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

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MASTER

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THE ENVIRONMENTAL PROTECTION DEPARTMENT
ENVIRONMENTAL MONITORING SECTION

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

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List of Acronyms and Abbreviations

The following acronyms and abbreviations are used in this QA/QC Summary Report:

°C	degrees Celsius
µg	microgram
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
B/N/A	base/neutral/acid extractables
BQ	bias qualifier
BS	blank spike
BSD	blank spike duplicate
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
COC	chain of custody
COD	chemical oxygen demand
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
EDD	electronic data deliverable
EGG	Environmental Geochemistry Group
Eh	oxidation-reduction potential
EM-PPM	parts per million methane equivalent
EMSL	Environmental Monitoring Section 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
ESS	Environmental Support Section
ExR	Exploration Resources, Inc.
FHST	F- and H-Area Seeplines, Tritium Survey
FID	flame ionization detector
ft	feet
g	gram
GC	gas chromatography

GC/MS	gas chromatography/mass spectrometry
GE	General Engineering Laboratories, Inc.
GFAA	graphite furnace atomic absorption (metals analysis)
GIMS	Geological 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 + analytes
kg	kilogram
km	kilometer
L	liter
LCS	laboratory control sample
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

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min.	minimum
mL	milliliter
MRD	mean relative difference
MS	matrix spike
MSA	method of standard addition
MSD	matrix spike duplicate
MSL	mean sea level
NA	not applicable
NAPL	non-aqueous phase liquid
ng	nanograms
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	picocuries
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
QA3	data quality objective 3
r	correlation coefficient
RCO	Radiological Control Officer
RCRA	Resource Conservation and Recovery Act
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
SAFER	Streamlined Approach for Environmental Restoration
SAIC	Science Applications International Corporation
SCDHEC	South Carolina Department of Health and Environmental Control
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	Test Methods for Evaluating Solid Waste
TAL	target analyte list
TCL	target compound list
TIC	tentatively identified compound
U	unclassified
UTM	Universal Transverse Mercator Zone 17 Coordinate System
VOA	volatile organic analyses
VOC	volatile organic compound
WA	Roy F. Weston, Inc., Analytics Division
WSRC	Westinghouse Savannah River Company

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

Fourmile Branch and the F- and H-Area Seepelines, Tritium

Executive Summary

Purpose

This report presents a summary of the definitive data validation and verification for the Semiannual Tritium Survey for Fourmile Branch and the F- and H-Area Seeplines (FHST¹). The survey was performed at the request of the WSRC ERD and conducted by WSRC/ESS. 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 reviewed by examining 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.

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

Sample holding times were checked by comparing the time between sample collection and analysis with a look-up table of required 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 QA/QC sample and associated project sample data were qualified when 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.

Laboratory-generated blanks (i.e., method blanks) were examined. Section 3.5.3, *Contamination in Quality Control Samples*, for a list of all constituents detected in method blanks. Method blanks were performed in ratios of more than one for every 20 samples.

Fourmile Branch and the F- and H-Area Seepines Affiliates

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

- Jim Koch II of WSRC-ESS, Aiken, SC, was the project manager
- WSRC-ESS, Aiken, SC, collected the water samples
- GE of Charleston, SC, and WSRC-EMSL of Aiken, SC, prepared the definitive-level analytical data
- Walt Kubilius of WSRC-EPD/EMS, Aiken, SC, directed the validation of the data and production of the report
- ExR of Athens, GA, validated the data and prepared this report.

1.0 Summary of the Project

1.1 Objectives

The objective of this project is to provide validated data for the semiannual tritium sampling events in Fourmile Branch, the F- and H-Area Seeplines, and the 643E Seepline.

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 (WSRC, 1995). 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 (WSRC, 1992f). 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 to 1989.

Prior to 1996, the tritium analyses were conducted by the EMS laboratory (interoffice memorandum dated February 19, 1996, from J. Koch to C. Nichols, WSRC, SRS, Aiken, SC). Data validation was required, so the tritium analyses were to be performed by an independent outside laboratory.

1.3 Field Sampling

Samples of 25 ml each were collected from containers that have been permanently installed at each sample point along the seeplines. There were two sampling events. The first sampling event occurred 3/25/96–4/17/96. The second event occurred 9/17/96–9/24/96. One hundred twenty-nine samples including duplicates and splits were collected. Concurrent

with the sample collection, pH and specific conductance were measured in the field and recorded in a logbook.

1.4 Analysis

The samples were analyzed for tritium to meet the requirements for definitive-level data. Seventeen samples, one duplicate, and six split samples were analyzed at the EMS laboratory.

1.5 Validation

The tritium results were validated as definitive-level data.

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

Of the 140 COC forms generated for this project, 129 were used. The 11 unused COC forms were for samples not taken due to insufficient material.

Table 2.1 lists the number of sample and QC records that were qualified after verification and validation were performed.

Table 2.1. Number of Records

Data Validation Records	Sample Records	QC Records	Total
Total Number of Analytical Records	129	46	175
Qualified Data			
Rejected Analytical Records	0	5	5
Result Qualifier <i>U</i>	2	15	17
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, as defined in the Data Quality Objectives Process for Superfund, *QA/QC Guidance for Removal Activities*, 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 and blank contamination.

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 based on an action level regarding

- 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 work plan sample lists, work plan 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, 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 QA/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 QA/QC categories: holding times, instrument calibration, analyte identification/quantitation, method blanks, 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, 1990b; 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 rinsates, 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 is collected.

The sampling and analysis plan (interoffice memorandum dated November 4, 1996 from J. Koch to W. Kubilius, WSRC, SRS, Aiken, SC) and work plan assessment (Nichols and Conner, 1996) describe the sample selection process.

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 FHST.

GE of Charleston, SC, the primary laboratory, provided definitive-level radiological analyses under contract AA07208N. EP, a subsidiary of GE, performed the analyses.

EMSL of Aiken, SC, the secondary laboratory, provided definitive-level radionuclide 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 Discrepancies from the Work Plan Assessment

Ten environmental samples listed in the work plan assessment could not be collected because the sample locations were dry, and there was insufficient volume to fill the sample bottles. The following table lists the samples that were not collected.

Table 2.2. Samples Not Collected

Sample ID	Survey Station ID
106511	FHB 1501
106545	HSP 3801
108931	HSP 3402
108932	HSP 3802
108933	HSP 4302
108937	HSP 6002
108945	FHB 1502
108946	FHB 0102
108949	FHB 1902
108969	HSP 1102

According to the work plan assessment only the split samples were to be sent to EMSL. However, ten environmental samples and one duplicate known to have high tritium concentrations were sent to EMSL because of difficulties shipping radiological samples above 2000 pCi/mL to off-site laboratories (interoffice memorandum dated November 4, 1996 from J. Koch to W. Kubilius, WSRC, SRS, Aiken, SC). These samples are listed in the following table.

Table 2.3. Non-split Samples Sent to EMSL

Sample ID	Survey Station ID
108900	FSP 20402
108901	FSP 21302
108914	FSP 1902
108915	FSP 2602
108916	FSP 2602A
108918	FSP 3502

Sample ID	Survey Station ID
108919	FSP 4002
108947	FHB 1702
108948	FHB 1802
108950	FHB 1302
108952	FHB 1202

The required rate of one per ten duplicates and splits was met for this project. However, there were six QC sample locations that deviated from the work plan assessment. During sampling, the QC samples were collected from alternate locations. The following table lists the planned QC sample locations and the alternate sample locations.

Table 2.4. QC Sample Locations Changed during Sampling

Planned QC Sample Location	Alternate QC Sample Location
FSP 5601A	FHB 2001A
FSP 4001D	FMC 2H01D
FMC 1H01A	HSP 5701D
FHB 1802A	HSP 5202A

Table 2.4. QC Sample Locations Changed during Sampling, continued

Planned QC Sample Location	Alternate QC Sample Location
HSP 6402A	HSP 9702A
HSP 10302D	FHB 0602D

2.3.2 Sample Documentation

The split sample (FMC 2H01D) for sample FMC 2H01 was collected six days after the parent sample was collected.

2.3.3 Holding Times and Preservation

No holding times were exceeded for this project.

There are no temperature requirements for tritium water samples.

2.3.4 Analytical Issues

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

2.3.5 Rejected Data

No environmental samples were rejected for this project. Five matrix spike records were rejected because the sample concentration exceeded the spike concentration by a factor of four.

3.0 Validation

3.1 Planning

A work plan assessment (Nichols and Conner, 1996) consistent with WSRC EGG Operating Handbook, Section 2.110, *Work Plan Assessment*, was conducted by Chet Nichols of WSRC and Steven P. Conner of SAIC.

3.1.1 Work Plan Assessment

Water samples were to be collected for two sampling events from 63 sampling locations. Samples were to be collected from the F-Area seepage, the H-Area seepage, 643E seepage, and background locations. Samples of 25 mL each were collected from permanently installed containers or field augered holes at each sample point along the seepages.

Sample splits and duplicates were planned at a frequency of one per 10 samples. Eight duplicates and six splits were planned.

The samples were to be analyzed for tritium. These 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 printed 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 signatures and dates of each person handling the sample
- the cooler number and temperature upon arrival at the analytical laboratory

A peel-off section of each bottle label, printed with the bottle number, was affixed to the analysis request line on the COC form. As specified in the Work Plan Assessment, 140 COCs were generated for this project.

3.1.3 Sample Set

The following table lists the sample identifiers, sample type, sample date and time, and the analyses requested for samples sent to the laboratory.

Table 3.1. Sample Set

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time	Analyses Requested
First Sampling Event					
FHB 0101	106500	9604371-04	Water	03/25/96, 12:30	Tritium
FHB 0201	106501	9604371-03	Water	03/25/96, 12:40	Tritium
FHB 0201D	106502	960847402	Split	03/25/96, 12:41	Tritium
FHB 0301	106512	9604371-06	Water	03/25/96, 12:51	Tritium
FHB 0401	106513	9604371-15	Water	03/25/96, 13:00	Tritium
FHB 0501	106515	9604371-32	Water	03/25/96, 13:50	Tritium
FHB 0601	106514	9604371-31	Water	03/25/96, 13:45	Tritium
FHB 0801	106516	9604371-39	Water	03/25/96, 14:00	Tritium
FHB 1201	106506	9604486-01	Water	03/25/96, 11:50	Tritium
FHB 1301	106505	9604486-02	Water	03/25/96, 11:45	Tritium
FHB 1401	106507	9604371-02	Water	03/25/96, 11:55	Tritium
FHB 1601	106510	9604371-38	Water	03/25/96, 12:15	Tritium
FHB 1701	106509	9604486-03	Water	03/25/96, 12:10	Tritium
FHB 1801	106508	9604486-04	Water	03/25/96, 12:00	Tritium
FHB 1901	106504	9604486-05	Water	03/25/96, 11:37	Tritium
FHB 2001	106503	9604371-01	Water	03/25/96, 11:30	Tritium
FHB 2001A	106542	9604371-11	Duplicate	03/25/96, 11:30	Tritium
FMC 1F01	106539	9604371-14	Water	03/27/96, 10:12	Tritium
FMC 1H01	106562	9604371-46	Water	04/10/96, 13:15	Tritium
FMC 2H01	106567	9604371-24	Water	04/11/96, 09:01	Tritium
FMC 2H01D	106568	9680847502	Split	04/17/96, 11:05	Tritium
FSP 0201	106528	9604371-12	Water	03/26/96, 12:34	Tritium
FSP 0201A	106529	9604371-34	Duplicate	03/26/96, 12:35	Tritium
FSP 0701	106527	9604371-16	Water	03/26/96, 12:24	Tritium
FSP 1201	106530	9604371-19	Water	03/26/96, 12:46	Tritium
FSP 1401	106534	9604371-07	Water	03/26/96, 13:55	Tritium
FSP 1901	106531	9604486-06	Water	03/26/96, 13:01	Tritium
FSP 2601	106533	9604486-07	Water	03/26/96, 13:26	Tritium
FSP 3201	106532	9604371-09	Water	03/26/96, 13:12	Tritium
FSP 3401	106566	9604371-10	Water	04/11/96, 08:49	Tritium
FSP 3501	106537	9604486-08	Water	03/26/96, 14:39	Tritium
FSP 4001	106536	9604486-09	Water	03/26/96, 14:31	Tritium
FSP 4701	106535	9604371-41	Water	03/26/96, 14:14	Tritium
FSP 5601	106538	9604371-29	Water	03/26/96, 15:03	Tritium
FSP 20401	106517	9604486-10	Water	03/26/96, 08:39	Tritium
FSP 21301	106518	9604486-11	Water	03/26/96, 08:57	Tritium
FSP 22001	106520	9604371-28	Water	03/26/96, 09:12	Tritium
FSP 22601	106519	9604371-18	Water	03/26/96, 09:02	Tritium

Fourmile Branch and the F- and H-Area Seepines, Tritium

Table 3.1. Sample Set, continued

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time	Analyses Requested
FSP 23501	106522	9604371-05	Water	03/26/96, 09:36	Tritium
FSP 24101	106521	9604371-40	Water	03/26/96, 09:26	Tritium
FSP 24901	106526	9604371-43	Water	03/26/96, 11:17	Tritium
FSP 25601	106525	9604371-17	Water	03/26/96, 11:07	Tritium
FSP 27001	106524	9604371-20	Water	03/26/96, 10:26	Tritium
FSP 29001	106523	9604371-33	Water	03/26/96, 10:17	Tritium
HSP 0301	106559	9604371-27	Water	04/10/96, 12:51	Tritium
HSP 0401	106560	9604371-37	Water	04/10/96, 12:58	Tritium
HSP 0401A	106561	9604371-23	Duplicate	04/10/96, 12:59	Tritium
HSP 0801	106557	9604486-18	Water	04/10/96, 12:23	Tritium
HSP 1101	106558	9604371-21	Water	04/10/96, 12:27	Tritium
HSP 1301	106556	9604486-12	Water	04/10/96, 12:12	Tritium
HSP 1501	106555	9604371-36	Water	04/10/96, 12:05	Tritium
HSP 2001	106554	9604371-45	Water	04/10/96, 11:51	Tritium
HSP 2501	106553	9604371-44	Water	04/10/96, 11:45	Tritium
HSP 2901	106552	9604371-08	Water	04/10/96, 11:34	Tritium
HSP 3401	106551	9604371-26	Water	04/10/96, 11:24	Tritium
HSP 4301	106544	9604486-13	Water	04/10/96, 09:38	Tritium
HSP 4601	106546	9604371-30	Water	04/10/96, 10:01	Tritium
HSP 4901	106548	9604486-14	Water	04/10/96, 10:20	Tritium
HSP 5201	106547	9604486-15	Water	04/10/96, 10:14	Tritium
HSP 5701	106549	9604371-13	Water	04/10/96, 10:38	Tritium
HSP 5701D	106550	9680847302	Split	04/10/96, 10:40	Tritium
HSP 6001	106540	9604486-16	Water	03/27/96, 10:32	Tritium
HSP 6401	106541	9604371-35	Water	03/27/96, 10:43	Tritium
HSP 7101	106563	9604371-25	Water	04/10/96, 13:40	Tritium
HSP 7601	106543	9604371-22	Water	03/27/96, 10:58	Tritium
HSP 9701	106565	9604486-17	Water	04/10/96, 14:30	Tritium
HSP 10301	106564	9604371-42	Water	04/10/96, 14:25	Tritium
Second Sampling Event					
FHB 0202	108943	9609541-37	Water	09/19/96, 11:10	Tritium
FHB 0302	108953	9609541-40	Water	09/19/96, 13:15	Tritium
FHB 0402	108954	9609541-41	Water	09/19/96, 13:25	Tritium
FHB 0502	108960	9609541-42	Water	09/19/96, 14:35	Tritium
FHB 0602	108958	9609541-01	Water	09/19/96, 14:20	Tritium
FHB 0602D	108959	9680977802	Split	09/19/96, 14:21	Tritium
FHB 0802	108961	9609541-43	Water	09/19/96, 14:55	Tritium
FHB 1202	108952	9680143000	Water	09/19/96, 12:07	Tritium
FHB 1302	108950	9680142900	Water	09/19/96, 12:00	Tritium
FHB 1402	108951	9609541-39	Water	09/19/96, 12:05	Tritium

Table 3.1. Sample Set, continued

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time	Analyses Requested
FHB 1602	108944	9609541-38	Water	09/19/96, 11:30	Tritium
FHB 1702	108947	9680143100	Water	09/19/96, 11:45	Tritium
FHB 1802	108948	9680144500	Water	09/19/96, 11:50	Tritium
FHB 2002	108942	9609541-35	Water	09/19/96, 11:05	Tritium
FMC 1F02	108964	9609541-44	Water	09/23/96, 12:31	Tritium
FMC 1H02	108962	9609541-45	Water	09/23/96, 11:59	Tritium
FMC 2H02	108963	9609541-46	Water	09/23/96, 12:11	Tritium
FMC 2H02D	108966	9680977900	Split	09/23/96, 12:12	Tritium
FSP 0202	108911	9609541-10	Water	09/18/96, 07:45	Tritium
FSP 0702	108912	9609541-11	Water	09/18/96, 07:55	Tritium
FSP 1202	108913	9609541-12	Water	09/18/96, 08:05	Tritium
FSP 1402	108921	9609541-15	Water	09/18/96, 11:30	Tritium
FSP 1902	108914	9680144900	Water	09/18/96, 08:30	Tritium
FSP 2602	108915	9680142700	Water	09/18/96, 08:35	Tritium
FSP 2602A	108916	9680142600	Duplicate	09/18/96, 08:36	Tritium
FSP 3202	108917	9609541-13	Water	09/18/96, 08:50	Tritium
FSP 3402	108967	9609541-47	Water	09/24/96, 12:21	Tritium
FSP 3502	108918	9680142400	Water	09/18/96, 09:00	Tritium
FSP 4002	108919	9680142800	Water	09/18/96, 09:11	Tritium
FSP 4702	108920	9609541-14	Water	09/18/96, 09:50	Tritium
FSP 5602	108922	9609541-16	Water	09/18/96, 11:50	Tritium
FSP 20402	108900	9680144600	Water	09/17/96, 09:33	Tritium
FSP 21302	108901	9680144800	Water	09/17/96, 10:22	Tritium
FSP 22002	108905	9609541-05	Water	09/17/96, 10:52	Tritium
FSP 22602	108902	9609541-03	Water	09/17/96, 10:33	Tritium
FSP 23502	108903	9609541-04	Water	09/17/96, 10:43	Tritium
FSP 23502A	108904	9609541-02	Duplicate	09/17/96, 10:44	Tritium
FSP 24102	108968	9609541-48	Water	09/24/96, 13:02	Tritium
FSP 24902	108908	9609541-08	Water	09/17/96, 13:11	Tritium
FSP 25602	108909	9609541-09	Water	09/17/96, 13:22	Tritium
FSP 25602D	108910	9680978000	Split	09/17/96, 13:25	Tritium
FSP 27002	108907	9609541-07	Water	09/17/96, 12:33	Tritium
FSP 29002	108906	9609541-06	Water	09/17/96, 12:21	Tritium
HSP 0302	108923	9609541-17	Water	09/18/96, 13:05	Tritium
HSP 0402	108924	9609541-18	Water	09/18/96, 13:10	Tritium
HSP 0802	108925	9609541-19	Water	09/18/96, 13:25	Tritium
HSP 1302	108926	9609541-20	Water	09/18/96, 13:50	Tritium
HSP 1502	108927	9609541-21	Water	09/18/96, 14:00	Tritium
HSP 2002	108928	9609541-22	Water	09/18/96, 14:20	Tritium
HSP 2502	108929	9609541-23	Water	09/18/96, 14:30	Tritium

Table 3.1. Sample Set, continued

Survey Station ID	Sample ID	Laboratory ID	Sample Type	Sample Date and Time	Analyses Requested
HSP 2902	108930	9609541-24	Water	09/18/96, 14:40	Tritium
HSP 4602	108936	9609541-27	Water	09/19/96, 09:00	Tritium
HSP 4902	108935	9609541-26	Water	09/19/96, 08:50	Tritium
HSP 5202	108934	9609541-25	Water	09/19/96, 08:40	Tritium
HSP 5202A	108965	9609541-36	Duplicate	09/19/96, 08:41	Tritium
HSP 5702	108938	9609541-28	Water	09/19/96, 09:40	Tritium
HSP 6402	108939	9609541-29	Water	09/19/96, 10:20	Tritium
HSP 7102	108940	9609541-30	Water	09/19/96, 10:30	Tritium
HSP 7602	108941	9609541-31	Water	09/19/96, 10:40	Tritium
HSP 9702	108956	9609541-32	Water	09/19/96, 13:50	Tritium
HSP 9702A	108957	9609541-33	Duplicate	09/19/96, 13:52	Tritium
HSP 10302	108955	9609541-34	Water	09/19/96, 13:40	Tritium

3.2 Field Data Quality Issues

3.2.1 Discrepancies from the Work Plan Assessment

Ten samples listed in the work plan assessment could not be collected because the sample locations were dry, and there was insufficient volume to fill the sample bottles. A listing of the samples not collected is given in subsection 2.3.1, *Discrepancies from the Work Plan Assessment*.

Ten environmental samples and one duplicate sample that were originally planned for GE were sent to EMSL because they had high concentrations of tritium. For a complete list of these samples, see Table 2.3 of subsection 2.3.1, *Discrepancies from the Work Plan Assessment*.

3.2.2 Sample Logbook Observations

The split sample (FMC 2H01D) for sample FMC 2H01 was collected six days after the parent sample was collected.

3.2.3 Chain-of-Custody Observations

There were no COC observations that impacted data quality.

3.3 Analytical Data Quality Issues

3.3.1 The Laboratories

The water samples were analyzed by GE under contract AA07208N. GE has been certified by SCDHEC. EP, a subsidiary of GE, performed the analyses. Ten samples, one duplicate, and six split samples were analyzed by EMSL.

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 they perform. 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 for all the samples for this project. See *Appendix A* for the methods used.

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:

- Because the field measurements are not analyte specific, they are designed to meet the criteria for screening data, and definitive data criteria are not applicable.
- Analytical error determination (a measurement of method precision) was not calculated.
- No adjustments to sample values were made for bias or precision.
- Through the use of 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.
- Five of the nine matrix spikes could not be evaluated due to high concentrations of the analyte in the samples.

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
- problems with matrix interference
- sample-specific adjustments to the method caused by high concentration of some analytes
- problems with sample holding time
- 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 chain-of-custody forms attached to the analytical narratives are used for data review.

3.4.2 Laboratory Data Records Review

On November 11, 1996, laboratory data records were reviewed at EP for radiological analyses associated with this project. The review was conducted by Raymond M. Keller of ExR.

The purpose of the review was to investigate technical validation issues discussed in EPA, 1990b that are not addressed adequately by computer checking of the EDDs, review of analytical narratives, or review of COC forms. These technical issues include instrument calibration, analyte identification, and analyte quantitation. The issues are addressed by comparing the instrument printouts associated with particular analyses against validation checklists. These checklists each consist of 13 questions and were prepared from six sources: EPA, 1986; EPA, 1988a; EPA, 1988b; EPA, 1990b; GE Standard Operating Procedures; and discussions with laboratory personnel.

For each analytical method, approximately 10% of the samples were chosen for review. Eleven LDRR forms for this project were completed. Each LDRR form represents one sample reviewed for one analytical method, (i.e., one sample/method combination [SMC]).

An inventory of the worksheets and methods reviewed is included in the following table.

Table 3.2. Laboratory Data Records Review Summary

Analyte/Suite	Method	Checklist Used	Number of SMCs
Tritium	EPA906.0	Liquid Scintillation	11

Scoring

EPA906.0 Tritium

All LDRR checklist criteria were met in the 11 samples reviewed.

Qualification of Analyses

No qualification was necessary based upon the results of the LDRR.

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
- trip blanks
- method blanks
- laboratory control samples/blank spikes
- rinsates, field blanks, and field duplicates
- laboratory duplicates
- matrix spikes
- surrogate recovery
- instrument readings
- internal standards

Holding Time

Criteria

Each analysis was evaluated according to the holding time limits for preparation (extraction or digestion) and analysis given in the following table.

Table 3.3. Holding Time Criteria

Analytes	Reference	Extraction/Digestion	Analysis
Cation exchange capacity	EPA, 1986	NA	NA
Cyanide	EPA, 1994a	NA	14 days from collection
Mercury	EPA, 1994a	NA	38 days in glass or 13 days in plastic from collection
Metals	EPA, 1994a	NA	6 months from collection
Nitrate	EPA, 1994a	NA	48 hours from collection
Nitrogen (Kjeldahl method)	EPA, 1994a	NA	28 days from collection
Orthophosphate	EPA, 1994a	NA	48 hours from collection
Pesticide (soil)	EPA, 1994a	14 days from collection	40 days from extraction
Pesticide (water)	EPA, 1994a	7 days from collection	40 days from extraction
Radionuclides	EPA, 1994a	NA	180 days from collection
Semivolatile organics (soil)	EPA, 1994a	14 days from collection	40 days from extraction
Semivolatile organics (water)	EPA, 1994a	7 days from collection	40 days from extraction
Sulfate	EPA, 1994a	NA	28 days from collection
Total phosphorus as P	EPA, 1994a	NA	28 days from collection
Volatile organics	EPA, 1994a	NA	14 days from collection

Action

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

Analysis Qualifier: *Q*

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

Findings

All criteria were met for this project.

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. General requirements follow.

Soil

Inorganics: Inorganic analyses for metals require that soil samples be kept between 2° and 6°C.

Organics: Organic analyses for chlorinated hydrocarbons, haloethers, PCBs, pesticides, phenols, phthalate esters, purgeable aromatic hydrocarbons, purgeable halocarbons, tetrachlorodibenzo-p-dioxin isomers, and total organic carbon also require that soil samples be kept between 2° and 6°C. Soil samples to be analyzed for nitroaromatics and isophorone, nitrosamines, or polynuclear aromatic hydrocarbons must be stored in the dark at temperatures between 2° and 6°C.

Water

Inorganics: Water samples collected for metals analyses should have nitric acid added so that pH is less than 2.

Organics: Water samples for all organic analyses should be kept between 2° and 6°C. Purgeable aromatic hydrocarbon analyses require that hydrochloric acid be added so that pH is less than 2, and total organic carbon analysis requires that hydrochloric acid or sulfuric acid be added so that pH is less than 2. Samples for nitroaromatics and isophorone must be stored in the dark. Samples for pesticides analyses should have pH adjusted to between 5 and 9.

Soil and water samples for organic and inorganic analyses (excluding radiologicals and metals) must be shipped in coolers with temperatures of 4°C ± 2°C.

Action

When cooler temperature requirements were not met, a Y analysis qualifier was assigned.

Under the current contract, the laboratories do not report pH of samples requiring preservation. Thus, no assessment of the pH preservation criterion could be made.

Findings

All criteria were met for this project.

Discussion

Temperatures greater than the established limit may compromise the integrity and representativeness of the samples due to increased biological activity, hydrolysis of organic compounds, thermal degradation, and the loss of volatile and semivolatile compounds. The analytical results are expected to be biased low, and false negative results are possible. False positive results also are possible due to the effects of biological and chemical degradation, and would most likely appear as TICs.

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

All criteria were met for this project.

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, and 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 subsection 3.4.2, *Laboratory Data Records Review*.

Trip Blanks

Criteria

Trip blanks were used to determine the existence and magnitude of contamination from shipping activities. Only data for the volatile organic fraction were evaluated based on trip blank results, and the CLP 5×/10× rule was used for data qualification.

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.

Analysis Qualifier: 8

Result Qualifier: U

Findings

Trip blanks were not applicable for 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 qualification was performed based on method blanks.

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 SVA (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 also 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 result 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 LCS criteria were met for this project.

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***

- Radiologicals: (WHC, not dated)

The RPD of a sample and its associated laboratory duplicate must be 20% or less for water samples and 35% or less for soil samples. These method-required limits do not apply to results reported at levels less than five times the detection limit. For results less than five times the detection limit, water samples must have RPDs less than 100% and soil samples must have RPDs less than 200%.

Action

For soil samples, when duplicate analysis results for a particular analyte fall outside the QC limits for the RPD, that analyte in the parent and duplicate samples was qualified.

Analysis Qualifier: X

For water samples, when the RPD for a particular analyte was outside the appropriate QC limits, analysis qualifiers were assigned to that analyte in the parent and duplicate samples and to that analyte in every sample in the same preparation batch.

Analysis Qualifier: X

Result Qualifiers: J—for detects   UJ—for nondetects

Findings

No qualification was performed based on laboratory duplicates.

Matrix Spikes***Criteria***

- Inorganics: Page 11 (EPA, 1988a)

Action

1. When an MS did not meet criteria, qualifiers were added only to the failed analyte in the MS and the failed analyte in the samples associated with the MS. Only the MS and parent sample records were qualified for soil samples. The MS, the parent sample, and all the samples in the same preparation batch were qualified for water samples. The data were qualified as follows:

Analysis Qualifier: I

Result Qualifiers: J—for detects   UJ—for nondetects

Bias Qualifiers: H—if all MS recoveries were above QC limits

L—if all MS recoveries were below QC limits

2. 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

3. If the laboratory believed poor recoveries were due to matrix interferences, the MS record was not used for qualification of any associated data. The MS record was qualified as follows:

Analysis Qualifier: 4

Result Qualifier: R

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

Analysis Qualifier: I

Findings

None of the environmental sample records were qualified. Only the matrix spike records were qualified. The following table lists matrix spike analyses were rejected.

Table 3.4. Matrix Spikes Rejected due to High Concentration of the Analyte in the Sample by EP

Analyte	Frequency Rejected
Radionuclides	
Tritium	5/6

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.

Surrogate Recovery

Criteria

- Pesticides by Method 8080: 60–150%, page D-56 PEST (EPA, 1991b)
- Semivolatiles by Method 8270: Table 8, page 8270-31 (EPA, 1986)
- Volatiles by Method 8240: Table 8, page 8240-38 (EPA, 1986)
- Volatiles by Method 8260: Table 9, page 8260-44 (EPA, 1986)

Action

Volatiles and/or pesticides: When one or more surrogates failed QC criteria, all volatile and/or pesticide analytes in the sample were qualified as follows:

Analysis Qualifier: *O*

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

Bias Qualifiers: *H*—if all failed surrogates have high recoveries

L—if all failed surrogates have low recoveries

When one surrogate was high and another was low, a bias qualifier was not assigned, and the *O* analysis qualifier was assigned to the failed surrogates.

Semivolatiles: When only one surrogate failed and its recovery was >10%, no action was taken. When more than one surrogate failed QC criteria, all semivolatile analytes in the sample were qualified as follows:

Analysis Qualifier: *O*

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

Bias Qualifiers: *H*—if all failed surrogates have high recoveries

L—if all failed surrogates have low recoveries

When one surrogate was high and another was low, a bias qualifier was not assigned, and the *O* analysis qualifier was assigned to the failed surrogates.

Findings

Surrogates were not applicable for this project.

Discussion

When the surrogate percent recovery is high, the results for associated data may be biased positively. When the surrogate percent recovery 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 required a result qualifier.

Action

The result qualifier was as follows:

Result Qualifier: *UI*—for nondetects

Findings

One of 129 environmental sample records was qualified.

Discussion

For radiological analyses, the laboratory's 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.

Internal Standards

Criteria

- Semivolatiles by Method 8270: Table 5, page 8270-20 or 8270A-35 (EPA, 1986)
- Volatiles by Method 8240: Table 5, page 8240A-33 (EPA, 1986)
- Volatiles by Method 8260: Table 6, page 8260-39 (EPA, 1986)

This requirement was evaluated during the LDRR.

Action

When the internal standard recovery varied more than the factor of two (-50% to +100%) from the associated calibration standard, all analytes quantified using the internal standard were qualified as follows:

Analysis Qualifier: *H*

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

No qualifier is used for nondetects with internal standards greater than the QC limits.

Findings

Internal standards were not applicable to this project.

Discussion

When the internal standard recovery is high, the associated data may be biased positively. When the internal standard recovery is low, the associated data may be biased negatively, and all nondetected results should be considered questionable.

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 and blank spikes, 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 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 MDA, the ssEQL is used for that result in the calculation. When both results are below the MDA, 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 MDA, 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 column 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 3.5. Relative Percent Differences of Laboratory Duplicates by EP

Analyte	Frequency Out of Range	Mean RPD (%)	Std. Dev.	Minimum RPD (%)	Maximum RPD (%)
Radionuclides					
Tritium	0/6	2.32	2.75	0	6.97

Table 3.6. Relative Percent Differences of Field Duplicates by EMSL

Analyte	Frequency Out of Range	Mean RPD (%)	Std. Dev.	Minimum RPD (%)	Maximum RPD (%)
Radionuclides					
Tritium	0/3	1.35	1.27	0.3	2.76

Table 3.7. Relative Percent Differences of Field Duplicates by EP

Analyte	Frequency Out of Range	Mean RPD (%)	Std. Dev.	Minimum RPD (%)	Maximum RPD (%)
Radionuclides					
Tritium	1/5	30.4	65.7	0.163	148

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, 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, a third-party supplier, or are prepared in the laboratory from chemicals from a different source than the calibration standards. The following table lists the QC limits for each analyte.

Table 3.8. EPA Quality Control Limits for Laboratory Control Samples

Analyte	Aqueous Samples (%)	Soil Samples (%)
Radionuclides¹	80–120	80–120

The following tables list the statistical information for the percent recovery for LCSs by analyte. The frequency out-of-range column 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.

¹ (WHC, not dated)

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 3.9. Laboratory Control Sample Recoveries by EMSL

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
Radionuclides					
Tritium	0/7	89.6	3.97	85	93.5

Table 3.10. Laboratory Control Sample Recoveries by EP

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
Radionuclides					
Tritium	0/7	98.2	1.82	95.9	101

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. For the inorganic analyses, all target analytes are spiked. For the organic analyses, selected target analytes are used in the spiking solution. 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 LCS/BSs given in Table 3.8, except for inorganics, which have limits of 75–125%. Matrix spikes are rejected if the concentration of the analyte in the samples 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 column 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 3.11. Matrix Spike Recoveries by EMSL

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
Radionuclides					
Tritium	0/3	90.7	3.58	86.7	93.6

Table 3.12. Matrix Spike Recoveries by EP

Analyte	Frequency Out of Range	Mean Recovery (%)	Std. Dev.	Minimum Recovery (%)	Maximum Recovery (%)
Radionuclides					
Tritium	0/1	98.8		98.8	98.8

3.5.3 Contamination in Quality Control Samples**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, which 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.

Table 3.13. Analytes Detected in Method Blanks by EMSL

Analyte	Frequency Detected	Mean Result	Std. Dev.	Min./Max. Result	Unit
Radionuclides					
Tritium	0/7	4.29E-10	1.13E-7	-1.97E-7/1.83E-7	pCi/mL

Table 3.14. Analytes Detected in Method Blanks by EP

Analyte	Frequency Detected	Mean Result	Std. Dev.	Min./Max. Result	Unit
Radionuclides					
Tritium	0/7	-0.0282	0.146	-0.279/0.203	pCi/mL

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 minimum detectable activity for each analyte, and reporting units.

Table 3.15. Split Sample Results

Analyte	RPD	EP		EMSL		Unit
		Sample ID	Result	Sample ID	Result	
Tritium	1.47	106560	541	106561	549	pCi/mL
Tritium	1.74	108909	285	108910	290	pCi/mL
Tritium	0.473	108958	211	108959	212	pCi/mL
Tritium	15.6	108963	75.5	108966	88.3	pCi/mL

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4.0 References

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Appendix A: Analytical Methods and Minimum Detectable Activity

In the following tables of analytical methods and minimum detectable activity, the **MDA** column reports the lowest concentration that can reliably be achieved within specified limits for precision and accuracy during routine laboratory operating conditions. The **Reference** column provides the published source for the method, with the exception of the analyses that are performed by the laboratories' established methods.

Table A.1. Water Analytical Method and Minimum Detectable Activity for EP

Analyte	Method	Unit	MDA	Reference
Radionuclides				
Tritium	EPA906.0	pCi/mL	NA	EP

Table A.2. Water Analytical Method and Minimum Detectable Activity for EMSL

Analyte	Method	Unit	MDA	Reference
Radionuclides				
Tritium	3Q1-6-1420	pCi/mL	NA	EMSL

*Done
JWL.*

Appendix B: Laboratory Performance Evaluation Results

No performance evaluation results for tritium are available for the EP or EMSL.

Appendix C: Formats of the Data Files

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.

The following table describes the sample data format, SAM93, which is used for coding and transmitting sampling data records. The formats presented in this appendix have been established by WSRC-EPD/EMS.

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	The 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

Table C.1. Sample Data Format SAM93, continued

Name	Columns	Type	Description
Associated sample	31–36	Integer	Sample identification of associated sample if this sample is a duplicate, split, rinsate, etc.
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 ¹	81	Numeric	Soil moisture coded as: 1 = dry 2 = damp 3 = wet 4 = sludge 5 = liquid
Munsell color ¹	82–91	Alphanumeric	Munsell color
Soil classification ¹	92–93	Alphanumeric	Unified Soil Classification
Number of bottles	94–96	Integer	The 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

¹ No data are reported for this field.

This is the 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	The number of the sample printed on the page of the sample logbook
Bottle label number	15-23	Integer	The number of the bottle label attached to the bottle

This is the 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	The identification of the station (the facility identification and sampling point)
SRS north coordinate	20-27	Numeric	The SRS grid north coordinate of the station reported in feet
SRS east coordinate	29-36	Numeric	The SRS grid east coordinate of the station reported in feet
Ground elevation	43-48	Numeric	Ground elevation reported in feet above median sea level

This is the 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	The 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	The number assigned to the cooler in which the samples are shipped to the analytical laboratory
Sample temperature upon receipt	54–57	Numeric	The temperature of the samples upon receipt at the analytical laboratory in °C

This is the 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 ¹	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 ¹	18–23	Numeric	Date that the sample was collected. For laboratory blanks and QC samples, enter the preparation date. For TCLP samples, enter the date of completion of TCLP sample generation
Sample collection time	24–27	Numeric	Time of sample collection or generation
Lab receipt date ¹	28–33	Numeric	Date that the sample was received by the laboratory; leave blank for laboratory blanks and QC samples
Extraction date	34–39	Numeric	Date that the sample was extracted; leave blank unless the holding time is dependent upon the extraction time

¹ This field must have an entry for every record.

Table C.5. Analytical Data Format AN95, continued

Name	Columns	Type	Description
Extraction time	40–43	Numeric	Time that the sample extraction was started; leave blank unless the holding time is dependent upon the extraction time
Extraction/digestion method	44–56	Alphanumeric	The coded identifier for the method used to perform the extraction or digestion (e.g., EPA###.#)
Analysis date ¹	57–62	Numeric	Date that the analyte concentration was determined
Analysis time ¹	63–66	Numeric	Time that the analyte concentration was determined
Analytical method ¹	67–79	Alphanumeric	The 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 ¹	88–89	Alphanumeric	Code assigned by EPD/EMS to identify the laboratory performing the analysis
Laboratory sample identification ¹	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 the end of this appendix for codes)
Analyte ¹	108–117	Alphanumeric	The coded identifier (provided by EPD/EMS) for the analyte
Quantitation limit	118–125	Numeric	GE and Weston report the ssEQL for non-radiochemistry analyses. All labs report the MDA for radiochemistry analyses
Result qualifier	126–128	Alphanumeric	The coded field used to qualify the analytical result (codes are in <i>Appendix D</i>)
Analysis qualifier	129–131	Alphanumeric	The coded field used to qualify the analysis (codes are in <i>Appendix D</i>)
Bias of analysis	132	Alphanumeric	The coded field for data having result qualifiers of <i>J</i> or <i>R</i> specifying the expected bias (codes are in <i>Appendix D</i>)
Analytical result	133–142	Numeric	The 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 ¹	143–146	Alpha	The coded identifier (provided by EPD/EMS) of the unit in which the analytical result is expressed

Table C.5. Analytical Data Format AN95, continued

Name	Columns	Type	Description
Accuracy	147–154	Numeric	The 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
Residual weight	155–160	Numeric	The weight of material in mg the planchet after evaporation; used for radionuclide determinations
Nominal concentration ¹	161–168	Numeric	The concentration of analyte added to the sample prior to analysis; reported in the same units as the analytical result; the value of 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 ¹	175	Numeric	The number of steps required to reach the final dilution factor; zero if the sample was not diluted
Dilution factor ¹	176–181	Numeric	The dilution used in the analysis; a value of one indicates the sample was not diluted
Instrument ¹	182–189	Alphanumeric	The coded identifier for the instrument used to perform the analysis; each laboratory develops its own codes and provides them to EPD/EMS
Instrument batch ¹	190–197	Alphanumeric	The 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 ¹	198–200	Alpha	The initials of the analyst
Percent solids	201–205	Numeric	The 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	The number on the bottle label; required field if bottle label is numbered
Sample fraction	216–219	Alphanumeric	The coded identifier (provided by EPD/EMS) for the fraction of the sample analyzed
Validation status	220–221	Alphanumeric	The lab will report a zero

Table C.5. Analytical Data Format AN95, continued

Name	Columns	Type	Description
EPD/EMS receipt date	222-227	Numeric	Date that the analytical data is received by EPD/EMS from the laboratory. The laboratory will leave this blank
ESH-EMS number	228-234	Alphanumeric	The document number assigned to the project report

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

Table C.6. Analytical Data AN95-R2 Format

Name	Columns	Type	Description
Station identifier	1-11	Alphanumeric	Identification of the actual sample (includes any modification made in the field)
Sample date	12-18	Numeric	Date sample was collected
Laboratory replicate	19-21	Alphanumeric	Indicates that the sample is a non-blind replicate analysis (see the end of this appendix for codes)
Analyte	22-71	Alphanumeric	Full analyte name
Analysis type	72-81	Alphanumeric	Analytical suite
Quantitation limit	82-89	Numeric	Both GE and EMSL reported the ssEQL for non-radiochemistry analyses. All labs reported the MDA for radiochemistry analyses
Result qualifier	90-92	Alphanumeric	The coded field used to qualify the analytical result (codes are in <i>Appendix D</i>)
Result	93-102	Numeric	The 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
Units	103-108	Alpha	The coded identifier (provided by EPD/EMS) of the units in which the analytical result is expressed
Validation status	109-110	Alphanumeric	Validated definitive data will report a three
ESH-EMS number	111-117	Alphanumeric	The document number assigned to the project report

When making entries in the laboratory replicate field of the data files, use only the codes listed below.

Table C.7. 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, use only the codes listed below.

Table C.8. Codes for Fractions

Code	Description
(blank)	The sample was not fractionated prior to analysis.
A	Ashed fraction.
D	Dried fraction of a soil or sludge sample. Not for use 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, use the following format for the WSRC identifier entered in the AN95 data file.

Table C.9. 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; QA/QC laboratory deionized water samples will 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	Can be blank
	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 were applied to the analytical results during data validation.

Table D.1. Result Qualifiers

Qualifier	Description
(blank)	The data are not remarked. The value should be interpreted exactly as reported.
C ¹	Calculated. The analytical result reported was not measured directly but was calculated from other data available. 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 it is known to be greater than the value shown.
R ¹	The 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 U.S. EPA.

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

Table D.2. Analysis Qualifiers, continued

Qualifier	Description
E	The detected result is between the ssEQL and the method detection limit. Report the actual result detected.
F	Pesticides Compound Identification The pesticide result has been confirmed by gas chromatography/mass spectrometry.
G	Pesticides Instrument Performance Used 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 was held beyond normal holding time.
R	ICP Interference Check Sample Criteria were not met.
S	The reported value was determined by the method of standard additions.
V	Method Blank Contamination 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, continued

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 Codes

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 Number of Qualified Samples

The following table presents the samples requested, received, and qualified for each analyte. Analytical results for both the primary laboratory and the laboratory receiving QA samples are included in the table. Surrogates, matrix spikes, and other laboratory QC results are not included in the table.

- The **Samples Requested** column contains the number of times the laboratory received a COC and its associated sample (environmental samples, field-generated duplicates, field blanks, and trip blanks) requesting that a particular analysis be performed.
- The **Samples Received** column contains the total number of samples for which at least one analytical record was reported.
- The **Analyses Reported** column contains the total number of reported results for the analyte. This number includes laboratory-initiated duplicate analyses and re-analysis results; it does not include analyses of associated laboratory blanks.

The remaining columns in the table list the number of analyses that were qualified for meeting specified conditions.

- The **Records Rejected** column contains the number of records for which the RQ was *R*. Samples having a rejected result also may have an acceptable re-analysis result.
- The column **Out of Holding** contains the number of records for which the time between sample collection and analysis exceeded the maximum allowed by the analytical method. These records have an AQ of *Q*. All laboratory pH measurements exceed holding time, regardless of the laboratory's efficiency.
- The column **QA/QC Problems** contains the number of records containing an AQ of *C*, *H*, *I*, *O*, *V*, or *X* because at least one associated laboratory QC sample did not meet the required standards.
- The column **Preservation** contains the number of records with preservation problems. These records have an AQ of *Y*.
- The column **Calibration** contains the number of records with identified calibration problems. These records have an AQ of *L*.

Table D.4. Number of Qualified Samples

Analyte	Samples Requested	Samples Received	Analyses Reported	Records Rejected	Out of Holding	QA/QC Problems	Preservation	Calibration
Radionuclides								
Tritium	129	129	138	0	0	0	0	0

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

Analytical Method	Sample Records	Laboratory Duplicates	Laboratory Blanks	Matrix Spikes/Duplicates	Calibration Checks	Totals
3Q1-6-1420	17	3	14	3	0	37
EPA906.0	112	6	14	6	0	138

Table D.6. Analytes Detected in Background and Water Samples

Analyte	Average Result	Min/Max Results	Unit
Analytes Detected in Background Water Samples			
Tritium	201	28.9/520	pCi/mL
Analytes Detected in Water Samples			
Tritium	692000	7.05/1910000	pCi/mL

D.3 Analytical Results Sorted by Sample**Table D.7. Water Results Sorted by Sample**

SURVEY ID: FHB 0101

SAMPLE ID: 106500

Survey location: 54075E 73758N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				1.02E+02±2.20E+00	pCi/mL	1.06E+00	EPA906.0

SURVEY ID: FHB 0201

SAMPLE ID: 106501

Survey location: 54095E 73540N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.54E+01±6.42E-01	pCi/mL	5.04E-01	EPA906.0

SURVEY ID: FHB 0201D

SAMPLE ID: 106502

Sample type: Split

Associated sample: 106501

<i>Radionuclides</i>							
Tritium	UI			3.72E+00±1.49E+01	pCi/mL	5.87E+04	3Q1-6-1420
Tritium	UI			4.84E+00±1.49E+01	pCi/mL	5.87E+04	3Q1-6-1420

SURVEY ID: FHB 0202

SAMPLE ID: 108943

Survey location: 54095E 73540N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.63E+01±6.45E-01	pCi/mL	4.94E-01	EPA906.0

SURVEY ID: FHB 0301

SAMPLE ID: 106512

Survey location: 53712E 73236N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.15E+02±1.99E+00	pCi/mL	7.89E-01	EPA906.0

SURVEY ID: FHB 0302

SAMPLE ID: 108953

Survey location: 53712E 73236N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method

Radionuclides

Tritium				8.71E+01±2.69E+00	pCi/mL	1.72E+00	EPA906.0

SURVEY ID: FHB 0401

SAMPLE ID: 106513

Survey location: 53741E 73029N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				1.15E+02±1.64E+00	pCi/mL	5.38E-01	EPA906.0

SURVEY ID: FHB 0402

SAMPLE ID: 108954

Survey location: 53741E 73029N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				2.47E+02±2.37E+00	pCi/mL	5.35E-01	EPA906.0

SURVEY ID: FHB 0501

SAMPLE ID: 106515

Survey location: 53910E 72800N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				4.06E+02±2.99E+00	pCi/mL	5.17E-01	EPA906.0

SURVEY ID: FHB 0502

SAMPLE ID: 108960

Survey location: 53910E 72800N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				4.96E+02±3.28E+00	pCi/mL	5.16E-01	EPA906.0

SURVEY ID: FHB 0601

SAMPLE ID: 106514

Survey location: 54129E 72672N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				2.07E+02±2.01E+00	pCi/mL	4.47E-01	EPA906.0

SURVEY ID: FHB 0602

SAMPLE ID: 108958

Survey location: 54129E 72672N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				2.11E+02±2.67E+00	pCi/mL	6.42E-01	EPA906.0

SURVEY ID: FHB 0602D

SAMPLE ID: 108959

Sample type: Split

Associated sample: 108958

<i>Radionuclides</i>							
Tritium				2.12E+02±1.62E+00	pCi/mL	1.17E+03	3Q1-6-1420
Tritium				2.10E+02±1.61E+00	pCi/mL	1.17E+03	3Q1-6-1420

SURVEY ID: FHB 0801

SAMPLE ID: 106516

Survey location: 54022E 72181N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.58E+02±1.78E+00	pCi/mL	4.58E-01	EPA906.0
Tritium				1.55E+02±1.76E+00	pCi/mL	4.58E-01	EPA906.0

SURVEY ID: FHB 0802

SAMPLE ID: 108961

Survey location: 54022E 72181N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				2.00E+02±2.09E+00	pCi/mL	5.14E-01	EPA906.0

SURVEY ID: FHB 1201

SAMPLE ID: 106506

Survey location: 53878E 73424N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.50E+04±5.52E+02	pCi/mL	3.00E+01	EPA906.0

SURVEY ID: FHB 1202

SAMPLE ID: 108952

Survey location: 53878E 73424N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.85E+04±1.82E+02	pCi/mL	1.17E+05	3Q1-6-1420

SURVEY ID: FHB 1301

SAMPLE ID: 106505

Survey location: 53848E 73508N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method

Radionuclides

Tritium				8.12E+03±3.91E+02	pCi/mL	2.76E+01	EPA906.0

SURVEY ID: FHB 1302

SAMPLE ID: 108950

Survey location: 53848E 73508N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				7.19E+03±4.82E+01	pCi/mL	1.17E+04	3Q1-6-1420

SURVEY ID: FHB 1401

SAMPLE ID: 106507

Survey location: 53728E 73561N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				3.07E+02±2.43E+00	pCi/mL	4.42E-01	EPA906.0

SURVEY ID: FHB 1402

SAMPLE ID: 108951

Survey location: 53728E 73561N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				2.09E+02±2.04E+00	pCi/mL	4.68E-01	EPA906.0

SURVEY ID: FHB 1601

SAMPLE ID: 106510

Survey location: 54030E 73716N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				2.40E+02±2.34E+00	pCi/mL	5.31E-01	EPA906.0

SURVEY ID: FHB 1602

SAMPLE ID: 108944

Survey location: 54030E 73716N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				2.78E+02±2.39E+00	pCi/mL	4.87E-01	EPA906.0

SURVEY ID: FHB 1701

SAMPLE ID: 106509

Survey location: 54000E 73668N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				1.04E+04±6.62E+02	pCi/mL	9.55E+01	EPA906.0

SURVEY ID: FHB 1702

SAMPLE ID: 108947

Survey location: 54000E 73668N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				8.83E+03±1.20E+02	pCi/mL	1.17E+05	3Q1-6-1420

SURVEY ID: FHB 1801

SAMPLE ID: 106508

Survey location: 54026E 73565N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				2.02E+04±6.01E+02	pCi/mL	2.62E+01	EPA906.0

SURVEY ID: FHB 1802

SAMPLE ID: 108948

Survey location: 54026E 73565N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.91E+04±1.89E+02	pCi/mL	1.17E+05	3Q1-6-1420

SURVEY ID: FHB 1901

SAMPLE ID: 106504

Survey location: 53895E 73485N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				5.63E+03±3.69E+02	pCi/mL	6.67E+01	EPA906.0

SURVEY ID: FHB 2001

SAMPLE ID: 106503

Survey location: 54008E 73434N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				2.41E+01±7.70E-01	pCi/mL	5.00E-01	EPA906.0

SURVEY ID: FHB 2001A		SAMPLE ID: 106542					
Sample type: Duplicate		Associated sample: 106503					
Constituent	RQ	AQ	B	Result	Unit	MDA	Method
Radionuclides							
Tritium				2.35E+01±7.67E-01	pCi/mL	5.07E-01	EPA906.0
SURVEY ID: FHB 2002		SAMPLE ID: 108942					
Survey location: 54008E 73434N (SRS coordinates)							
Sample type: Normal		Sample matrix: Water					
Radionuclides							
Tritium				2.18E+01±7.08E-01	pCi/mL	4.70E-01	EPA906.0
SURVEY ID: FMC 1F01		SAMPLE ID: 106539					
Survey location: 57050E 70350N (SRS coordinates)							
Sample type: Normal		Sample matrix: Water					
Radionuclides							
Tritium				4.56E+02±2.97E+00	pCi/mL	4.47E-01	EPA906.0
SURVEY ID: FMC 1F02		SAMPLE ID: 108964					
Survey location: 57050E 70350N (SRS coordinates)							
Sample type: Normal		Sample matrix: Water					
Radionuclides							
Tritium				5.20E+02±3.22E+00	pCi/mL	4.75E-01	EPA906.0
SURVEY ID: FMC 1H01		SAMPLE ID: 106562					
Survey location: 5300E 72600N (SRS coordinates)							
Sample type: Normal		Sample matrix: Water					
Radionuclides							
Tritium				2.89E+01±1.23E+00	pCi/mL	7.10E-01	EPA906.0
SURVEY ID: FMC 1H02		SAMPLE ID: 108962					
Survey location: 5300E 72600N (SRS coordinates)							
Sample type: Normal		Sample matrix: Water					
Radionuclides							
Tritium				3.46E+01±8.66E-01	pCi/mL	4.70E-01	EPA906.0

SURVEY ID: FMC 2H01

SAMPLE ID: 106567

Survey location: 53000E 72600N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				8.82E+01±1.33E+00	pCi/mL	4.53E-01	EPA906.0

SURVEY ID: FMC 2H01D

SAMPLE ID: 106568

Sample type: Split

Associated sample: 106567

Radionuclides

Tritium				8.58E+01±1.61E+01	pCi/mL	5.87E+04	3Q1-6-1420

SURVEY ID: FMC 2H02

SAMPLE ID: 108963

Survey location: 53000E 72600N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				7.55E+01±1.25E+00	pCi/mL	4.73E-01	EPA906.0

SURVEY ID: FMC 2H02D

SAMPLE ID: 108966

Sample type: Split

Associated sample: 108963

Radionuclides

Tritium				8.83E+01±1.07E+00	pCi/mL	1.17E+03	3Q1-6-1420

SURVEY ID: FSP 0201

SAMPLE ID: 106528

Survey location: 49133E 72796N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				6.12E+02±3.42E+00	pCi/mL	4.44E-01	EPA906.0

SURVEY ID: FSP 0201A

SAMPLE ID: 106529

Sample type: Duplicate

Associated sample: 106528

Radionuclides

Tritium				6.13E+02±3.43E+00	pCi/mL	4.44E-01	EPA906.0

SURVEY ID: FSP 0202

SAMPLE ID: 108911

Survey location: 49133E 72796N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				7.79E+02±5.13E+00	pCi/mL	6.50E-01	EPA906.0

SURVEY ID: FSP 0701

SAMPLE ID: 106527

Survey location: 49540E 73008N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				8.09E+02±6.55E+00	pCi/mL	1.06E+00	EPA906.0

SURVEY ID: FSP 0702

SAMPLE ID: 108912

Survey location: 49540E 73008N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.01E+03±6.12E+00	pCi/mL	7.11E-01	EPA906.0

SURVEY ID: FSP 1201

SAMPLE ID: 106530

Survey location: 49644E 73602N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.95E+01±6.96E-01	pCi/mL	4.91E-01	EPA906.0
Tritium				1.87E+01±7.18E-01	pCi/mL	5.35E-01	EPA906.0

SURVEY ID: FSP 1202

SAMPLE ID: 108913

Survey location: 49644E 73602N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				6.98E+01±1.59E+00	pCi/mL	6.61E-01	EPA906.0

SURVEY ID: FSP 1401

SAMPLE ID: 106534

Survey location: 49802E 73685N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.08E+01±7.45E-01	pCi/mL	7.82E-01	EPA906.0

SURVEY ID: FSP 1402

SAMPLE ID: 108921

Survey location: 49802E 73685N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method

Radionuclides

Tritium				5.08E+01±1.28E+00	pCi/mL	6.00E-01	EPA906.0

SURVEY ID: FSP 1901

SAMPLE ID: 106531

Survey location: 49778E 73177N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				4.53E+03±3.07E+02	pCi/mL	3.06E+01	EPA906.0

SURVEY ID: FSP 1902

SAMPLE ID: 108914

Survey location: 49778E 73177N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				4.27E+03±3.17E+01	pCi/mL	1.17E+04	3Q1-6-1420

SURVEY ID: FSP 2601

SAMPLE ID: 106533

Survey location: 49801E 72932N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				7.74E+03±3.99E+02	pCi/mL	3.04E+01	EPA906.0

SURVEY ID: FSP 2602

SAMPLE ID: 108915

Survey location: 49801E 72932N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				3.98E+03±3.06E+01	pCi/mL	1.17E+04	3Q1-6-1420

SURVEY ID: FSP 2602A

SAMPLE ID: 108916

Sample type: Duplicate

Associated sample: 108915

Radionuclides

Tritium				4.02E+03±3.09E+01	pCi/mL	1.17E+04	3Q1-6-1420
Tritium				3.92E+03±3.00E+01	pCi/mL	1.17E+04	3Q1-6-1420

SURVEY ID: FSP 3201

SAMPLE ID: 106532

Survey location: 50258E 73367N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				3.27E+01±8.27E-01	pCi/mL	4.42E-01	EPA906.0

SURVEY ID: FSP 3202

SAMPLE ID: 108917

Survey location: 50258E 73367N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				2.32E+02±2.83E+00	pCi/mL	6.56E-01	EPA906.0
Tritium				2.32E+02±2.83E+00	pCi/mL	6.56E-01	EPA906.0

SURVEY ID: FSP 3401

SAMPLE ID: 106566

Survey location: 50261E 73156N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				6.77E+02±4.29E+00	pCi/mL	6.49E-01	EPA906.0

SURVEY ID: FSP 3402

SAMPLE ID: 108967

Survey location: 50261E 73156N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				2.91E+03±1.04E+01	pCi/mL	1.44E+00	EPA906.0
Tritium				2.92E+03±1.04E+01	pCi/mL	1.43E+00	EPA906.0

SURVEY ID: FSP 3501

SAMPLE ID: 106537

Survey location: 50297E 73065N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				5.26E+03±3.28E+02	pCi/mL	3.02E+01	EPA906.0

SURVEY ID: FSP 3502

SAMPLE ID: 108918

Survey location: 50297E 73065N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				7.15E+03±7.86E+01	pCi/mL	5.87E+04	3Q1-6-1420

SURVEY ID: FSP 4001

SAMPLE ID: 106536

Survey location: 50630E 73101N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				4.60E+03±3.07E+02	pCi/mL	6.64E+01	EPA906.0

SURVEY ID: FSP 4002

SAMPLE ID: 108919

Survey location: 50630E 73101N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				4.64E+03±3.42E+01	pCi/mL	1.17E+04	3Q1-6-1420

SURVEY ID: FSP 4701

SAMPLE ID: 106535

Survey location: 50607E 73609N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				1.53E+01±7.04E-01	pCi/mL	5.35E-01	EPA906.0

SURVEY ID: FSP 4702

SAMPLE ID: 108920

Survey location: 50607E 73609N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				2.00E+01±8.55E-01	pCi/mL	6.13E-01	EPA906.0

SURVEY ID: FSP 5601

SAMPLE ID: 106538

Survey location: 51488E 73824N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				7.38E+00±4.54E-01	pCi/mL	4.44E-01	EPA906.0

SURVEY ID: FSP 5602

SAMPLE ID: 108922

Survey location: 51488E 73824N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				7.05E+00±5.94E-01	pCi/mL	6.33E-01	EPA906.0

SURVEY ID: FSP 20401

SAMPLE ID: 106517

Survey location: 48801E 73281N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent

RQ AQ B Result

Unit

MDA

Method

Radionuclides

Tritium

2.56E+03±1.62E+02 pCi/mL 1.84E+01

EPA906.0

SURVEY ID: FSP 20402

SAMPLE ID: 108900

Survey location: 48801E 73281N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

2.88E+03±2.43E+01 pCi/mL 1.17E+04

3Q1-6-1420

SURVEY ID: FSP 21301

SAMPLE ID: 106518

Survey location: 48725E 73486N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

1.79E+03±1.11E+02 pCi/mL 1.39E+01

EPA906.0

SURVEY ID: FSP 21302

SAMPLE ID: 108901

Survey location: 48725E 73486N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

2.20E+03±2.04E+01 pCi/mL 1.17E+04

3Q1-6-1420

SURVEY ID: FSP 22001

SAMPLE ID: 106520

Survey location: 48644E 72983N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

6.98E+02±3.93E+00 pCi/mL 5.24E-01

EPA906.0

SURVEY ID: FSP 22002

SAMPLE ID: 108905

Survey location: 48644E 72983N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

9.55E+02±5.96E+00 pCi/mL 7.15E-01

EPA906.0

SURVEY ID: FSP 22601

SAMPLE ID: 106519

Survey location: 48601E 73308N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				7.76E+02±3.90E+00	pCi/mL	4.58E-01	EPA906.0

SURVEY ID: FSP 22602

SAMPLE ID: 108902

Survey location: 48601E 73308N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				4.43E+02±4.11E+00	pCi/mL	7.30E-01	EPA906.0

SURVEY ID: FSP 23501

SAMPLE ID: 106522

Survey location: 48587E 72979N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				2.90E+02±2.83E+00	pCi/mL	6.54E-01	EPA906.0

SURVEY ID: FSP 23502

SAMPLE ID: 108903

Survey location: 48587E 72979N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.76E+02±2.55E+00	pCi/mL	6.95E-01	EPA906.0

SURVEY ID: FSP 23502A

SAMPLE ID: 108904

Sample type: Duplicate

Associated sample: 108903

<i>Radionuclides</i>							
Tritium				1.77E+02±2.55E+00	pCi/mL	6.89E-01	EPA906.0

SURVEY ID: FSP 24101

SAMPLE ID: 106521

Survey location: 48190E 72853N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				4.56E+02±8.94E+00	pCi/mL	1.60E+00	EPA906.0

SURVEY ID: FSP 24102

SAMPLE ID: 108968

Survey location: 48190E 72853N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method

Radionuclides

Tritium	UI			1.89E-01±3.95E-01	pCi/mL	6.69E-01	EPA906.0

SURVEY ID: FSP 24901

SAMPLE ID: 106526

Survey location: 47905E 73107N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				6.78E+01±2.84E+00	pCi/mL	1.50E+00	EPA906.0

SURVEY ID: FSP 24902

SAMPLE ID: 108908

Survey location: 47905E 73107N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				3.45E+02±4.61E+00	pCi/mL	1.17E+00	EPA906.0

SURVEY ID: FSP 25601

SAMPLE ID: 106525

Survey location: 47770E 73435N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				3.07E+02±2.45E+00	pCi/mL	4.53E-01	EPA906.0

SURVEY ID: FSP 25602

SAMPLE ID: 108909

Survey location: 47770E 73435N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				2.85E+02±3.21E+00	pCi/mL	6.88E-01	EPA906.0

SURVEY ID: FSP 25602D

SAMPLE ID: 108910

Sample type: Split

Associated sample: 108909

Radionuclides

Tritium				2.90E+02±1.94E+00	pCi/mL	1.17E+03	3Q1-6-1420

SURVEY ID: FSP 27001

SAMPLE ID: 106524

Survey location: 47411E 72805N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method

Radionuclides

Tritium				3.55E+01±9.07E-01	pCi/mL	4.94E-01	EPA906.0

SURVEY ID: FSP 27002

SAMPLE ID: 108907

Survey location: 47411E 72805N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				4.17E+01±1.25E+00	pCi/mL	6.56E-01	EPA906.0

SURVEY ID: FSP 29001

SAMPLE ID: 106523

Survey location: 46865E 73160N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				2.47E+01±7.63E-01	pCi/mL	4.82E-01	EPA906.0

SURVEY ID: FSP 29002

SAMPLE ID: 108906

Survey location: 46865E 73160N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				3.47E+01±1.16E+00	pCi/mL	6.71E-01	EPA906.0

SURVEY ID: HSP 0301

SAMPLE ID: 106559

Survey location: 56879E 70711N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				7.80E+02±4.71E+00	pCi/mL	6.80E-01	EPA906.0

SURVEY ID: HSP 0302

SAMPLE ID: 108923

Survey location: 56879E 70711N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				1.74E+03±1.09E+01	pCi/mL	1.38E+00	EPA906.0

SURVEY ID: HSP 0401

SAMPLE ID: 106560

Survey location: 56819E 70710N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				5.41E+02±3.93E+00	pCi/mL	6.80E-01	EPA906.0

SURVEY ID: HSP 0401A

SAMPLE ID: 106561

Sample type: Duplicate

Associated sample: 106560

Radionuclides

Tritium				5.49E+02±3.89E+00	pCi/mL	6.59E-01	EPA906.0

SURVEY ID: HSP 0402

Sample ID: 108924

Survey location: 56819E 70710N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				3.86E+02±4.48E+00	pCi/mL	1.03E+00	EPA906.0

SURVEY ID: HSP 0801

SAMPLE ID: 106557

Survey location: 56990E 71005N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				1.80E+03±1.10E+02	pCi/mL	1.37E+01	EPA906.0
Tritium				1.93E+03±1.16E+02	pCi/mL	1.41E+01	EPA906.0

SURVEY ID: HSP 0802

SAMPLE ID: 108925

Survey location: 56990E 71005N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				1.19E+03±7.15E+00	pCi/mL	8.64E-01	EPA906.0

SURVEY ID: HSP 1101

SAMPLE ID: 106558

Survey location: 57046E 71099N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				1.48E+02±1.73E+00	pCi/mL	4.61E-01	EPA906.0

SURVEY ID: HSP 1301

SAMPLE ID: 106556

Survey location: 56878E 71056N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				1.26E+03±7.90E+01	pCi/mL	1.29E+01	EPA906.0

SURVEY ID: HSP 1302

SAMPLE ID: 108926

Survey location: 56878E 71056N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				4.35E+02±4.61E+00	pCi/mL	9.72E-01	EPA906.0

SURVEY ID: HSP 1501

SAMPLE ID: 106555

Survey location: 56791E 71085N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				5.61E+02±3.51E+00	pCi/mL	5.17E-01	EPA906.0

SURVEY ID: HSP 1502

SAMPLE ID: 108927

Survey location: 56791E 71085N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				7.76E+02±5.01E+00	pCi/mL	6.49E-01	EPA906.0

SURVEY ID: HSP 2001

SAMPLE ID: 106554

Survey location: 56849E 71142N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.80E+02±7.19E+00	pCi/mL	2.20E+00	EPA906.0

SURVEY ID: HSP 2002

SAMPLE ID: 108928

Survey location: 56849E 71142N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				2.28E+02±3.34E+00	pCi/mL	9.65E-01	EPA906.0

SURVEY ID: HSP 2501

SAMPLE ID: 106553

Survey location: 56297E 70960N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method

Radionuclides

Tritium				6.55E+02±2.56E+01	pCi/mL	4.02E+00	EPA906.0

SURVEY ID: HSP 2502

SAMPLE ID: 108929

Survey location: 56297E 70960N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				7.99E+02±6.62E+00	pCi/mL	1.10E+00	EPA906.0

SURVEY ID: HSP 2901

SAMPLE ID: 106552

Survey location: 56257E 71278N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				9.77E+01±1.39E+00	pCi/mL	4.44E-01	EPA906.0

SURVEY ID: HSP 2902

SAMPLE ID: 108930

Survey location: 56257E 71278N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				7.04E+01±1.49E+00	pCi/mL	6.00E-01	EPA906.0

SURVEY ID: HSP 3401

SAMPLE ID: 106551

Survey location: 56193E 71698N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				3.41E+02±4.30E+00	pCi/mL	1.28E+00	EPA906.0

SURVEY ID: HSP 4301

SAMPLE ID: 106544

Survey location: 55722E 71644N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				2.31E+03±1.47E+02	pCi/mL	1.66E+01	EPA906.0

SURVEY ID: HSP 4601

SAMPLE ID: 106546

Survey location: 56052E 71621N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				6.03E+02±3.78E+00	pCi/mL	5.61E-01	EPA906.0

SURVEY ID: HSP 4602

SAMPLE ID: 108936

Survey location: 56052E 71621N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				6.63E+02±6.82E+00	pCi/mL	1.40E+00	EPA906.0

SURVEY ID: HSP 4901

SAMPLE ID: 106548

Survey location: 55987E 71389N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				1.87E+03±1.30E+02	pCi/mL	4.35E+01	EPA906.0

SURVEY ID: HSP 4902

SAMPLE ID: 108935

Survey location: 55987E 71389N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				1.06E+03±9.36E+00	pCi/mL	1.66E+00	EPA906.0

SURVEY ID: HSP 5201

SAMPLE ID: 106547

Survey location: 55743E 71413N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				7.66E+03±3.69E+02	pCi/mL	2.60E+01	EPA906.0

SURVEY ID: HSP 5202

SAMPLE ID: 108934

Survey location: 55743E 71413N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				1.31E+03±7.31E+00	pCi/mL	8.17E-01	EPA906.0

SURVEY ID: HSP 5202A

SAMPLE ID: 108965

Sample type: Duplicate

Associated sample: 108934

Constituent

RQ AQ B Result

Unit

MDA

Method

Radionuclides

Tritium

8.74E+03±1.37E+01 pCi/mL 5.15E-01

EPA906.0

SURVEY ID: HSP 5701

SAMPLE ID: 106549

Survey location: 55516E 71567N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

3.34E+02±2.96E+00 pCi/mL 6.20E-01

EPA906.0

SURVEY ID: HSP 5701D

SAMPLE ID: 106550

Sample type: Split

Associated sample: 106549

Radionuclides

Tritium

3.33E+02±2.01E+01 pCi/mL 5.87E+04

3Q1-6-1420

SURVEY ID: HSP 5702

SAMPLE ID: 108938

Survey location: 55516E 71567N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

1.08E+03±6.41E+00 pCi/mL 7.60E-01

EPA906.0

SURVEY ID: HSP 6001

SAMPLE ID: 106540

Survey location: 55190E 71629N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

1.26E+03±7.75E+01 pCi/mL 1.06E+01

EPA906.0

SURVEY ID: HSP 6401

SAMPLE ID: 106541

Survey location: 54768E 71846N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium

1.96E+01±6.64E-01 pCi/mL 4.47E-01

EPA906.0

SURVEY ID: HSP 6402

SAMPLE ID: 108939

Survey location: 54768E 71846N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				2.04E+01±8.53E-01	pCi/mL	6.01E-01	EPA906.0

SURVEY ID: HSP 7101

SAMPLE ID: 106563

Survey location: 54937E 71588N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.34E+03±5.35E+00	pCi/mL	5.04E-01	EPA906.0

SURVEY ID: HSP 7102

SAMPLE ID: 108940

Survey location: 54937E 71588N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.16E+03±6.20E+00	pCi/mL	6.69E-01	EPA906.0

SURVEY ID: HSP 7601

SAMPLE ID: 106543

Survey location: 54571E 71494N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.52E+02±1.73E+00	pCi/mL	4.50E-01	EPA906.0

SURVEY ID: HSP 7602

SAMPLE ID: 108941

Survey location: 54571E 71494N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				4.10E+02±3.56E+00	pCi/mL	6.17E-01	EPA906.0

SURVEY ID: HSP 9701

SAMPLE ID: 106565

Survey location: 54029E 72371N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

<i>Radionuclides</i>							
Tritium				1.44E+03±9.22E+01	pCi/mL	1.19E+01	EPA906.0

SURVEY ID: HSP 9702

SAMPLE ID: 108956

Survey location: 54029E 72371N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Constituent	RQ	AQ	B	Result	Unit	MDA	Method
<i>Radionuclides</i>							
Tritium				1.98E+03±7.74E+00	pCi/mL	6.10E-01	EPA906.0

SURVEY ID: HSP 9702A

SAMPLE ID: 108957

Sample type: Duplicate

Associated sample: 108956

Radionuclides

Tritium				1.99E+03±7.78E+00	pCi/mL	6.12E-01	EPA906.0
Tritium				2.00E+03±7.79E+00	pCi/mL	6.11E-01	EPA906.0

SURVEY ID: HSP 10301

SAMPLE ID: 106564

Survey location: 53665E 72448N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				3.57E+02±1.40E+01	pCi/mL	2.69E+00	EPA906.0

SURVEY ID: HSP 10302

SAMPLE ID: 108955

Survey location: 53665E 72448N (SRS coordinates)

Sample type: Normal

Sample matrix: Water

Radionuclides

Tritium				1.66E+03±5.76E+00	pCi/mL	4.77E-01	EPA906.0

D.4 Water Results Sorted by Analyte

Table D.8. Water Results Sorted by Analyte

ANALYTE: Tritium

Analytical Group: Radionuclides

Survey ID	Sample ID	RQ	B	Result	Unit	MDA	Method	AQ
FHB 0101	106500			1.02E+02±2.20E+00	pCi/mL	1.06E+00	EPA906.0	
FHB 0201	106501			1.54E+01±6.42E-01	pCi/mL	5.04E-01	EPA906.0	
FHB 0201D	106502	UI		3.72E+00±1.49E+01	pCi/mL	5.87E+04	3Q1-6-1420	
FHB 0201D	106502	UI		4.84E+00±1.49E+01	pCi/mL	5.87E+04	3Q1-6-1420	
FHB 0202	108943			1.63E+01±6.45E-01	pCi/mL	4.94E-01	EPA906.0	
FHB 0301	106512			1.15E+02±1.99E+00	pCi/mL	7.89E-01	EPA906.0	
FHB 0302	108953			8.71E+01±2.69E+00	pCi/mL	1.72E+00	EPA906.0	
FHB 0401	106513			1.15E+02±1.64E+00	pCi/mL	5.38E-01	EPA906.0	
FHB 0402	108954			2.47E+02±2.37E+00	pCi/mL	5.35E-01	EPA906.0	
FHB 0501	106515			4.06E+02±2.99E+00	pCi/mL	5.17E-01	EPA906.0	
FHB 0502	108960			4.96E+02±3.28E+00	pCi/mL	5.16E-01	EPA906.0	
FHB 0601	106514			2.07E+02±2.01E+00	pCi/mL	4.47E-01	EPA906.0	
FHB 0602	108958			2.11E+02±2.67E+00	pCi/mL	6.42E-01	EPA906.0	
FHB 0602D	108959			2.12E+02±1.62E+00	pCi/mL	1.17E+03	3Q1-6-1420	
FHB 0602D	108959			2.10E+02±1.61E+00	pCi/mL	1.17E+03	3Q1-6-1420	
FHB 0801	106516			1.58E+02±1.78E+00	pCi/mL	4.58E-01	EPA906.0	
FHB 0801	106516			1.55E+02±1.76E+00	pCi/mL	4.58E-01	EPA906.0	
FHB 0802	108961			2.00E+02±2.09E+00	pCi/mL	5.14E-01	EPA906.0	
FHB 1201	106506			1.50E+04±5.52E+02	pCi/mL	3.00E+01	EPA906.0	
FHB 1202	108952			1.85E+04±1.82E+02	pCi/mL	1.17E+05	3Q1-6-1420	
FHB 1301	106505			8.12E+03±3.91E+02	pCi/mL	2.76E+01	EPA906.0	
FHB 1302	108950			7.19E+03±4.82E+01	pCi/mL	1.17E+04	3Q1-6-1420	
FHB 1401	106507			3.07E+02±2.43E+00	pCi/mL	4.42E-01	EPA906.0	
FHB 1402	108951			2.09E+02±2.04E+00	pCi/mL	4.68E-01	EPA906.0	
FHB 1601	106510			2.40E+02±2.34E+00	pCi/mL	5.31E-01	EPA906.0	
FHB 1602	108944			2.78E+02±2.39E+00	pCi/mL	4.87E-01	EPA906.0	
FHB 1701	106509			1.04E+04±6.62E+02	pCi/mL	9.55E+01	EPA906.0	
FHB 1702	108947			8.83E+03±1.20E+02	pCi/mL	1.17E+05	3Q1-6-1420	
FHB 1801	106508			2.02E+04±6.01E+02	pCi/mL	2.62E+01	EPA906.0	
FHB 1802	108948			1.91E+04±1.89E+02	pCi/mL	1.17E+05	3Q1-6-1420	
FHB 1901	106504			5.63E+03±3.69E+02	pCi/mL	6.67E+01	EPA906.0	
FHB 2001	106503			2.41E+01±7.70E-01	pCi/mL	5.00E-01	EPA906.0	
FHB 2001A	106542			2.35E+01±7.67E-01	pCi/mL	5.07E-01	EPA906.0	
FHB 2002	108942			2.18E+01±7.08E-01	pCi/mL	4.70E-01	EPA906.0	
FMC 1F01	106539			4.56E+02±2.97E+00	pCi/mL	4.47E-01	EPA906.0	
FMC 1F02	108964			5.20E+02±3.22E+00	pCi/mL	4.75E-01	EPA906.0	
FMC 1H01	106562			2.89E+01±1.23E+00	pCi/mL	7.10E-01	EPA906.0	
FMC 1H02	108962			3.46E+01±8.66E-01	pCi/mL	4.70E-01	EPA906.0	
FMC 2H01	106567			8.82E+01±1.33E+00	pCi/mL	4.53E-01	EPA906.0	
FMC 2H01D	106568			8.58E+01±1.61E+01	pCi/mL	5.87E+04	3Q1-6-1420	
FMC 2H02	108963			7.55E+01±1.25E+00	pCi/mL	4.73E-01	EPA906.0	
FMC 2H02D	108966			8.83E+01±1.07E+00	pCi/mL	1.17E+03	3Q1-6-1420	
FSP 0201	106528			6.12E+02±3.42E+00	pCi/mL	4.44E-01	EPA906.0	
FSP 0201A	106529			6.13E+02±3.43E+00	pCi/mL	4.44E-01	EPA906.0	
FSP 0202	108911			7.79E+02±5.13E+00	pCi/mL	6.50E-01	EPA906.0	
FSP 0701	106527			8.09E+02±6.55E+00	pCi/mL	1.06E+00	EPA906.0	
FSP 0702	108912			1.01E+03±6.12E+00	pCi/mL	7.11E-01	EPA906.0	
FSP 1201	106530			1.95E+01±6.96E-01	pCi/mL	4.91E-01	EPA906.0	
FSP 1201	106530			1.87E+01±7.18E-01	pCi/mL	5.35E-01	EPA906.0	
FSP 1202	108913			6.98E+01±1.59E+00	pCi/mL	6.61E-01	EPA906.0	
FSP 1401	106534			1.08E+01±7.45E-01	pCi/mL	7.82E-01	EPA906.0	
FSP 1402	108921			5.08E+01±1.28E+00	pCi/mL	6.00E-01	EPA906.0	

Fourmile Branch and the F- and H-Area Seepines, Tritium

ANALYTE: Tritium (continued)

Survey ID	Sample ID	RQ	B	Result	Unit	MDA	Method	AQ
FSP 1901	106531			4.53E+03±3.07E+02	pCi/mL	3.06E+01	EPA906.0	
FSP 1902	108914			4.27E+03±3.17E+01	pCi/mL	1.17E+04	3Q1-6-1420	
FSP 2601	106533			7.74E+03±3.99E+02	pCi/mL	3.04E+01	EPA906.0	
FSP 2602	108915			3.98E+03±3.06E+01	pCi/mL	1.17E+04	3Q1-6-1420	
FSP 2602A	108916			4.02E+03±3.09E+01	pCi/mL	1.17E+04	3Q1-6-1420	
FSP 2602A	108916			3.92E+03±3.00E+01	pCi/mL	1.17E+04	3Q1-6-1420	
FSP 3201	106532			3.27E+01±8.27E-01	pCi/mL	4.42E-01	EPA906.0	
FSP 3202	108917			2.32E+02±2.83E+00	pCi/mL	6.56E-01	EPA906.0	
FSP 3202	108917			2.32E+02±2.83E+00	pCi/mL	6.56E-01	EPA906.0	
FSP 3401	106566			6.77E+02±4.29E+00	pCi/mL	6.49E-01	EPA906.0	
FSP 3402	108967			2.91E+03±1.04E+01	pCi/mL	1.44E+00	EPA906.0	
FSP 3402	108967			2.92E+03±1.04E+01	pCi/mL	1.43E+00	EPA906.0	
FSP 3501	106537			5.26E+03±3.28E+02	pCi/mL	3.02E+01	EPA906.0	
FSP 3502	108918			7.15E+03±7.86E+01	pCi/mL	5.87E+04	3Q1-6-1420	
FSP 4001	106536			4.60E+03±3.07E+02	pCi/mL	6.64E+01	EPA906.0	
FSP 4002	108919			4.64E+03±3.42E+01	pCi/mL	1.17E+04	3Q1-6-1420	
FSP 4701	106535			1.53E+01±7.04E-01	pCi/mL	5.35E-01	EPA906.0	
FSP 4702	108920			2.00E+01±8.55E-01	pCi/mL	6.13E-01	EPA906.0	
FSP 5601	106538			7.38E+00±4.54E-01	pCi/mL	4.44E-01	EPA906.0	
FSP 5602	108922			7.05E+00±5.94E-01	pCi/mL	6.33E-01	EPA906.0	
FSP 20401	106517			2.56E+03±1.62E+02	pCi/mL	1.84E+01	EPA906.0	
FSP 20402	108900			2.88E+03±2.43E+01	pCi/mL	1.17E+04	3Q1-6-1420	
FSP 21301	106518			1.79E+03±1.11E+02	pCi/mL	1.39E+01	EPA906.0	
FSP 21302	108901			2.20E+03±2.04E+01	pCi/mL	1.17E+04	3Q1-6-1420	
FSP 22001	106520			6.98E+02±3.93E+00	pCi/mL	5.24E-01	EPA906.0	
FSP 22002	108905			9.55E+02±5.96E+00	pCi/mL	7.15E-01	EPA906.0	
FSP 22601	106519			7.76E+02±3.90E+00	pCi/mL	4.58E-01	EPA906.0	
FSP 22602	108902			4.43E+02±4.11E+00	pCi/mL	7.30E-01	EPA906.0	
FSP 23501	106522			2.90E+02±2.83E+00	pCi/mL	6.54E-01	EPA906.0	
FSP 23502	108903			1.76E+02±2.55E+00	pCi/mL	6.95E-01	EPA906.0	
FSP 23502A	108904			1.77E+02±2.55E+00	pCi/mL	6.89E-01	EPA906.0	
FSP 24101	106521			4.56E+02±8.94E+00	pCi/mL	1.60E+00	EPA906.0	
FSP 24102	108968		UI	1.89E-01±3.95E-01	pCi/mL	6.69E-01	EPA906.0	
FSP 24901	106526			6.78E+01±2.84E+00	pCi/mL	1.50E+00	EPA906.0	
FSP 24902	108908			3.45E+02±4.61E+00	pCi/mL	1.17E+00	EPA906.0	
FSP 25601	106525			3.07E+02±2.45E+00	pCi/mL	4.53E-01	EPA906.0	
FSP 25602	108909			2.85E+02±3.21E+00	pCi/mL	6.88E-01	EPA906.0	
FSP 25602D	108910			2.90E+02±1.94E+00	pCi/mL	1.17E+03	3Q1-6-1420	
FSP 27001	106524			3.55E+01±9.07E-01	pCi/mL	4.94E-01	EPA906.0	
FSP 27002	108907			4.17E+01±1.25E+00	pCi/mL	6.56E-01	EPA906.0	
FSP 29001	106523			2.47E+01±7.63E-01	pCi/mL	4.82E-01	EPA906.0	
FSP 29002	108906			3.47E+01±1.16E+00	pCi/mL	6.71E-01	EPA906.0	
HSP 0301	106559			7.80E+02±4.71E+00	pCi/mL	6.80E-01	EPA906.0	
HSP 0302	108923			1.74E+03±1.09E+01	pCi/mL	1.38E+00	EPA906.0	
HSP 0401	106560			5.41E+02±3.93E+00	pCi/mL	6.80E-01	EPA906.0	
HSP 0401A	106561			5.49E+02±3.89E+00	pCi/mL	6.59E-01	EPA906.0	
HSP 0402	108924			3.86E+02±4.48E+00	pCi/mL	1.03E+00	EPA906.0	
HSP 0801	106557			1.80E+03±1.10E+02	pCi/mL	1.37E+01	EPA906.0	
HSP 0801	106557			1.93E+03±1.16E+02	pCi/mL	1.41E+01	EPA906.0	
HSP 0802	108925			1.19E+03±7.15E+00	pCi/mL	8.64E-01	EPA906.0	
HSP 1101	106558			1.48E+02±1.73E+00	pCi/mL	4.61E-01	EPA906.0	
HSP 1301	106556			1.26E+03±7.90E+01	pCi/mL	1.29E+01	EPA906.0	
HSP 1302	108926			4.35E+02±4.61E+00	pCi/mL	9.72E-01	EPA906.0	
HSP 1501	106555			5.61E+02±3.51E+00	pCi/mL	5.17E-01	EPA906.0	
HSP 1502	108927			7.76E+02±5.01E+00	pCi/mL	6.49E-01	EPA906.0	
HSP 2001	106554			1.80E+02±7.19E+00	pCi/mL	2.20E+00	EPA906.0	
HSP 2002	108928			2.28E+02±3.34E+00	pCi/mL	9.65E-01	EPA906.0	
HSP 2501	106553			6.55E+02±2.56E+01	pCi/mL	4.02E+00	EPA906.0	

ANALYTE: Tritium (continued)

Survey ID	Sample ID	RQ	B	Result	Unit	MDA	Method	AQ
HSP 2502	108929			7.99E+02±6.62E+00	pCi/mL	1.10E+00	EPA906.0	
HSP 2901	106552			9.77E+01±1.39E+00	pCi/mL	4.44E-01	EPA906.0	
HSP 2902	108930			7.04E+01±1.49E+00	pCi/mL	6.00E-01	EPA906.0	
HSP 3401	106551			3.41E+02±4.30E+00	pCi/mL	1.28E+00	EPA906.0	
HSP 4301	106544			2.31E+03±1.47E+02	pCi/mL	1.66E+01	EPA906.0	
HSP 4601	106546			6.03E+02±3.78E+00	pCi/mL	5.61E-01	EPA906.0	
HSP 4602	108936			6.63E+02±6.82E+00	pCi/mL	1.40E+00	EPA906.0	
HSP 4901	106548			1.87E+03±1.30E+02	pCi/mL	4.35E+01	EPA906.0	
HSP 4902	108935			1.06E+03±9.36E+00	pCi/mL	1.66E+00	EPA906.0	
HSP 5201	106547			7.66E+02±3.69E+02	pCi/mL	2.60E+01	EPA906.0	
HSP 5202	108934			1.31E+03±7.31E+00	pCi/mL	8.17E-01	EPA906.0	
HSP 5202A	108965			8.74E+03±1.37E+01	pCi/mL	5.15E-01	EPA906.0	
HSP 5701	106549			3.34E+02±2.96E+00	pCi/mL	6.20E-01	EPA906.0	
HSP 5701D	106550			3.33E+02±2.01E+01	pCi/mL	5.87E+04	3Q1-6-1420	
HSP 5702	108938			1.08E+03±6.41E+00	pCi/mL	7.60E-01	EPA906.0	
HSP 6001	106540			1.26E+03±7.75E+01	pCi/mL	1.06E+01	EPA906.0	
HSP 6401	106541			1.96E+01±6.64E-01	pCi/mL	4.47E-01	EPA906.0	
HSP 6402	108939			2.04E+01±8.53E-01	pCi/mL	6.01E-01	EPA906.0	
HSP 7101	106563			1.34E+03±5.35E+00	pCi/mL	5.04E-01	EPA906.0	
HSP 7102	108940			1.16E+03±6.20E+00	pCi/mL	6.69E-01	EPA906.0	
HSP 7601	106543			1.52E+02±1.73E+00	pCi/mL	4.50E-01	EPA906.0	
HSP 7602	108941			4.10E+02±3.56E+00	pCi/mL	6.17E-01	EPA906.0	
HSP 9701	106565			1.44E+03±9.22E+01	pCi/mL	1.19E+01	EPA906.0	
HSP 9702	108956			1.98E+03±7.74E+00	pCi/mL	6.10E-01	EPA906.0	
HSP 9702A	108957			1.99E+03±7.78E+00	pCi/mL	6.12E-01	EPA906.0	
HSP 9702A	108957			2.00E+03±7.79E+00	pCi/mL	6.11E-01	EPA906.0	
HSP 10301	106564			3.57E+02±1.40E+01	pCi/mL	2.69E+00	EPA906.0	
HSP 10302	108955			1.66E+03±5.76E+00	pCi/mL	4.77E-01	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.

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 appropriately over or through sample collection devices that tests for cleanliness of sampling equipment as well as those activities listed under field blank.
- 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): A method blank to which known concentrations of the analytes of interest are added prior to analysis. The blank spike is subjected to the entire analytical procedure in order to determine the accuracy of the procedure.

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 (CEC): 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 U.S. Environmental Protection Agency (EPA) can either

- pay for the site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work or
- 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, 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 of 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 person or 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 as well as the identity of the analyte of interest are assessed. Definitive data is 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 that 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 interferents only (ICSA) and one consisting of interferents mixed with the analytes (ICSAB), that are analyzed consecutively to verify the interelement and background correction factors for inductively coupled plasma metal analyses.

Interferents: 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, five micrograms of benzene in one kilogram of soil is five ppb; three milligrams of nitrate in one liter of water is three 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 driven purposes.
- An *Analysis Qualifier* is used to describes analytical conditions that apply to the datum. Analysis qualifiers are included here 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 means 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 peak 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 has settled out and deposited into beds.

Self-absorption: The internal absorption of radiation emitted by radioactive atoms by material in which the 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 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 that is 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 shall be 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).