forms were not returned for the three split samples sent to the EMS laboratory. Two samples were not taken because the locations were dry, and two samples were taken but not shipped to the laboratory.

For the FHST6 sampling event, 59 COCs were received from GE. COC forms were not returned for the three split samples sent to the EMS laboratory. Six samples were not taken because the locations were dry, and one sample was not taken because the location was inaccessible.

Tables 2.1 and 2.2 list the number of sample and QC records that were assigned *U*, *J*, or *UJ* result qualifiers after verification and validation were performed.

Table 2.1 Number of Records With Result Qualifiers for FHST5

Data Validation Records	Sample Records	QC Records	Total
Total Number of Analytical Records	67	20	87
Qualified Data			
Rejected Analytical Records	0	1	1
Result Qualifier <i>U</i>	0	7	7
Result Qualifier <i>J</i>	0	0	0
Result Qualifier <i>UJ</i>	0	0	0

Table 2.2 Number of Records With Result Qualifiers for FHST6

Data Validation Records	Sample Records	QC Records	Total
Total Number of Analytical Records	62	20	82
Qualified Data			
Rejected Analytical Records	0	1	1
Result Qualifier <i>U</i>	0	6	6
Result Qualifier <i>J</i>	0	0	0
Result Qualifier <i>UJ</i>	0	0	0

2.2 Program Description

This section discusses the validation of the data and gives a brief overview of the laboratories.

2.2.1 Verification and Validation Objectives

Data Quality Objectives

Definitive data (EPA, 1993), have been determined as most appropriate to meet the DQOs of this investigation. Validation and verification activities assessed the data in relation to these standards, especially with regard to the following issues:

- sample documentation
- maintenance of COC
- adherence to sample holding time and preservation requirements
- achievement of contract-required detection limits
- analytical instrument calibration
- analyte identification
- analyte quantitation

Evaluation of each laboratory's performance for analyte identification and quantitation included examination of analytical error, blank contamination, and laboratory performance in the analysis of independent standards.

Each analytical record in the computer data files contains three qualifier fields: result qualifier, analysis qualifier, and bias qualifier. The result qualifier describes the analytical result. The analysis qualifier describes issues arising during the analytical process. The bias qualifier describes whether the result is biased high or low. The laboratories use these fields in reporting the data. During validation and verification of the analytical data, additional qualifiers may be applied to provide additional information about data quality.

Data Quality Levels

Definitive-level data are used for data collection activities that require a high degree of qualitative and quantitative accuracy for all findings. Rigorous methods of analysis and quality assurance are used for those samples considered essential in making a decision. This data level is intended to give the decision maker a level of confidence to make decisions regarding the following:

- treatment
- disposal
- site remediation and/or removal of pollutants
- health risk or environmental impact
- cleanup verification, pollutant source identification, delineation of contaminants
- other significant decisions where an action level is of concern

Only analyte-specific methods can be used for definitive-level data.

2.2.2 Verification and Validation Functions

The data verification process confirms that the required samples were collected and documented, the required analyses were performed on the samples, and the analytical results were reported correctly. The information evaluated during this process includes the sampling plan, delivery order, sample lists, analyte/compound lists, field logbooks, COC forms, and analytical results files.

Data reviewers use computer programs and look-up tables to review the computer data files of sample collection, shipping, and analytical data. The data were examined as follows:

- The following fields were checked to ensure that they were not blank: WSRC sample identification number, sample collection date, laboratory receipt date, analysis date, analysis time, analytical method, laboratory code, laboratory sample identification number, analyte code, result units, nominal concentration, number of dilutions, dilution factor, instrument, instrument batch, and analyst's initials.
- The following fields were checked to ensure that the data were within an acceptable range of values: WSRC sample identification number, sample collection date, laboratory receipt date, analysis date, analysis time, analytical result, accuracy, residual weight, number of dilutions, nominal concentration, and bottle number.
- The following fields were checked against a look-up table or a list of valid codes: laboratory code, laboratory duplicate code, analyte code (test name), analytical method, result qualifier, analysis qualifier, analysis bias, result unit, and sample fraction.

The data validation process determines the usefulness of each analytical result based on QC and method requirements. The information evaluated during this process includes COC forms, analytical narrative summaries, analytical result data files, and raw result and calibration data.

Data validation involves evaluating requirements in the following QC categories: holding times, sample preservation, instrument calibration, analyte identification/quantitation, blanks (trip, method, and field), laboratory control samples, duplicates (field and laboratory), matrix spikes, surrogates, and internal standards.

Data validation and qualification policies were developed from the following sources: EPA, 1986; EPA, 1988a; EPA, 1988b; EPA, 1990; EPA, 1991b; contract-specific WSRC requirements; and discussions with laboratory personnel.

Data Qualifiers

When analytical data are validated, the analytical results and the associated QC information are reviewed using criteria specific to the analysis performed. Data qualifiers are used during the data validation process to classify sample data as conforming to QC requirements.

The qualifiers used for data associated with this project are defined in *Appendix D*.

Precision

Precision measures the reproducibility of measurements under a given set of conditions. It is a quantitative measure of the variability of a group of measurements compared to its average value. Precision is reported in terms of the relative percent difference. The analytical results from the field replicate samples provide data on overall measurement precision; analytical results from the laboratory duplicates provide data on analytical precision.

Accuracy

Accuracy measures the bias in a measurement system; it is difficult to measure for the entire data collection activity. Sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and sample analysis techniques. Sampling accuracy may be assessed by evaluating the results of field blanks and trip blanks. Analytical accuracy may be assessed through the use of known and unknown QC samples, matrix spikes, and method blanks.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program and is best satisfied by making certain that sampling locations are selected properly and that a sufficient number of samples are collected.

The project support request form states that 69 samples were to be taken for each event, including six QC samples. For the first event, 61 locations were sampled, and an additional six QC samples were taken. Three locations were dry. During the second event, samples were taken from 56 locations plus six QC samples. There were six dry locations and one inaccessible site.

Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements. It is important that critical samples are identified and that plans are made to achieve valid data for them. Completeness was not determined for this report.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through using standard techniques to collect and analyze representative samples and through reporting analytical results in appropriate units.

2.2.3 Laboratories

The following laboratories generated the analytical data for this project:

- EP of Charleston, SC, the primary laboratory, provided definitive-level radiological analyses under contract AA07208N.
- EMS/SRS of Aiken, SC, the QC laboratory, provided definitive-level radiological analyses.

2.3 Data Quality Issues Summary

This section provides a summary of the major data quality issues identified during the verification and validation process.

2.3.1 Missing Data

All planned data for environmental samples were collected and received except for the exceptions listed below.

The dry stations for each event are listed below:

FHST5: HSP-034, HSP-038

FHST6: FSP-235, FHB-019, HSP-011, HSP-034, HSP-038, HSP-046

The stations below were sampled, but not shipped to the laboratory:

FHST5: HSP-026, HSP-046 (duplicate)

Felled trees in the area made station FSP-026 inaccessible for sampling during FHST6.

2.3.2 Station Data Coordinates

Three stations have two names, though the coordinates are the same.

HSP-093 = FHB-005, HSP-092 = FHB-006, HSP-085 = FHB-008

For the FHST5 sampling event, these samples were recorded in the sampling logbook as HSP locations, while the FHST6 logbook entries were recorded as FHB locations.

In the FHST6 sampling event, several sampling stations were dry, but a sample was able to be collected within 100 feet of the station coordinates. The samples listed below were taken at an alternate location, but new survey coordinates were not taken. These samples are reported with the planned station name and coordinates.

FSP-056, FSP-220, FSP-226, FSP-249, HSP-013, HSP-015, HSP-049

2.3.3 Sample Documentation

COCs were not available for the three split samples sent to the EMS laboratory during each sampling event.

Table 2.3 Chain-of-Custody Documentation Summary for FHST5

Description	Number	Percent
Missing transfer dates, times, and signatures	63	98.4

Table 2.3 Chain-of-Custody Documentation Summary for FHST5 (cont.)

Description	Number	Percent
Missing transfer dates and/or times only	0	0
Missing transfer signatures only	0	0
Missing cooler number	0	0
Missing temperature	1	1.6
Missing COCs	0	0
No problems	0	0
Total number of COCs used = 64		

Table 2.4 Chain-of-Custody Documentation Summary for FHST6

Description	Number	Percent
Missing transfer dates, times, and signatures	0	0
Missing transfer dates and/or times only	0	0
Missing transfer signatures only	0	0
Missing cooler number	0	0
Missing temperature	1	100
Missing COCs	0	0
No problems	0	0
Total number of COCs used = 59		

2.3.4 Holding Times and Preservation

No holding times were exceeded for this project.

No cooler temperatures exceeded standards.

2.3.5 Analytical Issues

No significant analytical issues were encountered during verification and validation of the analytical data.

2.3.6 Rejected Data

No environmental sample records associated with this project were rejected. One matrix spike was rejected from each sampling event due to high analyte concentration in the environmental samples. See table 3.2. No environmental sample records required qualification on the basis of these rejected QC samples.

3.0 Validation

3.1 Planning

SAIC generated the COCs for this project according to a memo from Jim Koch to Dan Rogers dated December 9, 1996.

3.1.1 Planned Work

Samples were to be collected from 66 sampling locations during the first quarter 1998 sampling event (FHST5) and from 65 sampling locations during the third quarter 1998 sampling event (FHST6).

Sample splits and duplicates were planned at a frequency of approximately one per 10 samples, to be analyzed for the same parameter as the associated sample.

Samples were to be analyzed for tritium only. The data were validated as definitive-level data.

3.1.2 Production of Chain-of-Custody Forms

COC forms containing the list of requested analyses for each planned sample were printed on waterproof paper. A tear-off stub attached to the COC form stipulated the sample collection location. Information completed on the COC forms included the following:

- EMS sample identification number from the logbook page for that sample
- laboratory sample identification number (to be completed by the laboratory)
- sample collection date
- shipping information (including the signature of each person handling the sample and the date it was handled)
- cooler number and temperature upon arrival at the analytical laboratory

Seventy-one COC forms were generated for FHST5 and 69 COCs were generated for FHST6.

3.1.3 Sample Sets

The following tables list the sample identifiers, sample type, and sample date and time for samples sent to the laboratories. Tritium was the only analysis requested. *A* in the Station ID indicates a duplicate, and *D* indicates a split sample.

Table 3.1 Sample Set for FHST5

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time
FSP 29005	111765	9804217-31	Water	03/16/98, 09:25
FSP 25605	111766	9804217-32	Water	03/16/98, 10:07

Table 3.1 Sample Set for FHST5 (cont.)

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time
FSP 24905	111767	9804217-33	Water	03/16/98, 10:18
FSP 24105	111768	9804217-34	Water	03/16/98, 10:28
FSP 23505	111769	9804217-35	Water	03/16/98, 10:43
FSP 22005	111770	9804217-36	Water	03/16/98, 10:47
FSP 22605	111771	9804217-37	Water	03/16/98, 10:55
FSP 21305	111772	9804217-38	Water	03/16/98, 11:05
FSP 20405D	111773	9880851502	Split	03/16/98, 12: 04
FSP 27005	111774	9804217-39	Water	03/16/98, 12:36
FSP 20405	111775	9805027-02	Water	03/16/98, 13:00
FSP 00205	111776	9804217-40	Water	03/16/98, 13:11
FSP 00205D	111777	9880851702	Split	03/16/98,13:12
FSP 00705	111778	9804217-41	Water	03/16/98, 13:20
FSP 01205	111779	9804217-42	Water	03/16/98, 13:33
FSP 01405	111780	9804217-43	Water	03/16/98, 13:41
FSP 01905	111781	9804217-44	Water	03/16/98, 13:58
FSP 02605	111782	9805071-01	Water	03/16/98, 14:07
FSP 03205	111783	9804217-45	Water	03/16/98, 14:19
FSP 03405	111784	9804217-46	Water	03/17/98, 11:14
FSP 03505	111785	9805027-03	Water	03/17/98, 11:20
FSP 04005	111786	9805027-04	Water	03/17/98, 11:30
FSP 04705	111787	9804217-47	Water	03/17/98, 11:44
FSP 05605	111788	9804217-48	Water	03/17/98, 12:35
FHB 02005	111789	9804217-49	Water	03/17/98, 13:46
FHB 00205	111790	9804217-50	Water	03/17/98, 13:53
FHB 01805	111791	9805027-05	Water	03/17/98, 14:00
FHB 01705	111792	9804217-51	Water	03/17/98, 14:06
FHB 01605	111793	9804217-52	Water	03/17/98, 14:12
FHB 01505	111794	9804217-53	Water	03/17/98, 14:24
FHB 00105	111795	9804217-54	Water	03/17/98, 14:30
FHB 01905	111796	9804217-55	Water	03/17/98, 14:40
FHB 01305	111797	9805027-06	Water	03/17/98, 14:48
FHB 01405	111798	9804217-56	Water	03/17/98, 14:52
FHB 01205	111799	9805027-07	Water	03/17/98, 15:04
HSP 00305	113900	9804217-01	Water	03/18/98, 09:32
HSP 00405	113901	9804217-02	Water	03/18/98, 09:50
HSP 00805	113902	9804217-03	Water	03/18/98, 09:42
HSP 01505	113903	9804217-04	Water	03/18/98, 10:08
HSP 01105	113904	9804217-05	Water	03/18/98, 10:21
HSP 01105A	113905	9804217-06	Duplicate	03/18/98, 10:22
HSP 01305	113906	9804217-07	Water	03/18/98, 10:15
HSP 02005	113907	9804217-08	Water	03/18/98, 10:32

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Table 3.1 Sample Set for FHST5 (cont.)

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time
HSP 02505	113909	9804217-09	Water	03/18/98, 10:53
HSP 02905	113910	9804217-10	Water	03/18/98, 11:02
HSP 04305	113911	9804217-11	Water	03/18/98, 14:01
HSP 04305A	113912	9804217-12	Duplicate	03/18/98, 14:02
HSP 05205	113913	9805027-01	Water	03/18/98, 14:08
HSP 04905	113914	9804217-13	Water	03/18/98, 14:21
HSP 04605	113915	9804217-14	Water	03/18/98, 14:28
HSP 05705	113917	9804217-15	Water	03/18/98, 14:39
HSP 06405	113918	9804217-16	Water	03/18/98, 14:55
HSP 07605	113919	9804217-17	Water	03/18/98, 15:05
HSP 07105	113920	9804217-18	Water	03/18/98, 15:12
HSP 06005	113921	9804217-19	Water	03/18/98, 15:20
FHB 00405	113922	9804217-20	Water	03/18/98, 15:52
FHB 00305	113923	9804217-21	Water	03/18/98, 15:58
HSP 10305	113924	9804217-22	Water	03/18/98, 16:07
HSP 09705	113925	9804217-23	Water	03/18/98, 16:13
HSP 09305	113927	9804217-24	Water	03/18/98, 16:27
HSP 09205	113928	9804217-25	Water	03/18/98, 16:33
HSP 08505	113929	9804217-26	Water	03/18/98, 16:45
FHB 00105D	113931	9880851602	Split	03/17/98, 14:00
FMC001H05	113932	9804217-27	Water	03/23/98, 11:00
FMC002H05	113933	9804217-28	Water	03/23/98, 11:19
FMC002H05A	113934	9804217-29	Duplicate	03/23/98, 11:20
FMC001F05	113935	9804217-30	Water	03/23/98, 11:35

Table 3.2 Sample Set for FHST6

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time
FSP 29006	114023	9808415-01	Water	08/04/98, 08:45
FSP 27006	114024	9808415-02	Water	08/04/98, 09:07
FSP 25606	114025	9808415-03	Water	08/04/98, 09:40
FSP 24906	114026	9808415-04	Water	08/04/98, 09:55
FSP 24106	114027	9808415-47	Water	08/04/98, 10:10
FSP 22006	114029	9808415-05	Water	08/04/98, 10:30
FSP 22606	114030	9808415-06	Water	08/04/98, 10:38
FSP 21306	114031	9808415-07	Water	08/04/98, 10:48
FSP 20406	114032	9808781-08	Water	08/04/98, 11:19
FSP 00206	114033	9808415-08	Water	08/04/98, 11:32
FSP 00706	114034	9808415-09	Water	08/04/98, 11:39

Table 3.2 Sample Set for FHST6 (cont.)

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time
FSP 04706	114035	9808415-10	Water	08/04/98, 12:33
FSP 03506	114036	9808781-09	Water	08/04/98, 12:50
FSP 03406	114037	9808415-11	Water	08/04/98, 13:04
FSP 04006	114038	9808781-10	Water	08/04/98, 13:17
FSP 03206	114039	9808415-12	Water	08/04/98, 13:26
FSP 01206	114040	9808415-13	Water	08/04/98, 13:45
FSP 01206D	114041	9881132602	Split	08/04/98, 13:46
FSP 01406	114042	9808415-14	Water	08/04/98, 13:53
FSP 05606	114043	9808415-15	Water	08/04/98, 14:17
FMC002H06	114044	9808415-16	Water	08/04/98, 14:37
FSP 01906	114045	9808781-11	Water	08/05/98, 08:41
HSP 00306	114047	9808415-17	Water	08/05/98, 09:22
HSP 00406	114048	9808415-18	Water	08/05/98, 09:27
HSP 00806	114049	9808415-19	Water	08/05/98, 09:34
HSP 01306	114050	9808415-20	Water	08/05/98, 10:00
HSP 01506	114051	9808415-21	Water	08/05/98, 10:07
HSP 02006	114052	9808415-22	Water	08/05/98, 10:44
HSP 02506	114053	9808415-23	Water	08/05/98, 10:48
HSP 02906	114054	9808415-24	Water	08/05/98, 10:59
HSP 04306	114056	9808415-25	Water	08/05/98, 11:28
HSP 05206	114057	9808415-26	Water	08/05/98, 11:35
HSP 04906	114058	9808415-27	Water	08/05/98, 11:47
HSP 06006	114059	9808781-06	Water	08/05/98, 12:52
HSP 06406	114060	9808415-28	Water	08/05/98, 12:59
HSP 07106	114061	9808781-01	Water	08/05/98, 13:07
HSP 07606	114062	9808415-29	Water	08/05/98, 13:20
HSP 09706	114063	9808781-05	Water	08/05/98, 13:43
HSP 10306	114064	9808415-30	Water	08/05/98, 13:51
FMC001F06	114065	9808415-31	Water	08/05/98, 14:21
FMC001H06	114066	9808415-32	Water	08/05/98, 14:36
FHB 02006	114067	9808415-33	Water	08/06/98, 08:52
FHB 00206	114068	9808415-34	Water	08/06/98, 08:56
FHB 01806	114069	9808781-07	Water	08/06/98, 09:03
FHB 01706	114070	9808781-04	Water	08/06/98, 09:07
FHB 01606	114071	9808415-35	Water	08/06/98, 09:15
FHB 00106	114072	9808415-36	Water	08/06/98, 09:20
FHB 01506	114073	9808415-37	Water	08/06/98, 09:31
FHB 01306	114074	9808781-03	Water	08/06/98, 09:35
FHB 01406	114075	9808415-38	Water	08/06/98, 09:43
FHB 01206	114076	9808781-02	Water	08/06/98, 09:55
FHB 00406	114077	9808415-39	Water	08/06/98, 10:22

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Table 3.2 Sample Set for FHST6 (cont.)

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time
FHB 00306	114078	9808415-40	Water	08/06/98, 10:30
FHB 00306D	114079	9881132502	Split	08/06/98, 10:31
FHB 00606	114080	9808415-41	Water	08/06/98, 10:52
FHB 00806	114081	9808415-42	Water	08/06/98, 11:05
FHB 00506	114082	9808415-43	Water	08/06/98, 11:12
FSP 04706D	114083	9881132702	Split	08/04/98, 12:33
HSP 00806A	114084	9808415-44	Duplicate	08/05/98, 09:35
HSP 07106A	114085	9808781-12	Duplicate	08/05/98, 13:08
FMC001F06A	114086	9808415-45	Duplicate	08/05/98, 14:22
HSP 05706	114087	9808415-46	Water	08/05/98, 12:45

3.2 Field Data Quality Issues

3.2.1 Discrepancies From the Planned Work

General

For the FHST5 sampling event, three sample locations were recorded in the sample logbook as HSP 093 (113927), HSP 092 (113928), and HSP 085 (113929). However, the same locations were reported as FHB 005 (114082), FHB 006 (114080), and FHB 008 (114081), respectively, for the FHST6 sampling event.

Although 71 COCs were generated for FHST5, only 64 were used. And, of 69 COCs generated for FHST6, only 59 were used.

FHST5

Planned samples were not taken for FMC001H05A, HSP 03405, and HSP 03805 because the locations were dry.

One duplicate sample was collected from a station different than planned because the station was dry. Sample ID 113934 was taken from survey station FMC002H05A instead of station HSP 03405A.

Two FHST5 samples, HSP 026 (113908) and HSP 046-05A (113916), were collected but were not sent to the laboratory.

Samples 111791, 113912, and 113927 were taken from locations other than those planned, as shown in table 3.3. See table 3.6 in subsection 3.2.3, *Sample Logbook Observations*, for further details.

Table 3.3. Planned vs. Actual Stations for FHST5

Sample ID	Planned Station	Actual Station
111791	FHB-00105	FHB01805

Table 3.3. Planned vs. Actual Stations for FHST5 (cont.)

Sample ID	Planned Station	Actual Station
113912	HSP3405A	HSP-04305
113927	HSP-09205	HSP-09305

FHST6

Planned samples were not taken for sample locations FHB 01906, FSP 23506, HSP 01106, HSP 03406, HSP 03806, and HSP 04606 because the locations were dry. The sample planned for FSP 02606 was not taken because the location was inaccessible due to felled trees.

Seven samples were not collected at the planned stations because the stations were dry. Alternate locations were used but, because station coordinates were not reported for the alternate locations, these samples are reported here at the original planned stations. The stations and their sample IDs are as follows: FSP 056 (114043), FSP 220 (114029), FSP 226 (114030), FSP 249 (114026), HSP 013 (114050), HSP 015 (114051), and HSP 049 (114058).

3.2.2 Field Data Sets

The following tables list the sample identifiers, sample date and time, and the pH, conductivity, and temperature readings taken at the time of sampling. A in the Station ID indicates a duplicate, and D indicates a split sample.

Table 3.4 Field Data for FHST5

Survey Station ID	Sample ID	Sample Date and Time	pH	Conductivity (µmhos)	Water Temperature (°C)
FSP 29005	111765	03/16/98, 09:25	4.68	23.8	13.4
FSP 25605	111766	03/16/98, 10:07	5.78	42.2	13.1
FSP 24905	111767	03/16/98, 10:18	5.10	63.5	13.1
FSP 24105	111768	03/16/98, 10:28	5.46	82.2	13.9
FSP 23505	111769	03/16/98, 10:43	5.89	53.6	13.5
FSP 22005	111770	03/16/98, 10:47	5.05	133.6	13.2
FSP 22605	111771	03/16/98, 10:55	5.24	108.9	16.7
FSP 21305	111772	03/16/98, 11:05	4.10	222	13.5
FSP 20405D	111773	03/16/98, 12:04	4.15	273	17.2
FSP 27005	111774	03/16/98, 12:36	4.76	34.1	14.8
FSP 20405	111775	03/16/98, 13:00	4.15	273	17.2
FSP 00205	111776	03/16/98, 13:11	5.81	41.7	17.0
FSP 00205D	111777	03/16/98, 13:12	5.81	41.7	17.0
FSP 00705	111778	03/16/98, 13:20	5.68	86.2	15.2
FSP 01205	111779	03/16/98, 13:33	4.99	34.6	13.4
FSP 01405	111780	03/16/98, 13:41	4.53	32.4	17.2
FSP 01905	111781	03/16/98, 13:58	4.02	1018	14.5

Table 3.4 Field Data for FHST5 (cont.)

Survey Station ID	Sample ID	Sample Date and Time	pH	Conductivity (µmhos)	Water Temperature (°C)
FSP 02605	111782	03/16/98, 14:07	4.78	909	19.3
FSP 03205	111783	03/16/98, 14:19	4.41	39.3	14.2
FSP 03405	111784	03/17/98, 11:14	4.09	327	11.3
FSP 03505	111785	03/17/98, 11:20	4.08	954	10.9
FSP 04005	111786	03/17/98, 11:30	4.28	730	10.2
FSP 04705	111787	03/17/98, 11:44	4.80	324	11.6
FSP 05605	111788	03/17/98, 12:35	5.50	34.9	10.3
FHB02005	111789	03/17/98, 13:46	4.86	254	12.0
FHB00205	111790	03/17/98, 13:53	4.82	29.2	12.0
FHB01805	111791	03/17/98, 14:00	5.80	44.7	12.0
FHB01705	111792	03/17/98, 14:06	5.28	56.8	11.8
FHB01605	111793	03/17/98, 14:12	5.13	51.7	10.6
FHB01505	111794	03/17/98, 14:24	5.60	68.2	11.3
FHB00105	111795	03/17/98, 14:30	4.76	44.6	12.9
FHB01905	111796	03/17/98, 14:40	4.53	37.0	11.2
FHB01305	111797	03/17/98, 14:48	4.27	35.5	11.1
FHB01405	111798	03/17/98, 14:52	4.61	31.1	14.3
FHB01205	111799	03/17/98, 15:04	4.68	37.8	14.4
HSP 00305	113900	03/18/98, 09:32	6.38	115.9	10.3
HSP 00405	113901	03/18/98, 09:50	6.36	110.1	10.2
HSP 00805	113902	03/18/98, 09:42	5.95	109.6	10.9
HSP 01505	113903	03/18/98, 10:08	5.54	61.9	11.7
HSP 01105	113904	03/18/98, 10:21	5.45	46.5	12.1
HSP 01105A	113905	03/18/98, 10:22	5.45	46.5	12.1
HSP 01305	113906	03/18/98, 10:15	6.30	65.7	10.0
HSP02005	113907	03/18/98, 10:32	5.28	32.7	10.8
HSP02605	113908	03/18/98, 10:41	5.55	42.8	11.0
HSP02505	113909	03/18/98, 10:53	5.56	48.5	10.4
HSP02905	113910	03/18/98, 11:02	5.17	35.0	10.7
HSP04305	113911	03/18/98, 14:01	6.04	127.6	11.2
HSP04305A	113912	03/18/98, 14:02	6.04	127.6	11.2
HSP05205	113913	03/18/98, 14:08	5.92	316	10.7
HSP04905	113914	03/18/98, 14:21	5.84	53.9	12.0
HSP04605	113915	03/18/98, 14:28	6.07	84.3	11.1
HSP05705	113917	03/18/98, 14:39	5.56	51.7	13.0
HSP06405	113918	03/18/98, 14:55	5.40	25.8	12.2
HSP07605	113919	03/18/98, 15:05	6.19	110.8	15.0
HSP07105	113920	03/18/98, 15:12	6.48	77.7	14.4
HSP06005	113921	03/18/98, 15:20	6.06	122.9	13.6

Table 3.4 Field Data for FHST5 (cont.)

Survey Station ID	Sample ID	Sample Date and Time	pH	Conductivity (µmhos)	Water Temperature (°C)
FHB00405	113922	03/18/98, 15:52	4.89	276	14.4
FHB00305	113923	03/18/98, 15:58	5.18	35.9	14.5
HSP10305	113924	03/18/98, 16:07	4.82	51.6	14.9
HSP09705	113925	03/18/98, 16:13	4.70	45.7	12.5
HSP 09305	113927	03/18/98, 16:27	5.04	32.0	11.5
HSP 09205	113928	03/18/98, 16:33	4.88	26.6	13.1
HSP08505	113929	03/18/98, 16:45	4.94	298	16.3
FHB00105D	113931	03/17/98, 14:00	5.80	44.7	12.0
FMC001H05	113932	03/23/98, 11:08	5.86	21.9	11.2
FMC002H05	113933	03/23/98, 11:19	5.84	34.0	10.8
FMC002H05A	113934	03/23/98, 11:20	5.84	34.0	10.8
FMC001F05	113935	03/23/98, 11:35	5.62	33.7	13.8

Table 3.5 Field Data for FHST6

Survey Station ID	Sample ID	Sample Date and Time	pH	Conductivity (µmhos)	Water Temperature (°C)
FSP 29006	114023	08/04/98, 08:45	4.50	28.1	23.2
FSP 27006	114024	08/04/98, 09:07	4.49	30.5	21.0
FSP 25606	114025	08/04/98, 09:40	5.22	84.1	22.0
FSP 24906	114026	08/04/98, 09:55	5.94	310	22.7
FSP 24106	114027	08/04/98, 10:10	4.74	258	24.2
FSP 22006	114029	08/04/98, 10:30	5.29	406	22.7
FSP 22606	114030	08/04/98, 10:38	5.82	80.5	22.4
FSP 21306	114031	08/04/98, 10:48	3.98	249	22.1
FSP 20406	114032	08/04/98, 11:19	3.91	448	22.5
FSP 00206	114033	08/04/98, 11:32	6.15	84.0	23.4
FSP 00706	114034	08/04/98, 11:39	5.71	230	23.0
FSP 04706	114035	08/04/98, 12:33	5.41	26.6	22.5
FSP 03506	114036	08/04/98, 12:50	3.74	1,176	23.5
FSP 03406	114037	08/04/98, 13:04	4.30	410	24.2
FSP 04006	114038	08/04/98, 13:17	3.81	666	25.3
FSP 03206	114039	08/04/98, 13:26	5.03	40.9	23.5
FSP 01206	114040	08/04/98, 13:45	5.25	22.7	24.0
FSP-012D06	114041	08/04/98, 13:46	5.25	22.7	24.0
FSP 01406	114042	08/04/98, 13:53	5.02	35.2	23.7
FSP 05606	114043	08/04/98, 14:17	5.78	35.1	24.0
FMC002H06	114044	08/04/98, 14:37	5.69	90.9	26.3
FSP 01906	114045	08/05/98, 08:41	4.19	637	20.4
HSP 00306	114047	08/05/98, 09:22	6.23	239	20.8

Table 3.5 Field Data for FHST6 (cont.)

Survey Station ID	Sample ID	Sample Date and Time	pH	Conductivity (µmhos)	Water Temperature (°C)
HSP 00406	114048	08/05/98, 09:27	6.24	308	19.7
HSP 00806	114049	08/05/98, 09:34	5.83	70.8	19.2
HSP 01306	114050	08/05/98, 10:00	6.31	163.3	20.2
HSP 01506	114051	08/05/98, 10:07	5.34	982	20.1
HSP 02006	114052	08/05/98, 10:44	5.37	83.7	21.5
HSP 02506	114053	08/05/98, 10:48	5.82	73.5	19.9
HSP 02906	114054	08/05/98, 10:59	5.20	38.9	20.6
HSP 04306	114056	08/05/98, 11:28	5.95	276	23.0
HSP 05206	114057	08/05/98, 11:35	6.19	246	22.4
HSP 04906	114058	08/05/98, 11:47	6.13	140.3	23.9
HSP 06006	114059	08/05/98, 12:52	5.77	171.0	22.8
HSP 06406	114060	08/05/98, 12:59	4.97	29.9	22.2
HSP 07106	114061	08/05/98, 13:07	5.64	166.5	22.3
HSP 07606	114062	08/05/98, 13:20	6.14	141.7	23.8
HSP 09706	114063	08/05/98, 13:43	5.74	122.5	23.0
HSP 10306	114064	08/05/98, 13:51	4.50	105.1	21.9
FMC001F06	114065	08/05/98, 14:21	6.33	55.4	25.3
FMC001H06	114066	08/05/98, 14:36	5.87	52.8	25.1
FHB 02006	114067	08/06/98, 08:52	5.2	26.8	20.7
FHB 00206	114068	08/06/98, 08:56	4.93	39.8	21.2
FHB 01806	114069	08/06/98, 09:03	5.56	87.9	19.7
FHB 01706	114070	08/06/98, 09:07	5.20	52.1	21.5
FHB 01606	114071	08/06/98, 09:15	5.11	73.7	21.2
FHB 00106	114072	08/06/98, 09:20	5.11	62.7	21.7
FHB 01506	114073	08/06/98, 09:31	5.38	91.8	21.3
FHB 01306	114074	08/06/98, 09:35	4.71	43.0	20.9
FHB 01406	114075	08/06/98, 09:43	4.68	40.0	18.9
FHB 01206	114076	08/06/98, 09:55	4.70	44.3	18.8
FHB 00406	114077	08/06/98, 10:22	4.66	11.19	21.4
FHB 00306	114078	08/06/98, 10:30	4.49	31.0	22.1
FHB 00306D	114079	08/06/98, 10:31	4.49	31.0	22.1
FHB 00606	114080	08/06/98, 10:52	5.01	34.2	22.0
FHB 00806	114081	08/06/98, 11:05	5.76	105.6	21.7
FHB 00506	114082	08/06/98, 11:12	5.01	47.7	21.3
FSP04706D	114083	08/04/98, 12:33	5.41	26.6	22.5
HSP 00806A	114084	08/05/98, 09:35	5.83	70.8	19.2
HSP 07106A	114085	08/05/98, 13:08	5.64	116.5	22.3
FMC001F06A	114086	08/05/98, 14:22	6.33	55.4	25.3
HSP 05706	114087	08/05/98, 12:45	5.69	29.1	21.9

3.2.3 Sample Logbook Observations

Samplers noted that several sampling locations for FHST5 and FHST6 were dry and required moving to an alternate sampling location. Sample logbook observations are given in table 3.6.

Table 3.6 Sample Logbook Observations

Sample ID	Sample Location(s)	Sample Date/Time	Discrepancy/Change	Reason
FHST5				
111791	FHB-001-05	03/17/98, 14:00	Sample location moved to FHB-018-05.	No reason was given.
113912	HSP-3405A	03/18/98, 14:02	Sample location moved to HSP-04305A	Planned sampling location was dry.
113926	HSP-085-05	03/18/98	Sampling time, planned site not indicated.	No reason was given.
113930	HSP-038, HSP-034	03/18/98, 11:15	No sample was taken.	Both locations were dry. Samplers noted that both sites appeared to be too far upgradient.
FHST6				
114026	FSP-0249-06	08/04/98, 9:55	Sample location moved to FSP-0249-06ALT.	Planned sampling location was dry. Sampling occurred approximately 50 ft down-gradient from planned location.
114028	FSP-235-06	08/04/98, 10:25	No sample was taken.	Planned sampling location was dry.
114029	FSP-220-06	08/04/98, 10:30	Sample location moved to FSP-220-06ALT.	Planned sampling location was dry. Sampling occurred approximately 30 ft down-gradient from planned location.
114030	FSP-226-06	08/04/98, 10:38	Sample location moved to FSP-226-06ALT.	No reason was given.
114043	FSP-056-06	08/04/98, 14:17	Sample location moved to FSP-056-06ALT.	Planned sampling location was dry. Sampling occurred approximately 30-40 ft closer to the wet area.
114046	FSP-026-06	08/05/98	No sample was taken.	Felled trees prevented samplers from reaching the well.

Table 3.6 Sample Logbook Observations (cont.)

Sample ID	Sample Location(s)	Sample Date/Time	Discrepancy/Change	Reason
114050	HSP-011-06, HSP-013-06	08/05/98, 10:00	Sample location moved to HSP-013ALT.	Both HSP-011 and HSP-013 were dry. Sampling occurred approximately 100 ft down-gradient from planned location.
114051	HSP-015-06	08/05/98, 10:07	Sample location moved to HSP-015ALT.	Planned sampling location was dry. Sampling occurred approximately 30 ft down-gradient from planned location.
114055	HSP-034-06, HSP-034ALT	08/05/98	No sample was taken.	Planned sampling location and alternate sampling location (within 100 ft) were dry.
114058	HSP-049-06	08/05/98, 11:47	Sample location moved to HSP-049ALT.	No reason was given.
114059	HSP-0046-06	08/05/98, 12:52	Sample location moved to HSP-060-06	Planned sample location was dry within 100 ft.
114061	HSP-076-06	08/05/98, 13:07	Sample location moved to HSP-071-06.	No reason was given.
114074	FHB-019-06	08/06/98, 9:35	Sample location moved to FHB-013-06.	Planned sample location was dry.
114085	HSP-046-06A	08/05/98, 13:08	Sample location moved to HSP-071-06A.	No reason was given.

3.2.4 Chain-of-Custody Observations

No observations that impacted data quality were recorded on the chain-of-custody forms.

3.3 Analytical Data Quality Issues**3.3.1 The Laboratories**

The samples were analyzed by EP under contract AA07208N. The laboratory has been certified by SCDHEC. The splits were analyzed by the EMS laboratory.

3.3.2 Laboratory Quality Control

The laboratories follow their own QA/QC plans, which are designed to measure and document the accuracy and precision for the various sample control and analytical methods it performs. The laboratories are guided by published method-specific QC requirements as well as other regulatory and contract-required QC procedures.

3.3.3 List of Analytical Suites

Tritium was the only analyte requested in both sampling events. See *Appendix A* for a listing of the analytical methods and the lab's reporting of MDAs.

3.3.4 Analytical Data Observations

The data are final and complete except as noted in this subsection. Data validation is also complete.

Some of the data did not meet all the criteria listed in EPA, 1993, as noted below:

- Field measurements are designed to meet the criteria for screening-level data and they are not analyte specific. Therefore, definitive data criteria are not applicable.
- Analytical error determination (a measurement of method precision) was not calculated; however, precision can be evaluated by referring to the tables in section 3.5, *Precision and Accuracy*, of this report.
- Total measurement error determination (measurement of overall precision from sample acquisition through analysis) was not performed because it requires independently collected samples from the same location, and this practice does not fit into the scope of the project work plan.
- No adjustments to sample values were made for bias or precision.
- Using the criteria defined in EPA, 1993, matrix spike recoveries for an entire project are averaged, and all associated sample data are qualified on the basis of this average. Matrix spike-based qualification for this project, however, was done on a sample-by-sample basis, using the criteria in subsection 3.4.3, *Qualification of the Data*.
- One of three matrix spikes for FHST5 and one of four matrix spikes for FHST6 could not be evaluated due to high concentration of the analyte in the sample.

3.4 Verification and Validation Issues

3.4.1 Analytical Narrative Review

The EDDs and analytical narratives arrive from the laboratories and are logged in together. If the analytical narrative is missing, it is requested from the analytical laboratory. The narratives are reviewed and used as a reference throughout the data validation process. Discrepancies between the narratives and the analytical data must be resolved by the analytical laboratory. The analytical narratives contain summaries of the following problems encountered by the laboratory:

- QC samples that do not meet the criteria specified by the analytical method
- matrix interference problems
- sample-specific adjustments to the method caused by high concentration of some analytes
- sample preservation and holding time problems
- instrument calibration problems

- contaminated blanks
- other laboratory QC issues

Additional information about the chain-of-custody data and analytical data is often found in the analytical narratives. Copies of the COC forms attached to the analytical narratives are used for data review.

3.4.2 Laboratory Data Records Review

No laboratory data records reviews were performed for either sampling event in this project, due to the small size of the project.

3.4.3 Qualification of the Data

Each sample was evaluated on the following issues during validation:

- holding time
- sample preservation
- instrument calibration
- analyte identification and quantitation
- method blanks
- laboratory control samples
- rinsates, field blanks, and field duplicates
- laboratory duplicates
- matrix spikes
- instrument readings
- additional information

Holding Time

Criteria

Each analysis was evaluated according to the six-month holding time limit for radionuclides.

Action

When holding times were exceeded, the following qualifiers were applied:

Analysis Qualifier: *Q*

Result Qualifier: *J*—for detects *UJ*—for nondetects

Findings

No environmental sample records from either sampling event were qualified based on holding times.

Discussion

Most methods specify limits on the time that can pass between sample collection and extraction or analysis. When holding times are exceeded, sample integrity may be compromised due to chemical and/or physical effects that can bias sample results either positively or negatively.

Sample Preservation

Criteria

Sample preservation requirements are determined by regulatory guidance, method specifications, and laboratory protocols.

Findings

No environmental sample records from either sampling event were qualified based on sample preservation.

Instrument Calibration

Criteria

The calibration criteria specific to each method was used to evaluate instrument calibration during the LDRR.

Action

When calibration criteria were not met, the following qualifiers were assigned:

Analysis Qualifier: *L*

Result Qualifiers: *J* or *R*—detects *UJ*—for nondetects

Findings

No environmental sample records from either sampling event were qualified based on instrument calibration.

Discussion

Instrument calibration ensures that the instrument is capable of producing acceptable quantitative results. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of the analysis run. Continuing calibration verification documents that the initial calibration is still valid. After initial calibration, a continuing calibration standard and blank should be analyzed after every ten samples.

Analyte Identification and Quantitation

This issue was examined during the LDRR. The findings are presented in section 3.4.2, *Laboratory Data Records Review*.

Trip Blanks

Criteria

Trip blanks are used to determine the existence and magnitude of contamination from shipping activities.

Action

When an analyte is detected in a trip blank, an analysis qualifier is assigned to that analyte in the blank and to all samples that are shipped in the same cooler as the trip blank having positive results. If the analyte concentration in a sample is less than five times that in the blank (less than 10 times for the common laboratory contaminants acetone, dichloromethane [methylene chloride], and methyl ethyl ketone), assign a result qualifier to that analyte in the sample.

The following qualifiers may be assigned:

Analysis Qualifier: 8

Result Qualifier: U

Findings

There were no trip blanks associated with this project.

Discussion

Volatile organic contamination can be introduced into a trip blank in three ways: during blank preparation at the laboratory; during storage of the trip blank in the cooler; or by cross-contamination from other samples. The contamination can cause false positives in the trip blank and in the samples exposed to contamination.

Method Blanks

Criteria

Method blanks are used to determine the existence and magnitude of contamination from laboratory activities. Method blanks with analytical results greater than zero are considered to be contaminated. The CLP 5×/10× rule is used for data qualification.

Action

When an analyte is detected in a method blank, an analysis qualifier is assigned to that analyte in the blank and to every sample of the preparation batch having positive results. If the analyte concentration in a sample is less than five times that in the blank (less than 10 times for common laboratory contaminants), assign a result qualifier to that analyte in the sample. A bias qualifier should be used only if the laboratory believes the sample is contaminated and has assigned the qualifier.

The following qualifiers may be assigned:

Analysis Qualifier: V

Result Qualifier: *U*

Bias Qualifier: *H*

Findings

No environmental sample records from either sampling event were qualified based on method blank contamination.

Discussion

Laboratory contamination of samples during preparation and/or analysis is monitored through the method blank. Laboratory procedures may cause false positive results in the method blanks for common laboratory contaminants.

Laboratory Control Samples

Criteria

- Dioxins/furans: 40–120% recovery (EPA, 1986)
- Inorganics: 80–120% recovery except EPA6020 and EPA6020A, which have 70–130% recovery
- Pesticides: Page D-61 PEST (EPA, 1991b)
- Radiologicals: 80–120% (WHC, not dated)
- Semivolatiles: Table 7, page D-59 SV (EPA, 1991b)
- Volatiles: Table 7, page D-55 VOA (EPA, 1991b)

Action

When the percent recovery for an analyte in the LCS was outside the QC limits, that analyte in the LCS was qualified with an analysis qualifier. That analyte in each sample of the preparation batch was qualified. If an LCS was not included in the preparation batch, all spike compounds for the associated samples were qualified with an analysis and a results qualifier.

LCS recovery below lower QC limit:

Analysis Qualifier: *C*

Result Qualifiers: *J*—for detects — *UJ*—for nondetects

LCS recovery above upper QC limit:

Analysis Qualifier: *C*

Result Qualifiers: *J*—for detects

Findings

All LCSs reported for both sampling events by each laboratory were within acceptable ranges. Therefore, no environmental sample records were qualified.

Discussion

LCS percent recoveries that exceed the upper QC limit could indicate a high bias for samples with positive results. Percent recoveries that are less than the lower QC limit could indicate a low bias for samples with positive results, and nondetect results should be considered questionable.

Rinsates, Field Blanks, and Field Duplicates

No qualification is performed based on rinsates, field blanks, and field duplicates.

Laboratory Duplicates

Criteria

- Inorganics: Page 10 (EPA, 1988a)
- Organics: No qualification is done on this basis.
- Radiologicals: (WHC, not dated)

Findings

No environmental sample records from either sampling event were qualified based on RPDs.

Matrix Spikes

Criteria

- Dioxins: 40–120% (EPA, 1986)
- Inorganics: Page 11 (EPA, 1988a)
- Pesticides: Page D-61 PEST (EPA, 1991b)
- Semivolatiles: Table 7, page D-59 SV (EPA, 1991b)
- Volatiles: Table 7, page D-55 VOA (EPA, 1991b)

Action

1. MS recovery limits do not apply when the spike concentration is less than 25% of the sample concentration. When this occurred, the MS record only was qualified as follows:

Analysis Qualifier: 5

Result Qualifier: R

2. If the laboratory did not perform matrix spikes for nonradiological analyses, the following qualifier was used:

Analysis Qualifier: I

Findings

For both sampling events, no environmental sample records were qualified. The following table lists the frequency with which matrix spikes were rejected because the sample concentration was 4 times higher than the nominal concentration.

Table 3.7 Matrix Spikes With Sample Concentrations 4 Times Higher Than Nominal Concentration for Samples by EP

Analyte	Rejection Frequency
FHST5	
Tritium	1/2
FHST6	
Tritium	1/3

Discussion

When the matrix spike percent recovery for an analyte is high, the results for associated data may be biased positively. When the matrix spike percent recovery for an analyte is low, the results for associated data may be biased negatively, and the nondetected results should be considered questionable.

Instrument Readings

Criteria

For radiologicals, nondetected parameters reported from an instrument reading require a result qualifier.

Action

The result qualifier was as follows:

Result Qualifier: *UI*—for nondetects

Findings

No environmental sample records from either sampling event were qualified.

Discussion

For radiological analyses, the laboratory instrumentation and data management software calculate the MDA, result, and accuracy. If the reported result was less than the MDA and/or the accuracy, a *UI* result qualifier was assigned.

3.5 Precision and Accuracy

This section discusses the analytical data in terms of the precision and accuracy indicators of data quality. Precision is determined from the field and laboratory duplicate analyses and indicates the consistency of field and laboratory techniques. Accuracy is determined

from the laboratory control samples, matrix spikes, and the results of the method, field, trip, and equipment blanks or rinsates and indicates the ability of the laboratory to generate correct results.

3.5.1 Precision

Precision is a measure of the repeatability of a measurement and is evaluated from the results of field and laboratory duplicate samples. Field duplicates measure the repeatability for the sampling and analytical techniques, and laboratory duplicates measure the ability of the laboratory to reproduce a result. Low precision can be caused by poor instrument performance, poor operator technique, inconsistent application of method protocols, laboratory environment, time between analyses, or by a difficult, heterogeneous sample matrix. Precision is especially important when the action limit approaches the quantitation limit. At least 5% of the samples are collected in duplicate. The laboratory performs duplicate analyses on at least 10% of the samples received.

Precision is expressed in terms of the relative percent difference as follows:

$$RPD = \frac{|x - y|}{\left(\frac{x + y}{2}\right)} \times 100,$$

where x is the original sample result and y is the duplicate sample result. When one result of a duplicate pair is below the MDL, the ssEQL is used for that result in the calculation. When both results are below the MDL, the RPD cannot be calculated.

The RPD should be less than 20% for water samples and less than 35% for soil samples when results are above the ssEQL. In the case where results are between the ssEQL and the MDL, the RPD should be less than 100% for water samples and less than 200% for soil samples.

The RPDs for the laboratory and field duplicates are listed in the following tables. The frequency out of range is the number of duplicates that had RPDs greater than the acceptance limit compared to the total number analyzed; the other columns provide the mean RPD, standard deviation, and the minimum and maximum RPDs.

Table 3.8 Relative Percent Differences of Field Duplicates by EP for FHST5

Analyte	Frequency Out of Range	Mean RPD (%)	Std. Dev.	Minimum RPD (%)	Maximum RPD (%)
Radionuclides					
Tritium	0/3	2.49	3.24	0.298	6.21

Table 3.9 Relative Percent Differences of Field Duplicates by EP for FHST6

Analyte	Frequency Out of Range	Mean RPD (%)	Std. Dev.	Minimum RPD (%)	Maximum RPD (%)
Radionuclides					
Tritium	0/3	5.27	1.76	3.45	6.96

3.5.2 Accuracy

Accuracy is defined as the closeness of agreement between an observed value and an accepted reference value. Accuracy is especially important when the concentration of concern approaches the quantitation limit and/or the action limit. When the concentration is underestimated near the quantitation limit, the analyte may be present but reported as not detected. When the concentration is underestimated near the action limit, the analyte may be at a concentration that would require remediation, but the remediation would not be performed. When the concentration is overestimated near the quantitation limit, the analyte may not be present but reported as detected. When the concentration is overestimated near the action limit, the analyte may not be at a concentration that would require remediation, but the remediation would be performed. The sample types used to evaluate accuracy are performance evaluation studies (see *Appendix B*), LCS/BSs, surrogate spikes, and matrix spikes.

Laboratory Control Samples

LCSs monitor the performance of all steps in the analysis process, including sample preparation, and are used to identify problems with the analytical procedure. LCSs for inorganic analyses are DI water that is spiked with the target analyte, digested, and analyzed with the regular samples. LCSs for organic analyses are DI water that is spiked with selected target analytes, extracted, and analyzed with the regular samples. The LCS spiking solutions or solid LCSs are obtained from EPA or a third-party supplier or are prepared in the laboratory from chemicals from a different source than the calibration standards. The QC limits for radionuclide LCS are 80-120%.

The following tables list the statistical information for the percent recovery for LCSs by analyte. The frequency out of range is the number of LCSs that had percent recoveries outside the acceptance limits compared to the total number analyzed; the other columns provide the mean percent recovery, standard deviation, and the minimum and maximum percent recoveries.

The percent recovery is calculated as

$$\%R = \frac{SR}{SA} \times 100,$$

where %R = percent recovery

SR = LCS sample result

SA = spike-added result

Table 3.10 Laboratory Control Sample Recoveries for EP

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
FHST5					
Tritium	0/2	99.8	1.7	98.6	101
FHST6					
Tritium	0/4	95.9	5.84	88.7	103

Table 3.11 Laboratory Control Sample Recoveries for EM

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
FHST5					
Tritium	0/2	99.8	1.7	98.6	101
FHST6					
Tritium	0/2	95.5	0.14	95.4	95.6

Matrix Spikes

Matrix spikes are used to evaluate the effect of the sample matrix on the analytical procedure. Matrix spikes for at least 5% of the samples are prepared by adding a known quantity of the target analyte to the samples prior to sample preparation. All target analytes are spiked for the inorganic analyses. Selected target analytes are used in the spiking solution for the organic analyses. Results from the matrix spikes are used to evaluate the extent of matrix interference.

The QC limits for matrix spikes are the same as those for LCSs except for inorganics, which have limits of 75-125%. Matrix spikes are rejected if the concentration of the analyte in the sample is more than four times the amount of the spike.

The following tables list the percent recovery for the matrix spikes. The frequency out of range is the number of matrix spikes that had percent recoveries outside the acceptance limits compared to the total number analyzed; the other columns provide the mean percent recovery, standard deviation, and the minimum and maximum percent recoveries.

Table 3.12 Matrix Spike Recoveries for EP

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
FHST5					
Tritium	0/3	94.4	5.38	88.2	97.8

Table 3.12 Matrix Spike Recoveries for EP (cont.)

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
FHST6					
Tritium	0/2	89.6	12.2	80.9	98.2

Table 3.13 Matrix Spike Recoveries for EM

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
FHST5					
Tritium	0/1	119		119	119
FHST6					
Tritium	0/1	96.8		96.8	96.8

3.5.3 Contamination in Quality Control Samples**Field Blanks**

Field blanks are used to identify possible sources of contamination from the processing and shipping of samples. Field blanks consist of DI water or dry quartz sand sealed in sample bottles prior to sampling, opened in the field during sampling, resealed, and shipped to the laboratory with the samples. Positive results from field blanks can result from contaminated sample bottles, contaminated DI water or quartz sand, vapors in the air during sampling, contamination during shipping or analysis, or analytical bias. The results from all samples in the sample delivery group are evaluated to determine the cause of the contamination and the corrective action to be taken.

No field blanks were associated with this project.

Method Blanks

Method blanks are used to determine the existence and magnitude of contamination resulting from the analytical process. Method blanks are analyte-free matrices (DI water for aqueous samples and sodium sulfate for solid samples) that are prepared in the same manner and at the same time as the samples. When method blanks have detectable concentrations of analytes, the laboratory must determine the cause and take corrective action to eliminate the contamination.

The following tables list the statistical information for the method blanks. The frequency detected column gives the number of method blanks analyzed for each analyte that had detectable concentrations compared to the total number analyzed. The other columns list the mean result, standard deviation, minimum and maximum results, and reporting unit. When the analyte is not detected, the mean and minimum and maximum results are the ssEQLs for the method blanks.

Table 3.14 Frequency of Detection in Method Blanks for EP

Analyte	Frequency Detected	Mean Result	Std. Dev.	Min./Max. Result	Unit
FHST5					
Tritium	0/5	-0.0617	0.083	-0.134/0.0704	pCi/mL
FHST6					
Tritium	0/4	-0.0528	0.175	-0.211/-.158	pCi/mL

Table 3.15 Frequency of Detection in Method Blanks for EM

Analyte	Frequency Detected	Mean Result	Std. Dev.	Min./Max. Result	Unit
FHST5					
Tritium	0/2	0	0.344	-0.243/0.243	pCi/mL
FHST6					
Tritium	0/2	-0.001	0.229	-0.163/0.161	pCi/mL

Trip Blanks

Trip blanks are used to detect contamination by volatile substances during shipping, primarily due to the breaking of the seal on the vial caused by depressurization during air transport. Trip blanks are analyzed for VOAs only. Trip blanks are prepared by the EPD/EMS laboratory for groundwater studies and by the analytical laboratory for other studies. If prepared by the analytical laboratory, trip blanks are shipped to EPD/EMS with the sample containers. The blanks are prepared by adding preservative to a 40-mL vial, filling it completely with DI water (no air bubbles), and sealing the top with a Teflon-lined septum cap. If a trip blank is found to be contaminated, the results from all samples shipped in the same cooler are evaluated to determine the extent of the contamination and the corrective action to be taken.

No trip blanks were associated with this project.

Rinsates

Rinsates are used to determine if sampling equipment that has been cleaned in the field is contaminated. Prior to sampling, DI water is poured over or pumped through portions of the sampling equipment that come in contact with the sample. If the rinsate is contaminated, the field cleaning procedure must be evaluated to determine the cause of the contamination. Results for all samples collected with equipment cleaned in the field must be evaluated to determine if the contamination is isolated or generalized.

No rinsates were associated with this project.

3.5.4 Comparability

The comparability of the data from the laboratories is based on the results of the split samples. For at least 10% of the sample locations, a split sample is collected and sent to the designated QC laboratory. The following table lists the RPDs, sample IDs, results that are greater than the quantitation limit for each analyte, and reporting units.

Table 3.16 Split Sample Results for FHST5

Analyte	RPD	EP Sample ID	EP Result	EM Sample ID	EM Result	Unit
Radionuclides						
Tritium	0.582	111775	1370	111773	1378	pCi/mL
Tritium	6.69	111776	278	111777	260	pCi/mL
Tritium	1.32	111795	97.5	113931	98.8	pCi/mL

Table 3.17 Split Sample Results for FHST6

Analyte	RPD	EP Sample ID	EP Result	EM Sample ID	EM Result	Unit
Radionuclides						
Tritium	9.46	114035	74.5	114083	81.9	pCi/mL
Tritium	6.02	114040	129	114041	137	pCi/mL
Tritium	23	114078	69.7	114079	87.8	pCi/mL

4.0 References

- DOE (U.S. Department of Energy), 1992. **Environmental Measurements Laboratory Procedures Manual**, HASL-300, 27th edition. Environmental Measurements Laboratory, New York, NY.
- EPA (U.S. Environmental Protection Agency), 1983. **Methods for Chemical Analysis of Water and Wastes**, EPA-600/4-79-020. Environmental Monitoring and Support Laboratory, Cincinnati, OH.
- EPA (U.S. Environmental Protection Agency), 1986. **Test Methods for Evaluating Solid Waste (SW-846)**, Volume I, including updates. Office of Solid Waste, Washington, DC.
- EPA (U.S. Environmental Protection Agency), 1988a. **Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses**. Hazardous Site Evaluation Division, Washington, DC.
- EPA (U.S. Environmental Protection Agency), 1988b. **Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses**. Hazardous Site Evaluation Division, Washington, DC.
- EPA (U.S. Environmental Protection Agency), 1990. **Guidance for Data Usability in Risk Assessment**, EPA/540/G-90/008. Office of Emergency and Remedial Response, Washington, DC.
- EPA (U.S. Environmental Protection Agency), 1991a. **U.S. EPA Contract Laboratory Program, Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration**, OLM01.0. Washington, DC.
- EPA (U.S. Environmental Protection Agency), 1991b. **U.S. EPA Contract Laboratory Program, Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration**, ILM03.0. Washington, DC.
- EPA (U.S. Environmental Protection Agency), 1991c. **Test Method: The Determination of Inorganic Anions in Water by Ion Chromatography—Method 300.0**. Environmental Monitoring and Support Laboratory, Cincinnati, OH.
- EPA (U.S. Environmental Protection Agency), 1993. **Data Quality Objectives Process for Superfund**, EPA 540/R-93/071. Washington, DC.
- EPA (U.S. Environmental Protection Agency), 1994a. *Guidelines Establishing Test Procedures for the Analysis of Pollutants*, **Code of Federal Regulations**, Title 40, Part 136. Washington, DC.
- EPA (U.S. Environmental Protection Agency), 1994b. *Identification and Listing of Hazardous Waste*, **Code of Federal Regulations**, Title 40, Part 261. Washington, DC.
- WHC (Westinghouse Hanford Company), not dated. **Data Validation Procedures for Radiochemical Analyses**, WHC-SP-EN-SPP-001, rev. 1. Richland, WA.

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Appendix A: Analytical Methods and Minimum Detectable Activities

In the following tables of analytical methods and minimum detectable activities, the MDA column reports the mean matrix-specific minimum detectable activity. The MDA takes into account the reagents, sample matrix, and preparation steps of a specific analytical method, and is defined as the smallest quantity of a radionuclide that can be detected in a sample with a 95% confidence level.

FHST5

Table A.1 FHST5 Water Analytical Methods and Minimum Detectable Activities for EP

Analyte	Method	MDA	Units
Radionuclides			
Tritium	EPA906.0	2.37	pCi/mL

Table A.2 FHST5 Water Analytical Methods and Minimum Detectable Activities for EM

Analyte	Method	MDA	Units
Radionuclides			
Tritium	3Q1-6-1420	1.5	pCi/mL

FHST6

Table A.3 FHST6 Water Analytical Methods and Minimum Detectable Activities for EP

Analyte	Method	MDA	Units
Radionuclides			
Tritium	EPA906.0	4.32	pCi/mL

Table A.4 FHST6 Water Analytical Methods and Minimum Detectable Activities for EM

Analyte	Method	MDA	Units
Radionuclides			
Tritium	3Q1-6-1420	1.5	pCi/mL

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Appendix B: Laboratory Performance Evaluation Results

This appendix contains recent performance evaluation results for the laboratories that report data for soils and groundwater samples. Not all laboratories report data for each project.

B.1 EPA Performance Evaluation Study Results

EPA conducts the water pollution (WP) and water supply (WS) performance evaluation studies biannually to certify laboratories for specific analyses. EPA's Environmental Monitoring Systems Laboratory (EMSL) of Cincinnati, OH, distributes water samples spiked with known concentrations of constituents found in polluted waters and potable water and submits them to laboratories seeking certification to analyze wastewater and potable water. EMSL evaluates the results, using limits statistically based on the performance of approximately 100 top-rated laboratories that analyze each constituent by the same procedure as the laboratory being evaluated.

EMAX, QST, and Recra reported results for WP038 (November 1997) and Recra reported results for WP039 (May 1998).

For study WP038, the results for EMAX were outside the acceptance limits for aluminum, chloride, fluoride, and total phenolics. The results for antimony, mercury, and 1,1,1-trichloroethane were acceptable but near the acceptance limits; EMAX was instructed to check for error. The results for QST were acceptable but near the acceptance limits for aldrin, chloroform, PCB1232, specific conductance, and total organic carbon; QST was instructed to check for error. The results for Recra were outside the acceptance limits for nitrate as nitrogen, non-filterable residue, and sulfate. The results for arsenic, chlordane, molybdenum, and selenium were acceptable but near the acceptance limits; Recra was instructed to check for error.

For study WP039, the results for Recra were all acceptable. However, the results for chemical oxygen demand and methylene chloride were close to the acceptance limits; Recra was instructed to check for error.

EMAX and QST reported results for WS039 (September 1997). Recra reported results for WS040 (March 1998).

For study WS039, the results for EMAX were outside the acceptance limits for 2,4-D, cis-1,2-dichloroethylene, ethylene dibromide, and nitrate. The results for QST were outside the acceptance limits for beryllium, fluoride, total cyanide, and turbidity.

For study WS040, the results for Recra were all acceptable.

B.2 EMS Quality Control Standards Results

During second quarter 1998, EPD/EMS conducted quality assessments of the laboratories. Each laboratory received a set of certified environmental quality control standards from Environmental Resource Associates (ERA) of Arvada, CO (lot numbers 435, 582, 3224, 3424, 8913, and 9982). Each laboratory's results were compared with the ERA-certified values and performance acceptance limits (PALs). The PALs are listed as guidelines for

acceptable analytical results given the limitations of the EPA methods used to determine these parameters. The PALs closely approximate the 95% confidence interval.

Of the 103 analyses reported by GE, 101 (or 98.1%), were within the PALs. Of 101 analyses reported by Recra, 92 (or 91.1%), were within the PALs. Of the 104 analyses reported by EMAX, 99 (or 95.2%) were within the PALs.

B.3 Mixed Analyte Performance Evaluation Program

The Department of Energy mixed analyte performance evaluation program provides proficiency samples containing metals, pesticides, and radionuclides. The results from the June 1996 MAPEP-96-S3 study were reported in December 1996.

For GE, copper was not acceptable and nickel was reported at 23.4 mg/kg although it was not included in the original sample. Five of the eight pesticides had a negative bias and were not acceptable; 4,4'-DDE and methoxychlor were not reported. For Recra, all the metals were within the acceptance limits. Four of the eight pesticides were not acceptable, three were acceptable, and methoxychlor was not reported.

For Environmental Physics, Inc. (EP), all eight radionuclides were acceptable, but plutonium-238 was close to the upper acceptance limit and given a warning flag. For Thermo NUtech (TNU), seven of eight radionuclides were within the acceptance limits; however the result for strontium-90 was not acceptable.

The results for EP and TNU are reported in table B.1.

The results for MAPEP-96-W4 were reported in April 1997. For QST, the results for 4-methylphenol and phenol were outside the acceptance limits. The results are reported in table B.9.

Table B.1 Mixed Analyte Performance Evaluation Program Results for MAPEP-96-S3 for EP and TNU

Analyte	EP Result	TNU Result	Reference Value	Acceptance Limits
Radionuclides (Bq/kg)				
Americium-241	29.0	28.7	28.7	20.09-37.31
Cesium-137	1770	1359	1531	1071.7-1990.3
Cobalt-60	931	727	812	568.4-1055.6
Plutonium-238	20.5^a	17.3	15.9	11.13-20.67
Plutonium-239/240	22.6	18.9	19.7	13.79-25.61
Strontium-90	540	347^b	536.0	375.2-696.8

^a In cases where a warning was given, the reported values appear in ***bold italic***.

^b Reported values that were outside the acceptance limits appear in **bold**.

Table B.1 Mixed Analyte Performance Evaluation Program Results for MAPEP-96-S3 for EP and TNU (cont.)

Analyte	EP Result	TNU Result	Reference Value	Acceptance Limits
Uranium-233/234	56.6	59.7	63.9	44.73-83.07
Uranium-238	52.9	59.7	64.0	44.80-83.20

B.4 EPA Radiological Performance Evaluation Studies

EP and QR participated in the EPA radiological performance evaluation studies administered by the Characterization Research Division-Las Vegas. The studies included in this order are the following:

- Tritium in Water, August 9, 1996
- Blind-A, October 15, 1996
- Blind-B, October 15, 1996
- Gamma in Water, November 8, 1996
- Strontium in Water, January 17, 1997
- Gross Alpha-Beta in Water, January 31, 1997
- Iodine in Water, February 7, 1997
- Uranium-Radium in Water, February 14, 1997

For tritium in water (8/9/96), the results were 9,613 pCi/L for EP and 10,707 pCi/L for QR. The EPA reference value was 10,879 pCi/L and the acceptance limits were 8,991-12,767 pCi/L.

For iodine in water (2/7/97), both EP and QR reported results of 88.00 pCi/L. The EPA reference value was 86.0 pCi/L and the acceptance limits were 70.4-101.6 pCi/L.

In the following tables, all results are reported in pCi/L.

Table B.2 Blind-A Results for EP and QR (10/15/96)

Analyte	EP Result	QR Result	Reference Value	Acceptance Limits
Gross Alpha	65.27	48.87	59.1	33.4-84.8
Radium-226	9.40	9.60	9.9	7.3-12.5
Radium-228	4.67	4.57	5.1	2.8-7.4
Uranium (natural)	37.33	40.10	40.9	33.8-48.0

Table B.3 Blind-B Results for EP and QR (10/15/96)

Analyte	EP Result	QR Result	Reference Value	Acceptance Limits
Cesium-134	18.00	18.00	20.0	11.3-28.7
Cesium-137	31.33	30.67	30.0	21.3-38.7

Table B.3 Blind-B Results for EP and QR (10/15/96) (cont.)

Analyte	EP Result	QR Result	Reference Value	Acceptance Limits
Cobalt-60	15.33	15.33	15.0	6.3-23.7
Gross Beta	43.43^c	119.67	111.8	82.7-140.9
Strontium-89	11.67	16.67	10.0	1.3-18.7
Strontium-90	24.67	21.33	25.0	16.3-33.7

Table B.4 Gamma in Water Results for EP and QR (11/8/96)

Analyte	EP Result	QR Result	Reference Value	Acceptance Limits
Cobalt-60	45.67	43.33	44.0	35.3-52.7
Zinc-65	39.33	36.67	35.0	26.3-43.7
Cesium-134	10.67	9.33	11.0	2.3-19.7
Cesium-137	22.67	20.33	19.0	10.3-27.7
Barium-133	64.67	61.00	64.0	53.6-74.4

Table B.5 Strontium in Water Results for EP and QR (1/17/97)

Analyte	EP Result	QR Result	Reference Value	Acceptance Limits
Strontium-89	8.67	11.00	12.0	3.3-20.7
Strontium-90	26.33	24.33	25.0	16.3-33.7

Table B.6 Gross Alpha-Beta in Water Results for EP and QR (1/31/97)

Analyte	EP Result	QR Result	Reference Value	Acceptance Limits
Gross alpha	4.83	4.60	5.2	0.0-13.9
Gross beta	14.23	17.40	14.7	6.0-23.4

Table B.7 Uranium-Radium in Water Results for EP and QR (2/14/97)

Analyte	EP Result	QR Result	Reference Value	Acceptance Limits
Radium-226	5.17	5.90	5.9	4.3-7.5
Radium-228	7.30	8.33	8.2	4.6-11.8
Uranium (natural)	32.07	27.8	27.0	21.8-32.2

^c Reported values that were out of range appear in **bold**.

Appendix C: Formats of the Data Files

The formats presented in this appendix have been established by WSRC-EPD/EMS. When entering data in any of the formats, the following conventions are to be used:

- Alpha and alphanumeric entries must be left justified in the records.
- Numeric entries must be right justified in the records.
- There will be no leading zeros except in dates and times.

Table C.1 describes the sample data format, SAM93, which is used for coding and transmitting sampling data records.

Table C.1 Sample Data Format SAM93

Name	Columns	Type	Description
Record format	1-8	Alphanumeric	SAM93 (the format of the data record)
Sample identification number	9-14	Integer	Number of the sample printed on the page of the sample logbook
Sample collection date	15-20	Numeric	Sample collection date recorded using the MMDDYY format
Sample collection time	21-24	Integer	Sample collection time recorded as military time
Sample type	25	Numeric	Sample type coded as 1 = normal 2 = trip blank 3 = field blank 4 = split 5 = rinsate 6 = duplicate 7 = other
Sample matrix	26	Numeric	Sample matrix coded as 1 = soil 2 = rock 3 = sludge 4 = water 5 = sediment 6 = other
Delay check	27	Alpha	Enter a Y if there was an unusual delay in bottling samples
Sampler's initials	28-30	Alpha	Sampler's initials
Associated sample	31-36	Integer	Sample identification of associated sample if this sample is a duplicate, split, rinsate, etc.

Table C.1 Sample Data Format SAM93 (cont.)

Name	Columns	Type	Description
Planned sample name	37-46	Alphanumeric	Identification of the sample as it appears in the site work plan
Sample name	47-56	Alphanumeric	Identification of the actual sample (includes any modification made in the field)
Planned top of interval	57-62	Numeric	Depth from the ground to the top of the planned sampling interval to the nearest 0.01 ft
Top of interval	63-68	Numeric	Depth from the ground to the top of the actual sampling interval to the nearest 0.01 ft
Planned bottom of interval	69-74	Numeric	Depth from the ground to the bottom of the planned sampling interval to the nearest 0.01 ft
Bottom of interval	75-80	Numeric	Depth from the ground to the bottom of the actual sampling interval to the nearest 0.01 ft
Soil moisture ^a	81	Numeric	Soil moisture coded as 1 = dry 2 = damp 3 = wet 4 = sludge 5 = liquid
Munsell color ^a	82-91	Alphanumeric	Munsell color
Soil classification ^a	92-93	Alphanumeric	Unified Soil Classification
Number of bottles	94-96	Integer	Number of bottle label numbers used during collection
Insufficient recovery check	97	Alpha	Enter an <i>R</i> if insufficient material was recovered to perform all analyses
Improper procedure check	98	Alpha	Enter a <i>P</i> if an improper sampling procedure was followed

^a No datum is reported for this field.

Table C.2 is a description of the sample bottle data format, SAM93A, which is used for coding and transmitting sample bottle data records.

Table C.2 Sample Bottle Data Format SAM93A

Name	Columns	Type	Description
Record format	1-8	Alphanumeric	SAM93A (the format of the data record)
Sample identification number	9-14	Integer	Number of the sample printed on the page of the sample logbook
Bottle label number	15-23	Integer	Number of the bottle label attached to the bottle

Table C.3 is a description of the survey station data format, STA93, which is used for coding and transmitting station data records.

Table C.3 Survey Station Data Format STA93

Name	Columns	Type	Description
Record format	1-8	Alphanumeric	STA93 (the format of the data record)
Station	9-18	Alphanumeric	Identification of the station (the facility identification and sampling point)
SRS north coordinate	20-27	Numeric	SRS grid north coordinate of the station reported in feet
SRS east coordinate	29-36	Numeric	SRS grid east coordinate of the station reported in feet
Ground elevation	43-48	Numeric	Ground elevation reported in feet above median sea level

Table C.4 is a description of the chain-of-custody data format, COC93, which is used for coding and transmitting chain-of-custody data records.

Table C.4 Chain-of-Custody Data Format COC93

Name	Columns	Type	Description
Record format	1-8	Alphanumeric	COC93 (the format of the data record)
Sample identification number	9-18	Integer	Number of the sample printed on the page of the sample logbook
Laboratory sample identification	19-33	Alphanumeric	Identifier used for the sample by the analytical laboratory
Sample collection date	34-39	Numeric	Sample collection date recorded using the MMDDYY format
Shipping date	40-45	Numeric	Sample shipping date recorded using the MMDDYY format
Cooler identification	46-53	Alphanumeric	Number assigned to the cooler in which the samples are shipped to the analytical laboratory
Sample temperature upon receipt	54-57	Numeric	Temperature of the samples upon receipt at the analytical laboratory in °C

Table C.5 is a description of the analytical data format, AN95, which is used for coding and transmitting analytical data records.

Table C.5 Analytical Data Format AN95

Name	Columns	Type	Description
WSRC identifier ^b	1-12	Alphanumeric	WSRC identifier for the sample
COC number	13-17	Alphanumeric	Identifier of the sample's chain-of-custody form (Required field for groundwater samples; not used for soil samples)
Sample collection date ^b	18-23	Numeric	Date the sample was collected. Enter the preparation date for laboratory blanks and QC samples; enter the date of completion of TCLP sample generation for TCLP samples
Sample collection time	24-27	Numeric	Time of sample collection or generation
Lab receipt date ^b	28-33	Numeric	Date the sample was received by the laboratory; blank for laboratory blanks and QC samples
Extraction date	34-39	Numeric	Date the sample was extracted; blank unless the holding time is dependent upon the extraction time

^b This field must have an entry for every record.

Table C.5 Analytical Data Format AN95 (cont.)

Name	Columns	Type	Description
Extraction time	40-43	Numeric	Time the sample extraction was started; blank unless the holding time is dependent upon the extraction time
Extraction/digestion method	44-56	Alphanumeric	Coded identifier for the method used to perform the extraction or digestion (e.g., EPA###.#)
Analysis date ^a	57-62	Numeric	Date the analyte concentration was determined
Analysis time ^a	63-66	Numeric	Time the analyte concentration was determined
Analytical method ^a	67-79	Alphanumeric	Coded identifier for the method used to perform the analysis (e.g., EPA###.#)
Preparation batch	80-87	Alphanumeric	Identification of the sample preparation batch
Laboratory ^a	88-89	Alphanumeric	Code assigned by EPD/EMS to identify the laboratory performing the analysis
Laboratory sample identification ^a	90-104	Alphanumeric	Identifier used for the sample by the analytical laboratory
Laboratory replicate	105-107	Alphanumeric	Indicates that the sample is a non-blind replicate analysis (see table C.8)
Analyte ^a	108-117	Alphanumeric	EPD/EMS identifier for the analyte
Quantitation limit	118-125	Numeric	GE and WA report the ssEQL for non-radiochemistry analyses; all labs report the MDA for radiochemistry analyses
Result qualifier	126-128	Alphanumeric	Coded field used to qualify the analytical result (see table D.1)
Analysis qualifier	129-131	Alphanumeric	Coded field used to qualify the analytical result (see table D.2)
Bias of analysis	132	Alphanumeric	Coded field for specifying the expected bias (see table D.3)
Analytical result	133-142	Numeric	Concentration of the analyte. For non-detects, the ssEQL is reported. Results are reported on a dry weight basis for all analyses reported in per mass units
Result unit ^a	143-146	Alpha	Unit in which the analytical result is expressed
Accuracy	147-154	Numeric	Statistically determined value, 95% confidence level, representing a plus or minus value for the result and reported in the same units as the analytical result. Required for all radiochemical analyses above the detection limit, but not generally reported for non-radiochemical analyses. Do not report more figures than are significant

Table C.5 Analytical Data Format AN95 (cont.)

Name	Columns	Type	Description
Residual weight	155-160	Numeric	Weight of material in milligrams on the planchet after evaporation; used for radionuclide determinations
Nominal concentration ^a	161-168	Numeric	Concentration of analyte added to the sample prior to analysis; reported in the same units as the analytical result. Zero must be entered if the sample was not spiked
Percent recovery	169-174	Numeric	Recovery of the spiked constituent reported as a percentage
Number of dilutions ^a	175	Numeric	Number of steps required to reach the final dilution factor. Zero must be entered if the sample was not diluted
Dilution factor ^a	176-181	Numeric	Dilution used in the analysis; a value of one indicates the sample was not diluted
Instrument ^a	182-189	Alphanumeric	Coded identifier for the instrument used to perform the analysis; each laboratory develops its own codes and provides them to EPD/EMS
Instrument batch ^a	190-197	Alphanumeric	Number assigned by the analytical laboratory to the analysis batch (group of samples analyzed together in a single instrument run along with the associated QC samples)
Analyst's initials ^a	198-200	Alpha	Initials of the analyst
Percent solids	201-205	Numeric	Percentage of the sample that is dry solids; required field if result is reported in per mass units; not applicable for water samples
Bottle label number	206-215	Integer	Number on the bottle label; required field if bottle label is numbered
Sample fraction	216-219	Alphanumeric	EPD/EMS identifier for the fraction of the sample analyzed (see table C.9)
Validation status	220-221	Alphanumeric	0 = Unvalidated (used by laboratory) 3 = Validated definitive data
EPD/EMS receipt date	222-227	Numeric	Date that the analytical data are received by EPD/EMS from the laboratory. The laboratory leaves this blank
ESH-EMS number	228-234	Alphanumeric	Document number assigned to the project report

Table C.6 is a description of the analytical data format, AN95-R1.B which is used for coding and transmitting a subset of the AN95 analytical data records.

Table C.6 Analytical Data Format AN95-R1.B

Name	Columns	Type	Description
WSRC identifier	1-12	Numeric	WSRC identifier for the sample
Station identifier	13-23	Alphanumeric	Identification of the actual sample (includes any modification made in the field)
Top of interval	24-29	Numeric	Depth from the ground to the top of the actual sampling interval to the nearest 0.01 ft
Bottom of interval	30-35	Numeric	Depth from the ground to the bottom of the actual sampling interval to the nearest 0.01 ft
Sample collection date	36-42	Numeric	Date sample was collected. Enter the preparation date for laboratory blanks and QC samples; enter the date of completion of TCLP sample generation for TCLP samples
Laboratory replicate	43-45	Alphanumeric	Indicates that the sample is a non-blind replicate analysis (see table C.8)
Analyte name	46-95	Alphanumeric	Full analyte name
Analytical method	96-108	Alphanumeric	Coded identifier for the method used to perform the analysis (e.g., EPA###.#)
Quantitation limit	109-116	Numeric	GE and WA report the ssEQL for non-radiochemistry analyses; all labs report the MDA for radiochemistry analyses
Result qualifier	117-119	Alphanumeric	Coded field used to qualify the analytical result (see table D.1)
Result	120-129	Numeric	Concentration of the analyte. For non-detects, the ssEQL is reported. Results were reported on a dry weight basis for all analyses reported in per mass units
Analysis qualifier	130-132	Alphanumeric	Coded field used to qualify the analytical result (see table D.2)
Bias of analysis	133-134	Alpha	Coded field for specifying the expected bias (see table D.3)
Result unit	135-140	Alpha	Unit in which the analytical result is reported
Validation status	141-142	Alphanumeric	0 = Unvalidated (used by laboratory) 3 = Validated definitive data
ESH-EMS document number	143-149	Alphanumeric	Document number assigned to the project report

Table C.7 is a description of the analytical data format, AN95-R2.B which is used for coding and transmitting a subset of the AN95 analytical data records.

Table C.7 Analytical Data Format AN95-R2.B

Name	Columns	Type	Description
Station identifier	1-11	Alphanumeric	Identification of the actual sample (includes any modification made in the field)
Top of interval	12-17	Numeric	Depth from the ground to the top of the actual sampling interval to the nearest 0.01 ft
Bottom of interval	18-23	Numeric	Depth from the ground to the bottom of the actual sampling interval to the nearest 0.01 ft
Sample collection date	24-30	Numeric	Date sample was collected. Enter the preparation date for laboratory blanks and QC samples; enter the date of completion of TCLP sample generation for TCLP samples
Laboratory replicate	31-43	Alphanumeric	Indicates that the sample is a non-blind replicate analysis (see table C.8)
Analyte name	44-83	Alphanumeric	Full analyte name
Analysis type	84-93	Alphanumeric	Analytical suite
Quantitation limit	95-102	Numeric	GE and WA report the ssEQL for non-radiochemistry analyses; all labs report the MDA for radiochemistry analyses
Result qualifier	103-105	Alphanumeric	Coded field used to qualify the analytical result (see table D.1)
Result	106-115	Numeric	Concentration of the analyte. For non-detects, the ssEQL is reported. Results are reported on a dry weight basis for all analyses reported in per mass units
Result unit	116-121	Alpha	Unit in which the analytical result is reported
Validation status	122-123	Alphanumeric	0 = Unvalidated (used by laboratory) 3 = Validated definitive data
ESH-EMS document number	124-130	Alphanumeric	Document number assigned to the project report

When making entries in the laboratory replicate field of the data files, only the codes listed in table C.8 are used.

Table C.8 Codes for Laboratory Replicates

Remark	Definition
(blank)	Data not remarked; the result is a routine analysis of a sample
1	Laboratory replicate
2A	Matrix spike
2B	Matrix spike duplicate
2C	Surrogate spike
2D	Blank spike
2E	Blank spike duplicate
3	Laboratory blank
4	Re-analysis of a sample at the request of EPD/EMS
CCB	Continuing calibration blank
CCV	Continuing calibration verification sample
ICB	Initial calibration blank
ICS	Interference check sample
ICV	Initial calibration verification sample

When making entries in the sample fraction field of the data files, only the codes listed in table C.9 are used.

Table C.9 Codes for Fractions

Code	Description
(blank)	Sample was not fractionated prior to analysis
A	Ashed fraction
D	Dried fraction of a soil or sludge sample; not used with water samples
F	Liquid fraction passing through a filter was analyzed
SL	Liquid fraction of a sample separated from the solid fraction
SS	Suspended soils
T	TCLP extraction

When entering the identifiers for groundwater samples, the format listed in table C.10 is used for the WSRC identifier entered in the AN95 data file.

Table C.10 WSRC Identifier for Groundwater Samples

Name	Columns	Type	Description
Well name			
Series name	1-3	Alpha	Name of the well series (except 241-H) from which the sample was collected; QC laboratory deionized water samples have LB (the first character is blank) as well series designation
Cluster number	4-6	Numeric	Number of the cluster (except 241-H)
Well within cluster	7-8	Alphanumeric	Blank, if not applicable
	9-10	Blank	Unused
Duplicate identification	11	Alphanumeric	Assigned by field personnel to identify different sampling events occurring in one day
Secondary identifier	12	Alphanumeric	Used as an alternate identifier by the Groundwater Monitoring group of EPD/EMS

Appendix D: Data Tables

D.1 Qualifiers

The following qualifiers may have been applied to the analytical results during data validation.

Table D.1 Result Qualifiers

Qualifier	Description
(blank)	Data are not remarked. Values should be interpreted exactly as reported.
C ¹	Calculated. Analytical result reported was not measured directly but was calculated from other available data. This does not apply to conversions, nor does it apply to calculations made as part of an analytical procedure.
D ¹	Field measurement
I	The value in the result field is the instrument reading, not the sample quantitation limit. Always used with the result qualifier <i>U</i> .
J ²	The analytical result is an estimated quantity.
L ¹	Off-scale high. The actual value is not known but is known to be greater than value shown.
R ¹	Result was rejected because performance requirements in the sample or associated quality control analysis were not met. The analyte may or may not be present.
U ²	Material analyzed for but not detected. The analyte concentration is less than the ssEQL. NOTE: When both the result qualifier <i>U</i> and the result qualifier <i>I</i> are reported, the numerical value in the result field is the instrument reading rather than the ssEQL.

Table D.2 Analysis Qualifiers

Qualifier	Description
A	GC/MS Compound Identification Relative retention time or mass spectra criteria were not met. Compound Identification All anomalies
B	The result is below the sample quantitation limit and above or equal to the instrument detection limit.
C	Laboratory Control Sample Criteria were not met.
D	ICP Serial Dilution Criteria were not met.

¹ This code is based on the STORET codes from the EPA.

² This code is based on the CLP Laboratory Data Qualifiers from the EPA.

Table D.2 Analysis Qualifiers (cont.)

Qualifier	Description
E	The detected result is between the ssEQL and the method detection limit. Report the actual result detected.
F	Pesticides Compound Identification Pesticide result has been confirmed by gas chromatography/mass spectrometry.
G	Pesticides Instrument Performance Use for all conditions outside criteria other than those flagged <i>N</i> (see code <i>N</i> below).
H	Internal Standards Performance Criteria were not met.
I	Matrix Spike/Matrix Spike Duplicate Matrix Spike Sample Analysis Spike recovery was not within control limits.
K	Tentatively Identified Compounds A tentatively identified compound is a suspected aldol-condensation product.
L	Calibration Criteria Not Met Calibration criteria (initial or continuing) were not met. See also <i>Z</i> for inorganics.
M	GC/MS Tuning Mass calibration criteria were not met.
N	Tentatively Identified Compounds All TIC results
O	Surrogate Recovery Surrogate spike recovery results are not within control limits.
P	Furnace Atomic Absorption QC Duplicate injection precision criteria were not met, or post-digestion spike recovery was not within control limits, but sample absorbance is greater than 50% of post-digestion spike absorbance.
Q	Holding Time Sample held beyond normal holding time.
R	ICP Interference Check Sample Criteria not met
S	The reported value was determined by the method of standard additions.
V	Method Blank Contamination Indicates the analyte was detected in both the sample and associated method blank.
W	Furnace Atomic Absorption QC Post-digestion spike recovery for furnace atomic absorption analysis is not within control limits while sample absorbance is less than 50% of spike absorbance.
X	Matrix Spike/Matrix Spike Duplicates Laboratory Duplicate Sample Analysis Duplicate analysis relative percent difference is not within control limits.
Y	Result obtained from unpreserved or improperly preserved sample.
Z	Calibration Furnace Atomic Absorption QC Correlation coefficient was less than 0.995.

Table D.2 Analysis Qualifiers (cont.)

Qualifier	Description
4	Matrix interference; value cannot be determined.
5	The analytical value was four times higher than the standard concentration, and percent recovery cannot be determined.
6	The analyte was detected in both the sample and associated field blank.
7	The analyte was detected in both the sample and associated rinsate or equipment blank.
8	The analyte was detected in both the sample and associated trip blank.
9	Field Duplicate Sample Analysis Duplicate analysis relative percent difference is not within control limits.

Table D.3 Bias Qualifiers

Qualifier	Description
L	Analytical factor causing bias. The associated result may underestimate the true value.
H	Analytical factor causing bias. The associated result may overestimate the true value.

D.2 Data Summaries

The remainder of this appendix contains data tables:

Table D.4 Number of Analytical Records by Method and Type of Record for FHST5

Table D.5 Number of Analytical Records by Method and Type of Record for FHST6

Table D.6 Analytes Detected in Routine Water Samples for FHST5

Table D.7 Analytes Detected in Routine Water Samples for FHST6

Table D.8 Results Sorted by Sample for FHST5

Table D.9 Results Sorted by Sample for FHST6

Table D.10 Results Sorted by Analyte for FHST5

Table D.11 Results Sorted by Analyte for FHST6

The numbers of analytical records sorted by analytical method and type of record are given in tables D.4 and D.5.

Table D.4 Number of Analytical Records by Method and Type of Record for FHST5

Analytical Method	Sample Records	Laboratory Duplicates	Laboratory Blanks	Matrix Spike Duplicates	Calibration Checks	Totals
3Q1-6-1420	3	1	2	1	0	7
EPA906.0	64	5	5	5	0	79

Table D.5 Number of Analytical Records by Method and Type of Record for FHST6

Analytical Method	Sample Records	Laboratory Duplicates	Laboratory Blanks	Matrix Spike Duplicates	Calibration Checks	Totals
3Q1-6-1420	3	1	2	1	0	7
EPA906.0	59	3	4	3	0	69

Tables D.6 and D.7 list the minimum and maximum results for tritium in FHST5 and FHST6. These tables do not include field QC samples.

Table D.6 Analytes Detected in Routine Water Samples for FHST5

Analyte	Average Result	Minimum/Maximum MDA	Units
Tritium	906	3.39/9840	pCi/mL

Table D.7 Analytes Detected in Routine Water Samples for FHST6

Analyte	Average Result	Minimum/Maximum MDA	Units
Tritium	2120	6/32,300	pCi/mL

Table D.8 Results Sorted by Sample for FHST5**SURVEY ID:** FHB 00105**Sample ID:** 111795

Survey location: 54075E 73758N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				9.75E+01	pCi/mL	8.22E-01	EPA906.0

SURVEY ID: FHB 00105D**Sample ID:** 113931

Sample type: Split

Associated sample: 111795

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				9.88E+01	pCi/mL	1.50E+00	3Q1-6-1420

SURVEY ID: FHB 00205**Sample ID:** 111790

Survey location: 54095E 73540N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.19E+01	pCi/mL	3.57E+00	EPA906.0

SURVEY ID: FHB 00305**Sample ID:** 113923

Survey location: 53712E 73236N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.32E+01	pCi/mL	3.64E+00	EPA906.0

SURVEY ID: FHB 00405**Sample ID:** 113922

Survey location: 53741E 73029N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.02E+01	pCi/mL	7.85E-01	EPA906.0

SURVEY ID: FHB 01205**Sample ID:** 111799

Survey location: 53878E 73424N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				9.84E+03	pCi/mL	8.81E+00	EPA906.0

SURVEY ID: FHB 01305**Sample ID:** 111797

Survey location: 53848E 73508N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.33E+03	pCi/mL	4.45E+00	EPA906.0

SURVEY ID: FHB 01405**Sample ID:** 111798

Survey location: 53728E 73561N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.91E+02	pCi/mL	1.41E+00	EPA906.0

SURVEY ID: FHB 01505**Sample ID:** 111794

Survey location: 54012E 73818N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.67E+01	pCi/mL	7.70E-01	EPA906.0

SURVEY ID: FHB 01605**Sample ID:** 111793

Survey location: 54030E 73716N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.10E+02	pCi/mL	3.77E+00	EPA906.0

SURVEY ID: FHB 01705**Sample ID:** 111792

Survey location: 54000E 73668N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				9.72E+02	pCi/mL	2.88E+00	EPA906.0

SURVEY ID: FHB 01805**Sample ID:** 111791

Survey location: 54026E 73565N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.18E+03	pCi/mL	7.87E+00	EPA906.0

SURVEY ID: FHB 01905**Sample ID:** 111796

Survey location: 53895E 73485N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.23E+02	pCi/mL	1.28E+00	EPA906.0

SURVEY ID: FHB 02005**Sample ID:** 111789

Survey location: 54008E 73434N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.25E+01	pCi/mL	7.60E-01	EPA906.0

SURVEY ID: FMC001F05**Sample ID:** 113935

Survey location: 57050E 70350N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.88E+01	pCi/mL	7.14E-01	EPA906.0

SURVEY ID: FMC001H05**Sample ID:** 113932

Survey location: 5300E 72600N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.39E+00	pCi/mL	7.08E-01	EPA906.0

SURVEY ID: FMC002H05**Sample ID:** 113933

Survey location: 53000E 72600N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.36E+01	pCi/mL	7.07E-01	EPA906.0

SURVEY ID: FMC002H05A**Sample ID:** 113934

Sample type: Duplicate

Associated sample: 113933

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.35E+01	pCi/mL	7.10E-01	EPA906.0

SURVEY ID: FSP 00205**Sample ID:** 111776

Survey location: 49133E 72796N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.78E+02	pCi/mL	1.38E+00	EPA906.0

SURVEY ID: FSP 00205D**Sample ID:** 111777

Sample type: Split

Associated sample: 111776

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.60E+02	pCi/mL	1.50E+00	3Q1-6-1420
Tritium				2.62E+02	pCi/mL	1.50E+00	3Q1-6-1420

SURVEY ID: FSP 00705**Sample ID:** 111778

Survey location: 49540E 73008N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.03E+02	pCi/mL	1.44E+00	EPA906.0

SURVEY ID: FSP 01205**Sample ID:** 111779

Survey location: 49644E 73602N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.05E+01	pCi/mL	7.81E-01	EPA906.0

SURVEY ID: FSP 01405**Sample ID:** 111780

Survey location: 49802E 73685N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.65E+01	pCi/mL	7.64E-01	EPA906.0

SURVEY ID: FSP 01905**Sample ID:** 111781

Survey location: 49778E 73177N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.08E+03	pCi/mL	2.86E+00	EPA906.0

SURVEY ID: FSP 02605**Sample ID:** 111782

Survey location: 49801E 72932N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				5.16E+03	pCi/mL	5.80E+00	EPA906.0

SURVEY ID: FSP 03205**Sample ID:** 111783

Survey location: 50258E 73367N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				5.15E+01	pCi/mL	7.44E-01	EPA906.0

SURVEY ID: FSP 03405**Sample ID:** 111784

Survey location: 50261E 73156N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.24E+03	pCi/mL	6.58E+00	EPA906.0

SURVEY ID: FSP 03505**Sample ID:** 111785

Survey location: 50297E 73065N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.67E+03	pCi/mL	5.48E+00	EPA906.0

SURVEY ID: FSP 04005**Sample ID:** 111786

Survey location: 50630E 73101N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.29E+03	pCi/mL	6.93E+00	EPA906.0

SURVEY ID: FSP 04705**Sample ID:** 111787

Survey location: 50607E 73609N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.18E+01	pCi/mL	7.57E-01	EPA906.0

SURVEY ID: FSP 05605**Sample ID:** 111788

Survey location: 51488E 73824N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.44E+01	pCi/mL	8.04E-01	EPA906.0

SURVEY ID: FSP 20405**Sample ID:** 111775

Survey location: 48801E 73281N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.37E+03	pCi/mL	2.72E+00	EPA906.0

SURVEY ID: FSP 20405D**Sample ID:** 111773

Sample type: Split

Associated sample: 111775

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.38E+03	pCi/mL	1.50E+00	3Q1-6-1420

SURVEY ID: FSP 21305**Sample ID:** 111772

Survey location: 48725E 73486N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.41E+02	pCi/mL	7.01E-01	EPA906.0

SURVEY ID: FSP 22005**Sample ID:** 111770

Survey location: 48644E 72983N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.29E+03	pCi/mL	4.25E+00	EPA906.0

SURVEY ID: FSP 22605**Sample ID:** 111771

Survey location: 48601E 73308N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.70E+02	pCi/mL	7.06E-01	EPA906.0

SURVEY ID: FSP 23505**Sample ID:** 111769

Survey location: 48587E 72979N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.22E+02	pCi/mL	7.27E-01	EPA906.0

SURVEY ID: FSP 24105**Sample ID:** 111768

Survey location: 48190E 72853N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.53E+02	pCi/mL	4.03E+00	EPA906.0

SURVEY ID: FSP 24905**Sample ID:** 111767

Survey location: 47905E 73107N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.40E+01	pCi/mL	3.59E+00	EPA906.0

SURVEY ID: FSP 25605**Sample ID:** 111766

Survey location: 47770E 73435N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.13E+02	pCi/mL	7.42E-01	EPA906.0

SURVEY ID: FSP 27005**Sample ID:** 111774

Survey location: 47411E 72805N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.92E+01	pCi/mL	3.34E+00	EPA906.0
Tritium				2.96E+01	pCi/mL	3.49E+00	EPA906.0

SURVEY ID: FSP 29005**Sample ID: 111765**

Survey location: 46865E 73160N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.16E+01	pCi/mL	7.11E-01	EPA906.0

SURVEY ID: HSP 00305**Sample ID: 113900**

Survey location: 56879E 70711N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.70E+02	pCi/mL	4.54E+00	EPA906.0

SURVEY ID: HSP 00405**Sample ID: 113901**

Survey location: 56819E 70710N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.88E+02	pCi/mL	3.84E+00	EPA906.0

SURVEY ID: HSP 00805**Sample ID: 113902**

Survey location: 56990E 71005N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.58E+02	pCi/mL	7.51E-01	EPA906.0

SURVEY ID: HSP 01105**Sample ID: 113904**

Survey location: 57046E 71099N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.21E+01	pCi/mL	3.63E+00	EPA906.0

SURVEY ID: HSP 01105A**Sample ID: 113905**

Sample type: Duplicate

Associated sample: 113904

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.48E+01	pCi/mL	7.35E-01	EPA906.0

SURVEY ID: HSP 01305**Sample ID:** 113906

Survey location: 56878E 71056N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.30E+02	pCi/mL	8.33E-01	EPA906.0

SURVEY ID: HSP 01505**Sample ID:** 113903

Survey location: 56791E 71085N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.42E+02	pCi/mL	3.66E+00	EPA906.0

SURVEY ID: HSP 02005**Sample ID:** 113907

Survey location: 56849E 71142N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.17E+01	pCi/mL	1.01E+00	EPA906.0

SURVEY ID: HSP 02505**Sample ID:** 113909

Survey location: 56297E 70960N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.71E+02	pCi/mL	3.74E+00	EPA906.0

SURVEY ID: HSP 02905**Sample ID:** 113910

Survey location: 56257E 71278N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.70E+01	pCi/mL	7.31E-01	EPA906.0

SURVEY ID: HSP 04305**Sample ID:** 113911

Survey location: 55722E 71644N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.03E+03	pCi/mL	3.92E+00	EPA906.0

SURVEY ID: HSP 04305A**Sample ID:** 113912

Sample type: Duplicate

Associated sample: 113911

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.04E+03	pCi/mL	3.74E+00	EPA906.0

SURVEY ID: HSP 04605**Sample ID:** 113915

Survey location: 56052E 71621N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.58E+02	pCi/mL	3.76E+00	EPA906.0

SURVEY ID: HSP 04905**Sample ID:** 113914

Survey location: 55987E 71389N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.14E+01	pCi/mL	9.25E-01	EPA906.0

SURVEY ID: HSP 05205**Sample ID:** 113913

Survey location: 55743E 71413N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.20E+03	pCi/mL	6.73E+00	EPA906.0

SURVEY ID: HSP 05705**Sample ID:** 113917

Survey location: 55516E 71567N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				9.74E+01	pCi/mL	3.57E+00	EPA906.0

SURVEY ID: HSP 06005**Sample ID:** 113921

Survey location: 55190E 71629N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.15E+02	pCi/mL	7.72E-01	EPA906.0
Tritium				3.19E+02	pCi/mL	7.90E-01	EPA906.0

SURVEY ID: HSP 06405**Sample ID:** 113918

Survey location: 54768E 71846N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.13E+01	pCi/mL	7.22E-01	EPA906.0

SURVEY ID: HSP 07105**Sample ID:** 113920

Survey location: 54937E 71588N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.58E+02	pCi/mL	7.98E-01	EPA906.0

SURVEY ID: HSP 07605**Sample ID:** 113919

Survey location: 54571E 71494N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.10E+02	pCi/mL	7.39E-01	EPA906.0

SURVEY ID: HSP 08505**Sample ID:** 113929

Survey location: 54022E 72181N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.44E+01	pCi/mL	7.11E-01	EPA906.0

SURVEY ID: HSP 09205**Sample ID:** 113928

Survey location: 54129E 72672N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				-9.07E+01	pCi/mL	6.72E-01	EPA906.0

SURVEY ID: HSP 09305**Sample ID:** 113927

Survey location: 53910E 72800N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.18E+01	pCi/mL	7.01E-01	EPA906.0

SURVEY ID: HSP 09705**Sample ID:** 113925

Survey location: 54029E 72371N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				7.96E+02	pCi/mL	7.24E-01	EPA906.0

SURVEY ID: HSP 10305**Sample ID:** 113924

Survey location: 53665E 72448N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				5.30E+02	pCi/mL	7.18E-01	EPA906.0

Table D.9 Results Sorted by Sample for FHST6**SURVEY ID:** FHB 00106**Sample ID:** 114072

Survey location: 54075E 73758N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.13E+02	pCi/mL	1.63E+00	EPA906.0

SURVEY ID: FHB 00206**Sample ID:** 114068

Survey location: 54095E 73540N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.28E+01	pCi/mL	5.48E-01	EPA906.0
Tritium				2.30E+01	pCi/mL	6.08E-01	EPA906.0

SURVEY ID: FHB 00306**Sample ID:** 114078

Survey location: 53712E 73236N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.97E+01	pCi/mL	3.50E+00	EPA906.0

SURVEY ID: FHB 00306D**Sample ID:** 114079

Sample type: Split

Associated sample: 114078

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.78E+01	pCi/mL	1.50E+00	3Q1-6-1420

SURVEY ID: FHB 00406**Sample ID:** 114077

Survey location: 53741E 73029N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.05E+02	pCi/mL	1.21E+00	EPA906.0

SURVEY ID: FHB 00506**Sample ID:** 114082

Survey location: 53910E 72800N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.04E+02	pCi/mL	1.40E+00	EPA906.0

SURVEY ID: FHB 00606**Sample ID:** 114080

Survey location: 54129E 72672N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.81E+02	pCi/mL	9.15E-01	EPA906.0

SURVEY ID: FHB 00806**Sample ID:** 114081

Survey location: 54022E 72181N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.32E+03	pCi/mL	2.69E+00	EPA906.0

SURVEY ID: FHB 01206**Sample ID:** 114076

Survey location: 53878E 73424N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.78E+04	pCi/mL	1.25E+01	EPA906.0

SURVEY ID: FHB 01306**Sample ID:** 114074

Survey location: 53848E 73508N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.96E+03	pCi/mL	3.27E+00	EPA906.0

SURVEY ID: FHB 01406**Sample ID:** 114075

Survey location: 53728E 73561N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.36E+02	pCi/mL	7.91E-01	EPA906.0

SURVEY ID: FHB 01506**Sample ID:** 114073

Survey location: 54012E 73818N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				7.07E+01	pCi/mL	6.18E-01	EPA906.0

SURVEY ID: FHB 01606**Sample ID:** 114071

Survey location: 54030E 73716N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

SURVEY ID: FHB 01606 (cont.)**Sample ID:** 114071

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.52E+03	pCi/mL	3.14E+00	EPA906.0

SURVEY ID: FHB 01706**Sample ID:** 114070

Survey location: 54000E 73668N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.57E+04	pCi/mL	1.21E+01	EPA906.0

SURVEY ID: FHB 01806**Sample ID:** 114069

Survey location: 54026E 73565N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.23E+04	pCi/mL	1.62E+01	EPA906.0

SURVEY ID: FHB 02006**Sample ID:** 114067

Survey location: 54008E 73434N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.41E+01	pCi/mL	6.02E-01	EPA906.0

SURVEY ID: FMC001F06**Sample ID:** 114065

Survey location: 57050E 70350N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.56E+02	pCi/mL	1.08E+00	EPA906.0

SURVEY ID: FMC001F06A**Sample ID:** 114086

Sample type: Duplicate

Associated sample: 114065

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.65E+02	pCi/mL	1.12E+00	EPA906.0

SURVEY ID: FMC001H06**Sample ID:** 114066

Survey location: 5300E 72600N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.46E+01	pCi/mL	5.97E-01	EPA906.0

SURVEY ID: FMC002H06**Sample ID:** 114044

Survey location: 53000E 72600N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.84E+01	pCi/mL	5.50E-01	EPA906.0

SURVEY ID: FSP 00206**Sample ID:** 114033

Survey location: 49133E 72796N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.99E+02	pCi/mL	1.87E+00	EPA906.0

SURVEY ID: FSP 00706**Sample ID:** 114034

Survey location: 49540E 73008N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.05E+03	pCi/mL	3.40E+00	EPA906.0

SURVEY ID: FSP 01206**Sample ID:** 114040

Survey location: 49644E 73602N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.29E+02	pCi/mL	7.39E-01	EPA906.0

SURVEY ID: FSP 01206D**Sample ID:** 114041

Sample type: Split

Associated sample: 114040

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.37E+02	pCi/mL	1.50E+00	3Q1-6-1420
Tritium				1.38E+02	pCi/mL	1.50E+00	3Q1-6-1420

SURVEY ID: FSP 01406**Sample ID:** 114042

Survey location: 49802E 73685N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.74E+02	pCi/mL	6.20E+00	EPA906.0
Tritium				2.66E+02	pCi/mL	6.10E+00	EPA906.0

SURVEY ID: FSP 01906**Sample ID:** 114045

Survey location: 49778E 73177N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.57E+03	pCi/mL	3.82E+00	EPA906.0

SURVEY ID: FSP 03206**Sample ID:** 114039

Survey location: 50258E 73367N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.66E+01	pCi/mL	6.02E-01	EPA906.0

SURVEY ID: FSP 03406**Sample ID:** 114037

Survey location: 50261E 73156N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.55E+03	pCi/mL	4.76E+01	EPA906.0

SURVEY ID: FSP 03506**Sample ID:** 114036

Survey location: 50297E 73065N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.57E+03	pCi/mL	7.97E+00	EPA906.0

SURVEY ID: FSP 04006**Sample ID:** 114038

Survey location: 50630E 73101N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.53E+03	pCi/mL	4.63E+00	EPA906.0

SURVEY ID: FSP 04706**Sample ID:** 114035

Survey location: 50607E 73609N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				7.45E+01	pCi/mL	5.89E-01	EPA906.0

SURVEY ID: FSP 04706D**Sample ID:** 114083

Sample type: Split

Associated sample: 114035

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.19E+01	pCi/mL	1.50E+00	3Q1-6-1420

SURVEY ID: FSP 05606**Sample ID:** 114043

Survey location: 51488E 73824N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.00E+00	pCi/mL	5.66E-01	EPA906.0

SURVEY ID: FSP 20406**Sample ID:** 114032

Survey location: 48801E 73281N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.51E+03	pCi/mL	3.73E+00	EPA906.0

SURVEY ID: FSP 21306**Sample ID:** 114031

Survey location: 48725E 73486N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.33E+03	pCi/mL	2.66E+00	EPA906.0

SURVEY ID: FSP 22006**Sample ID:** 114029

Survey location: 48644E 72983N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.40E+03	pCi/mL	2.77E+00	EPA906.0

SURVEY ID: FSP 22606**Sample ID: 114030**

Survey location: 48601E 73308N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				9.33E+01	pCi/mL	7.09E-01	EPA906.0

SURVEY ID: FSP 24106**Sample ID: 114027**

Survey location: 48190E 72853N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.06E+03	pCi/mL	2.37E+00	EPA906.0

SURVEY ID: FSP 24906**Sample ID: 114026**

Survey location: 47905E 73107N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.47E+03	pCi/mL	8.61E+00	EPA906.0

SURVEY ID: FSP 25606**Sample ID: 114025**

Survey location: 47770E 73435N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.97E+02	pCi/mL	7.04E+00	EPA906.0

SURVEY ID: FSP 27006**Sample ID: 114024**

Survey location: 47411E 72805N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.58E+01	pCi/mL	6.41E+00	EPA906.0

SURVEY ID: FSP 29006**Sample ID: 114023**

Survey location: 46865E 73160N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				5.99E+01	pCi/mL	6.13E-01	EPA906.0

SURVEY ID: HSP 00306**Sample ID:** 114047

Survey location: 56879E 70711N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.27E+02	pCi/mL	2.00E+00	EPA906.0

SURVEY ID: HSP 00406**Sample ID:** 114048

Survey location: 56819E 70710N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.17E+02	pCi/mL	1.16E+00	EPA906.0

SURVEY ID: HSP 00806**Sample ID:** 114049

Survey location: 56990E 71005N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.99E+02	pCi/mL	1.50E+00	EPA906.0

SURVEY ID: HSP 00806A**Sample ID:** 114084

Sample type: Duplicate

Associated sample: 114049

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				5.35E+02	pCi/mL	1.65E+00	EPA906.0

SURVEY ID: HSP 01306**Sample ID:** 114050

Survey location: 56878E 71056N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				4.94E+02	pCi/mL	2.95E+01	EPA906.0

SURVEY ID: HSP 01506**Sample ID:** 114051

Survey location: 56791E 71085N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.07E+02	pCi/mL	1.75E+00	EPA906.0

SURVEY ID: HSP 02006**Sample ID:** 114052

Survey location: 56849E 71142N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				7.03E+01	pCi/mL	9.07E-01	EPA906.0

SURVEY ID: HSP 02506**Sample ID:** 114053

Survey location: 56297E 70960N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.31E+02	pCi/mL	1.06E+00	EPA906.0

SURVEY ID: HSP 02906**Sample ID:** 114054

Survey location: 56257E 71278N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.91E+01	pCi/mL	5.90E-01	EPA906.0

SURVEY ID: HSP 04306**Sample ID:** 114056

Survey location: 55722E 71644N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.24E+03	pCi/mL	1.05E+01	EPA906.0

SURVEY ID: HSP 04906**Sample ID:** 114058

Survey location: 55987E 71389N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.20E+03	pCi/mL	3.67E+00	EPA906.0

SURVEY ID: HSP 05206**Sample ID:** 114057

Survey location: 55743E 71413N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				6.10E+03	pCi/mL	6.72E+00	EPA906.0

SURVEY ID: HSP 05706**Sample ID: 114087**

Survey location: 55516E 71567N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				8.25E+00	pCi/mL	6.15E-01	EPA906.0

SURVEY ID: HSP 06006**Sample ID: 114059**

Survey location: 55190E 71629N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.09E+03	pCi/mL	4.52E+00	EPA906.0

SURVEY ID: HSP 06406**Sample ID: 114060**

Survey location: 54768E 71846N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				3.93E+01	pCi/mL	5.94E-01	EPA906.0

SURVEY ID: HSP 07106**Sample ID: 114061**

Survey location: 54937E 71588N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.09E+03	pCi/mL	3.40E+00	EPA906.0

SURVEY ID: HSP 07106A**Sample ID: 114085**

Sample type: Duplicate

Associated sample: 114061

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.96E+03	pCi/mL	3.28E+00	EPA906.0
Tritium				1.98E+03	pCi/mL	3.34E+00	EPA906.0

SURVEY ID: HSP 07606**Sample ID: 114062**

Survey location: 54571E 71494N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				2.92E+02	pCi/mL	1.15E+00	EPA906.0

SURVEY ID: HSP 09706**Sample ID:** 114063

Survey location: 54029E 72371N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.66E+03	pCi/mL	2.97E+00	EPA906.0

SURVEY ID: HSP 10306**Sample ID:** 114064

Survey location: 53665E 72448N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Tritium				1.67E+03	pCi/mL	3.01E+00	EPA906.0

D.4 Results Sorted by Analyte

Table D.10 Results Sorted by Analyte for FHST5

ANALYTE: Tritium

Survey ID	Sample ID	RQ	B	Result	Unit	MDA	Method	AQ
FHB 00105	111795			9.75E+01	pCi/mL	8.22E-01	EPA906.0	
FHB 00105D	113931			9.88E+01	pCi/mL	1.50E+00	3Q1-6-1420	
FHB 00205	111790			2.19E+01	pCi/mL	3.57E+00	EPA906.0	
FHB 00305	113923			8.32E+01	pCi/mL	3.64E+00	EPA906.0	
FHB 00405	113922			4.02E+01	pCi/mL	7.85E-01	EPA906.0	
FHB 01205	111799			9.84E+03	pCi/mL	8.81E+00	EPA906.0	
FHB 01305	111797			3.33E+03	pCi/mL	4.45E+00	EPA906.0	
FHB 01405	111798			2.91E+02	pCi/mL	1.41E+00	EPA906.0	
FHB 01505	111794			1.67E+01	pCi/mL	7.70E-01	EPA906.0	
FHB 01605	111793			1.10E+02	pCi/mL	3.77E+00	EPA906.0	
FHB 01705	111792			9.72E+02	pCi/mL	2.88E+00	EPA906.0	
FHB 01805	111791			8.18E+03	pCi/mL	7.87E+00	EPA906.0	
FHB 01905	111796			2.23E+02	pCi/mL	1.28E+00	EPA906.0	
FHB 02005	111789			2.25E+01	pCi/mL	7.60E-01	EPA906.0	
FMC001F05	113935			3.88E+01	pCi/mL	7.14E-01	EPA906.0	
FMC001H05	113932			3.39E+00	pCi/mL	7.08E-01	EPA906.0	
FMC002H05	113933			3.36E+01	pCi/mL	7.07E-01	EPA906.0	
FMC002H05A	113934			3.35E+01	pCi/mL	7.10E-01	EPA906.0	
FSP 00205	111776			2.78E+02	pCi/mL	1.38E+00	EPA906.0	
FSP 00205D	111777			2.60E+02	pCi/mL	1.50E+00	3Q1-6-1420	
FSP 00205D	111777			2.62E+02	pCi/mL	1.50E+00	3Q1-6-1420	
FSP 00705	111778			3.03E+02	pCi/mL	1.44E+00	EPA906.0	
FSP 01205	111779			1.05E+01	pCi/mL	7.81E-01	EPA906.0	
FSP 01405	111780			2.65E+01	pCi/mL	7.64E-01	EPA906.0	
FSP 01905	111781			1.08E+03	pCi/mL	2.86E+00	EPA906.0	
FSP 02605	111782			5.16E+03	pCi/mL	5.80E+00	EPA906.0	
FSP 03205	111783			5.15E+01	pCi/mL	7.44E-01	EPA906.0	
FSP 03405	111784			1.24E+03	pCi/mL	6.58E+00	EPA906.0	
FSP 03505	111785			4.67E+03	pCi/mL	5.48E+00	EPA906.0	
FSP 04005	111786			3.29E+03	pCi/mL	6.93E+00	EPA906.0	
FSP 04705	111787			3.18E+01	pCi/mL	7.57E-01	EPA906.0	
FSP 05605	111788			1.44E+01	pCi/mL	8.04E-01	EPA906.0	
FSP 20405	111775			1.37E+03	pCi/mL	2.72E+00	EPA906.0	
FSP 20405D	111773			1.38E+03	pCi/mL	1.50E+00	3Q1-6-1420	
FSP 21305	111772			6.41E+02	pCi/mL	7.01E-01	EPA906.0	
FSP 22005	111770			1.29E+03	pCi/mL	4.25E+00	EPA906.0	
FSP 22605	111771			1.70E+02	pCi/mL	7.06E-01	EPA906.0	
FSP 23505	111769			1.22E+02	pCi/mL	7.27E-01	EPA906.0	
FSP 24105	111768			8.53E+02	pCi/mL	4.03E+00	EPA906.0	
FSP 24905	111767			6.40E+01	pCi/mL	3.59E+00	EPA906.0	
FSP 25605	111766			1.13E+02	pCi/mL	7.42E-01	EPA906.0	
FSP 27005	111774			2.92E+01	pCi/mL	3.34E+00	EPA906.0	
FSP 27005	111774			2.96E+01	pCi/mL	3.49E+00	EPA906.0	
FSP 29005	111765			3.16E+01	pCi/mL	7.11E-01	EPA906.0	
HSP 00305	113900			2.70E+02	pCi/mL	4.54E+00	EPA906.0	
HSP 00405	113901			2.88E+02	pCi/mL	3.84E+00	EPA906.0	
HSP 00805	113902			6.58E+02	pCi/mL	7.51E-01	EPA906.0	
HSP 01105	113904			4.21E+01	pCi/mL	3.63E+00	EPA906.0	
HSP 01105A	113905			4.48E+01	pCi/mL	7.35E-01	EPA906.0	
HSP 01305	113906			2.30E+02	pCi/mL	8.33E-01	EPA906.0	

ANALYTE: Tritium (cont.)

Survey ID	Sample ID	RQ	B	Result	Unit	MDA	Method	AQ
HSP 01505	113903			1.42E+02	pCi/mL	3.66E+00	EPA906.0	
HSP 02005	113907			4.17E+01	pCi/mL	1.01E+00	EPA906.0	
HSP 02505	113909			1.71E+02	pCi/mL	3.74E+00	EPA906.0	
HSP 02905	113910			2.70E+01	pCi/mL	7.31E-01	EPA906.0	
HSP 04305	113911			1.03E+03	pCi/mL	3.92E+00	EPA906.0	
HSP 04305A	113912			1.04E+03	pCi/mL	3.74E+00	EPA906.0	
HSP 04605	113915			4.58E+02	pCi/mL	3.76E+00	EPA906.0	
HSP 04905	113914			6.14E+01	pCi/mL	9.25E-01	EPA906.0	
HSP 05205	113913			6.20E+03	pCi/mL	6.73E+00	EPA906.0	
HSP 05705	113917			9.74E+01	pCi/mL	3.57E+00	EPA906.0	
HSP 06005	113921			3.15E+02	pCi/mL	7.72E-01	EPA906.0	
HSP 06005	113921			3.19E+02	pCi/mL	7.90E-01	EPA906.0	
HSP 06405	113918			2.13E+01	pCi/mL	7.22E-01	EPA906.0	
HSP 07105	113920			8.58E+02	pCi/mL	7.98E-01	EPA906.0	
HSP 07605	113919			1.10E+02	pCi/mL	7.39E-01	EPA906.0	
HSP 08505	113929			4.44E+01	pCi/mL	7.11E-01	EPA906.0	
HSP 09205	113928			9.07E+01	pCi/mL	6.72E-01	EPA906.0	
HSP 09305	113927			8.18E+01	pCi/mL	7.01E-01	EPA906.0	
HSP 09705	113925			7.96E+02	pCi/mL	7.24E-01	EPA906.0	
HSP 10305	113924			5.30E+02	pCi/mL	7.18E-01	EPA906.0	

Table D.11 Results Sorted by Analyte for FHST6

ANALYTE: Tritium

Analytical Group: Radionuclides

Survey ID	Sample ID	RQ	B	Result	Unit	MDA	Method	AQ
FHB 00106	114072			4.13E+02	pCi/mL	1.63E+00	EPA906.0	
FHB 00206	114068			2.28E+01	pCi/mL	5.48E-01	EPA906.0	
FHB 00206	114068			2.30E+01	pCi/mL	6.08E-01	EPA906.0	
FHB 00306	114078			6.97E+01	pCi/mL	3.50E+00	EPA906.0	
FHB 00306D	114079			8.78E+01	pCi/mL	1.50E+00	3Q1-6-1420	
FHB 00406	114077			2.05E+02	pCi/mL	1.21E+00	EPA906.0	
FHB 00506	114082			3.04E+02	pCi/mL	1.40E+00	EPA906.0	
FHB 00606	114080			1.81E+02	pCi/mL	9.15E-01	EPA906.0	
FHB 00806	114081			1.32E+03	pCi/mL	2.69E+00	EPA906.0	
FHB 01206	114076			1.78E+04	pCi/mL	1.25E+01	EPA906.0	
FHB 01306	114074			1.96E+03	pCi/mL	3.27E+00	EPA906.0	
FHB 01406	114075			1.36E+02	pCi/mL	7.91E-01	EPA906.0	
FHB 01506	114073			7.07E+01	pCi/mL	6.18E-01	EPA906.0	
FHB 01606	114071			1.52E+03	pCi/mL	3.14E+00	EPA906.0	
FHB 01706	114070			1.57E+04	pCi/mL	1.21E+01	EPA906.0	
FHB 01806	114069			3.23E+04	pCi/mL	1.62E+01	EPA906.0	
FHB 02006	114067			2.41E+01	pCi/mL	6.02E-01	EPA906.0	
FMC001F06	114065			2.56E+02	pCi/mL	1.08E+00	EPA906.0	
FMC001F06A	114086			2.65E+02	pCi/mL	1.12E+00	EPA906.0	
FMC001H06	114066			2.46E+01	pCi/mL	5.97E-01	EPA906.0	
FMC002H06	114044			4.84E+01	pCi/mL	5.50E-01	EPA906.0	
FSP 00206	114033			6.99E+02	pCi/mL	1.87E+00	EPA906.0	
FSP 00706	114034			2.05E+03	pCi/mL	3.40E+00	EPA906.0	
FSP 01206	114040			1.29E+02	pCi/mL	7.39E-01	EPA906.0	
FSP 01206D	114041			1.37E+02	pCi/mL	1.50E+00	3Q1-6-1420	
FSP 01206D	114041			1.38E+02	pCi/mL	1.50E+00	3Q1-6-1420	
FSP 01406	114042			2.74E+02	pCi/mL	6.20E+00	EPA906.0	
FSP 01406	114042			2.66E+02	pCi/mL	6.10E+00	EPA906.0	
FSP 01906	114045			2.57E+03	pCi/mL	3.82E+00	EPA906.0	
FSP 03206	114039			8.66E+01	pCi/mL	6.02E-01	EPA906.0	
FSP 03406	114037			1.55E+03	pCi/mL	4.76E+01	EPA906.0	
FSP 03506	114036			8.57E+03	pCi/mL	7.97E+00	EPA906.0	
FSP 04006	114038			3.53E+03	pCi/mL	4.63E+00	EPA906.0	
FSP 04706	114035			7.45E+01	pCi/mL	5.89E-01	EPA906.0	
FSP 04706D	114083			8.19E+01	pCi/mL	1.50E+00	3Q1-6-1420	
FSP 05606	114043			6.00E+00	pCi/mL	5.66E-01	EPA906.0	
FSP 20406	114032			2.51E+03	pCi/mL	3.73E+00	EPA906.0	
FSP 21306	114031			1.33E+03	pCi/mL	2.66E+00	EPA906.0	
FSP 22006	114029			1.40E+03	pCi/mL	2.77E+00	EPA906.0	
FSP 22606	114030			9.33E+01	pCi/mL	7.09E-01	EPA906.0	
FSP 24106	114027			1.06E+03	pCi/mL	2.37E+00	EPA906.0	
FSP 24906	114026			1.47E+03	pCi/mL	8.61E+00	EPA906.0	
FSP 25606	114025			3.97E+02	pCi/mL	7.04E+00	EPA906.0	
FSP 27006	114024			3.58E+01	pCi/mL	6.41E+00	EPA906.0	
FSP 29006	114023			5.99E+01	pCi/mL	6.13E-01	EPA906.0	
HSP 00306	114047			8.27E+02	pCi/mL	2.00E+00	EPA906.0	
HSP 00406	114048			3.17E+02	pCi/mL	1.16E+00	EPA906.0	
HSP 00806	114049			4.99E+02	pCi/mL	1.50E+00	EPA906.0	
HSP 00806A	114084			5.35E+02	pCi/mL	1.65E+00	EPA906.0	
HSP 01306	114050			4.94E+02	pCi/mL	2.95E+01	EPA906.0	
HSP 01506	114051			6.07E+02	pCi/mL	1.75E+00	EPA906.0	
HSP 02006	114052			7.03E+01	pCi/mL	9.07E-01	EPA906.0	
HSP 02506	114053			2.31E+02	pCi/mL	1.06E+00	EPA906.0	
HSP 02906	114054			3.91E+01	pCi/mL	5.90E-01	EPA906.0	

ANALYTE: Tritium (cont.)

Survey ID	Sample ID	RQ	B	Result	Unit	MDA	Method	AQ
HSP 04306	114056			2.24E+03	pCi/mL	1.05E+01	EPA906.0	
HSP 04906	114058			2.20E+03	pCi/mL	3.67E+00	EPA906.0	
HSP 05206	114057			6.10E+03	pCi/mL	6.72E+00	EPA906.0	
HSP 05706	114087			8.25E+00	pCi/mL	6.15E-01	EPA906.0	
HSP 06006	114059			3.09E+03	pCi/mL	4.52E+00	EPA906.0	
HSP 06406	114060			3.93E+01	pCi/mL	5.94E-01	EPA906.0	
HSP 07106	114061			2.09E+03	pCi/mL	3.40E+00	EPA906.0	
HSP 07106A	114085			1.96E+03	pCi/mL	3.28E+00	EPA906.0	
HSP 07106A	114085			1.98E+03	pCi/mL	3.34E+00	EPA906.0	
HSP 07606	114062			2.92E+02	pCi/mL	1.15E+00	EPA906.0	
HSP 09706	114063			1.66E+03	pCi/mL	2.97E+00	EPA906.0	
HSP 10306	114064			1.67E+03	pCi/mL	3.01E+00	EPA906.0	

Appendix E: Data Management/Administrative Files

This section discusses the generation, processing, and storage of paper and computer records produced during the completion of this project. The processing of the materials follows methodology prescribed by EGG EPD/EMS.

EGG establishes administrative files for each project that are maintained as permanent SRS records. The following materials are placed in the administrative files:

- Bound sample-collection logbooks
- Original copies of the chain-of-custody forms
- Case narratives from the laboratories
- Data-validation logbooks
- Data-entry cover sheets for data files created by EGG
- Copies of all correspondence between data validation personnel and the laboratories

EGG generates computer data files from paper records using double-entry methods to ensure a low transcription error rate. Computer data files for analytical data also are received from the laboratories. Changes to the data are recorded in the data-validation logbook, approved by the project technical manager, and confirmed through a computer program by comparing the modified and original data files. EGG stores the final computer data files, original source files, and computer listings of all changes made to the original files in the administrative files.

Access to the administrative files remains with the manager of EGG. Paper materials eventually will be transferred to permanent box storage; however, EGG plans to make the final data files available to SRS computer users indefinitely. Please contact the manager of EGG to obtain access to this data.

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Appendix F: Glossary

Acceptance limits: The range of acceptable analytical results established by a laboratory for spike recovery, duplicate precision, and contamination levels.

Accuracy: The closeness of agreement between an observed value and an accepted reference value.

Activity: The rate of decay of a radioactive source at a given time.

Advisory range: The limits of acceptable analytical results established by the provider of certified quality control standards.

Aliquot: A measured portion of a sample taken for analysis.

Analysis: The separation and determination of the component parts or a specific property or element contained within a sample. The determination of the concentration or activity of an analyte contained within a sample.

Analysis date/time: The date and military time (24-hour clock) of the start of analysis on a prepared sample.

Analysis qualifier (AQ): See **Qualifier**.

Analyte: The specific compound, element, isotope, or radionuclide of interest that an analyst seeks to determine.

Analytical batch: A group of samples of the same matrix analyzed together using the same method and containing the required number of method blanks, matrix spike samples, laboratory control samples, and duplicate samples.

Analytical narrative: A portion of the data package that includes laboratory, contract, and sample identification. The analytical narrative also contains descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problems resolved.

Analytical sample: Any solution or medium introduced into an instrument on which an analysis is performed, excluding instrument calibration standards, calibration verification standards, and calibration blanks.

Appendix IX analytes: The list of analytes specified in Appendix IX of the *Code of Federal Regulations, Title 40, Part 264* that is required by the Resource Conservation and Recovery Act.

Aquifer: A geologic formation, group of formations, or part of a formation capable of yielding groundwater to wells or springs.

Associated sample: Any sample that is related to another sample or quality control sample. Some examples are the parent sample of a matrix spike, a sample in a preparation batch, a split sample, a duplicate sample, and a sample related to a blank.

Batch: A group of samples prepared at the same time, in the same location, using the same method.

Bias qualifier (BQ): See **Qualifier**.

Blank: An artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, deionized water is used as the blank matrix. A universal matrix does not exist for solid samples; therefore, no matrix blank is routinely used. There are several types of blanks that monitor a variety of processes. They are

- A *Field Blank for Soils* consists of DI water or dry quartz sand placed in a stainless steel bowl and exposed to the atmosphere while the associated sample is being taken. The field blank is shipped to the laboratory with the samples. The field blank measures contamination introduced during sample collection.
- A *Field Blank for Groundwater* is a sample container filled with DI water and capped in the WSRC well building. It is taken to the field during sampling, but is not opened. It is shipped to the laboratory with the samples to be analyzed.
- A *Rinsate or Equipment Blank* is deionized water poured over or through sample collection devices that tests for cleanliness of sampling equipment.
- A *Trip Blank* is shipped to the laboratory in the same cooler with the sample containers for volatile organic analytes. It provides a test for contamination from sample preservation and transport as well as sample storage, preparation, and analysis.
- A *Method Blank* is prepared in the laboratory and analyzed exactly as the samples it accompanies. It is a test for contamination in laboratory sample preparation and analyses.

These blanks are handled by the laboratory as actual samples; however, they are not to be used for matrix spike or duplicate samples.

Blank spike (BS): See **Laboratory Control Sample**.

Calibration: The establishment of an instrument response curve or mathematical correlation based on the measured response of known concentrations of an analyte or group of analytes.

Calibration blank: A volume of deionized water in the same matrix as the calibration standards, an empty planchet, or the instrument geometry that is analyzed to establish the instrument accuracy at the low end of the calibration curve.

Calibration verification: The periodic analysis of one or more standards independent of the calibration standards to verify the accuracy and stability of the initial instrument calibration.

Cation exchange capacity: The sum of exchangeable cations a soil can absorb expressed in milli-equivalents per 100 grams of soil. The cation exchange capacity is determined by sampling to the depth of solid waste placement and analyzing by the summation method for distinctly acid soils or the sodium acetate method for neutral, calcareous, or saline soils.

Certified value: The known concentration of an analyte in a reference sample as affirmed by the preparer.

Chain-of-custody (COC) form: A document designed to trace the custody of a sample(s) from the point of origin to final disposition, with the intent of legally proving that custody remained intact and that tampering or substitutions were precluded.

Coefficient of variation (CV): The standard deviation as a percent of the arithmetic mean.

Comparability: The degree of confidence with which one set of data can be compared to a related set of data.

Completeness: A measure of the amount of valid data obtained from a measurement system relative to the amount that was expected to be obtained under current, normal conditions.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and periodically modified by the Superfund Amendments and Reauthorization Acts passed by the U.S. Congress. The acts created a special tax that goes into a trust fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, the EPA has the following options:

- pay for the site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work
- take legal action to force parties responsible for site contamination to clean up the site or repay the federal government for the cost of the cleanup

Concentration: The relative fraction of one substance in another, normally expressed in weight percent, in volume percent, as a weight per volume ratio, or as a weight per weight ratio.

Confidence limits: The limits within which, at some specified level of probability, the true value of a result lies.

Confined aquifer: An aquifer bounded above and below by impermeable beds or by beds of distinctly lower permeability than the aquifer itself. Also, an aquifer containing confined groundwater.

Congener: Any one particular member of a class of chemical substances. A specific congener is denoted by a unique chemical structure e.g., 2,3,7,8-tetrachlorodibenzofuran.

Contaminant: A chemical or biological substance that is harmful if it is incorporated into, onto, or ingested by organisms, consumers of organisms, or users of the environment.

Continuing calibration blank (CCB): A blank analyzed periodically during an analytical run to detect carryover contamination.

Continuing calibration verification (CCV): The periodic analysis of one or more standards during an analytical run to verify that the initial calibration continues to be valid.

Contract-required quantitation limit (CRQL): The lowest required concentration of an analyte the laboratory may report for a specific contract. The contract-required quantitation limit is usually greater than the method detection limit.

Control limits: A range within which specified measurement results must fall to be compliant. Control limits may be mandatory, requiring corrective action if exceeded, or advisory, requiring that noncompliant data be flagged.

Correlation coefficient (r): A numeric value (r) that indicates the degree of dependence between two variables (concentration vs. response). The more dependent they are, the closer the value is to one. The correlation coefficient is determined on the basis of the least squares function.

Custody: Immediate charge, control, or possession exercised by a competent authority on a sample.

Data quality objectives: The objectives for precision, accuracy, representativeness, completeness, comparability, and detection levels that are required to support the intended use of the data.

Definitive data: Data for which the accuracy of the concentration level and the identity of the analyte of interest are assessed. Definitive data are determined for samples considered essential in the decision-making process.

Deionized (DI) water: Water from which all charged species or ionizable organic and inorganic salts are removed by means of ion exchange.

Detection: The act of measuring the quantity of a property, compound, or element contained in a sample.

Dilution factor: The mathematical factor by which a sample is diluted to bring the concentration of an analyte in the sample within the analytical range of the instrument (e.g., 1 mL of sample + 9 mL of solvent = 1:10 dilution, or a dilution factor of 10).

Dry weight: The weight of a sample based on percent solids or the weight after drying in an oven for a specified time period at a specified temperature.

Electronic data deliverable (EDD): The summary of analytical results on machine-readable media received from a laboratory.

Estimated quantitation limit (EQL): The minimum concentration of a substance that can be reliably measured and reported within specified limits of precision and accuracy during routine laboratory operating conditions.

Field blank: See Blank.

Field duplicate: A second sample taken at the same time as the primary sample and sent to the laboratory for analysis as an unknown. The field duplicate is used to determine the precision of the entire sampling and analytical process.

Field sample: The material received at the laboratory to be analyzed that is contained in single or multiple containers and identified by a unique WSRC sample identification number.

Frequency: The specified intervals between samples in which quality control samples or standards must be analyzed during an analytical run.

Groundwater: Water in a saturated zone or stratum beneath the surface of land.

Half-life: The time required for one-half of the initial number of radioactive nuclei of a specific isotopic species to undergo radioactive decay.

Holding time: The maximum amount of time allowed for samples to be held from sample collection to laboratory analysis.

Independent standard: A laboratory-prepared standard solution that is composed of analytes from a different source than those used in the standards for the initial calibration.

Initial calibration: The analysis of standards containing varying concentration levels of the analytes of interest in order to establish the ratio of concentration vs. response across the working range of the analytical technique. The initial calibration is used to define the linearity and dynamic range of response of the detector to the target analytes.

Initial calibration blank (ICB): A blank analyzed immediately after the initial calibration verification but before the analytical run to detect carryover contamination.

Initial calibration verification (ICV): The analysis of one or more standards immediately after the initial calibration but before the analytical run to verify that the initial calibration was valid.

Instrument detection limit (IDL): The minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. It is determined from analysis of a deionized water blank containing the analyte.

Interference check sample (ICS): Two solutions, one consisting of interferences only (ICSA) and one consisting of interferences mixed with the analytes (ICSAB), that are analyzed consecutively to verify the interelement and background correction factors for inductively coupled plasma metal analyses.

Interferences: Substances that affect the analysis for the element of interest.

Interlaboratory comparison: The comparison of results from split samples analyzed by two laboratories.

Internal standard: A chemically inert compound not expected to occur in an environmental sample that is added to a sample prior to analysis; it is used as an instrument response check.

Intralaboratory comparison: The comparison of duplicate results from a single sample analyzed by a laboratory.

Isomer: One of two or more chemical substances having the same elementary percentage composition and molecular weight but differing in structure and properties.

Isotope: One of a number of specific atoms with identical atomic numbers but with discrete atomic weights, or similarly specific atoms whose nuclei have the same number of protons but different numbers of neutrons.

Laboratory control sample (LCS): A control sample of known composition. Aqueous and solid laboratory control samples are analyzed using the same sample preparation, reagents, and analytical methods employed for the samples received.

Laboratory data records review (LDRR): The investigation of technical data validation issues that are not adequately addressed by the computer checking of EDDs, the review of the analytical narratives, and the review of the COC forms. The review is conducted at the laboratory using the laboratory's instrument logs, raw analytical data, and other pertinent documentation.

Laboratory duplicate: A second aliquot of a homogenized sample that is analyzed as an individual sample, using the same procedure. This duplicate is used to determine the precision of the method.

Laboratory ID: The identifier assigned by the laboratory for its internal use during the analytical process.

Linear range, linear dynamic range: The concentration range over which the calibration curve remains linear.

Lowest practical quantitation limit (LPQL): The lowest concentration of an analyte that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Matrix: The predominant material of which the sample to be analyzed is composed. For the purpose of this document, a sample matrix is either water or soil/sediment.

Matrix interference: The influence of the sample matrix or sample components upon the ability to quantitatively measure compounds in environmental samples.

Matrix spike/matrix spike duplicate: A first and second aliquot of a matrix fortified (spiked) with a known quantity of analyte(s) and subjected to the entire analytical procedure in order to determine the appropriateness of the method for the matrix by measuring accuracy (recovery) and precision (relative percent difference).

Maximum contaminant level (MCL): The maximum permissible level of a contaminant in a specified medium.

Mean relative difference (MRD): The average of the absolute difference of the results from two laboratories for the i^{th} sample that is expressed as a percentage of the mean of both laboratories.

Method blank: See Blank.

Method detection limit (MDL): The minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. It is determined from analysis of a sample in a given matrix containing the analyte.

Minimum detectable activity (MDA): The smallest quantity of a radionuclide that can be detected in a sample with a 95% confidence level.

Nuclide: General term applied to all isotopes of all elements including stable and radioactive forms. Nuclides are not considered isotopes; rather, a given nuclide is characterized by the number of neutrons and protons contained in the atomic nuclei of that species.

Null hypothesis: A statement that can be tested statistically to determine if there is a significant difference between duplicate/split results.

Parts per billion (ppb)/Parts per million (ppm): Units commonly used to express low concentrations of contaminants. For example, 5 micrograms of benzene in 1 kilogram of soil is 5 ppb; 3 milligrams of nitrate in 1 liter of water is 3 ppm.

Percent moisture: An approximation of the amount of water in a soil/sediment sample determined by drying an aliquot of sample at a specified temperature until constant weight is achieved.

Percent recovery: A measure of recovery that is calculated as the measured value relative to the true value, expressed as a percent.

Percent solids: The proportion of solid in a soil/sediment sample determined by the percent moisture procedure.

Performance evaluation sample: A sample of known composition that may be provided by the EPA or WSRC for laboratory analysis that is used to evaluate laboratory performance.

PicoCurie (pCi): The unit of radiation equivalent to 3.7×10^{-2} disintegrations per second.

Precision: The agreement or repeatability of a set of replicate results among themselves, usually expressed in terms of the deviation of a set of results from the arithmetic mean. Precision may be qualified in terms of possible sources of variability, replicability, repeatability, and reproducibility.

Preparation log: An official record of the sample preparation.

Preservative: A chemical compound added to a sample or a physical process (such as cooling) to prevent or slow decomposition or degradation of a target analyte. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

Primary laboratory: The laboratory having a contract with WSRC to perform a specific set of analyses for field-generated samples, duplicates, and blanks. A primary laboratory may subcontract this work to other laboratories.

Qualifier: A code used to convey additional information about an analytical result. See the following examples.

- A *Result Qualifier* is used to indicate the usability of the result for regulatory purposes.
- An *Analysis Qualifier* is used to describes analytical conditions which apply to the datum. Analysis qualifiers are included for information only.

- A *Bias Qualifier* is a code used to indicate whether a result may overestimate or underestimate the true value. It also may be used to indicate poor precision.

See *Appendix D* for additional information and the specific qualifiers used.

Qualitative analysis: An analysis to determine the presence or absence of a target analyte.

Quality assurance plan: The documented data quality objectives and the actions to be performed to meet those objectives.

Quality control (QC): The performance of actions that provide a way to control and measure the characteristics of measurement equipment and processes to meet the established data quality objectives.

Quantitative analysis: An analysis to measure or determine the amount of a target compound or analyte within the limits of defined precision and accuracy requirements.

Radionuclide: Any radioactive isotope of an element.

Range: The difference between the maximum and minimum values within a set of values.

RCRA Facility Investigation/Remedial Investigation (RFI/RI) program: The EPA-regulated investigation of a solid-waste management site, including CERCLA and hazardous-substance regulations, with regard to its potential impact on the environment.

Recovery: A determination of accuracy of the analytical procedure made by comparing measured values for a reference or fortified (spiked) sample against the known true reference or spike values.

Reference detection limit (RDL): The detection limit chosen to allow comparison of multiple analyses with different detection limits. For this report, the individual detection limits of at least 90% of the analyses are less than the reference detection limit.

Relative percent difference (RPD): A measure of precision that is calculated as the absolute value of the difference between two results, relative to their arithmetic mean, expressed as a percent.

Reporting limit: The value reported in the result field when an analyte is not detected.

Reproducibility: The precision of measurements of the same sample at different laboratories using the same protocols.

Resolution: The degree to which two signal peaks are separated. Resolution is calculated by dividing the height of the valley between the peaks by the height of the peak being resolved, multiplied by 100.

Resource Conservation and Recovery Act (RCRA): A 1976 federal law that established a regulatory system to define and track hazardous wastes from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances.

Rinsate blank: See **Blank**.

Run: A continuous analytical sequence consisting of prepared samples and all associated quality control measurements.

Sample: A portion of material to be analyzed that is contained in single or multiple containers and identified by a unique sample number.

Sample ID: A unique identification number designated by WSRC for each sample. The WSRC sample ID appears on the sample chain of custody that documents information on that sample.

Sample matrix: All of the chemical components and physical characteristics of a sample other than the parameter of interest.

Sample-specific estimated quantitation limit (ssEQL): The estimated quantitation limit multiplied by factors of concentration, dilution, aliquot size, and percent solids.

Sediment: The unconsolidated inorganic and organic material that is suspended in and being transported by surface water or that has settled out and has deposited into beds.

Self-absorption: The internal absorption of radiation by material in which radioactive atoms are located.

Sensitivity: The ability of a measurement system to detect and accurately quantitate a parameter at a critical level within a specific sample matrix. The critical level may be a regulatory maximum contaminant level (MCL), MDA, or risk-based exposure level.

Significance of probability: The probability of observing a statistical value as significant as, or even more significant than, the value actually observed.

Soil: All unconsolidated materials normally found on or near the surface of the earth including, but not limited to, silts, clays, sands, gravel, and small rocks.

Solvent: Liquid that is capable of dissolving another substance.

Split sample: A second aliquot of a sample, generated in the field, that is sent to a secondary laboratory for analysis; a split sample serves as a quality control check.

Standard deviation: The measurement of dispersion about a mean value of a series of observations expressed in the same units as the mean value.

Surface water: All water that is open to the atmosphere and subject to surface runoff.

Surrogate: A chemically inert organic compound similar in composition and test performance to an analyte of interest added to samples prior to analysis as a quality control check.

Surrogate recovery: A quality control measurement to monitor unusual matrix effects, gross sample processing errors, etc. It is evaluated for acceptance by determining whether the measured concentration falls within the statistical acceptance limits established by the laboratory.

Target analyte list (TAL): The list of inorganic analytes required by CERCLA.

Target compound list (TCL): The list of organic analytes required by CERCLA.

Technical holding time: The storage time allowed between sample collection and sample analysis when designated preservation and storage techniques are employed. This is determined by the elapsed time in days from the date and time of collection to the date and time of sample preparation and analysis.

- Technical holding time = (sample analysis date and time – sample collection date and time).

Tentatively identified compound (TIC): Chromatographic peak in volatile and semivolatile fraction analysis that is not a target analyte, surrogate, or internal standard.

Time: When required to record time on any deliverable item, time is expressed as military time, i.e., on a 24-hour clock.

Toxicity characteristic leaching procedure (TCLP): An analytical extraction procedure used to determine the mobility of both inorganic and organic analytes present in solid, liquid, and multiphasic wastes.

Tracer: A quantity of a unique radioisotope of the same element added to a sample, chemically prepared, or separated and counted. The quantity of tracer measured is compared to the quantity of target radioactive element measured, and the target quantity is calculated on the basis of unity with the tracer concentration.

Trip blank: See Blank.

Wet weight: The weight of a sample aliquot including moisture (undried).