

APPENDIX G

DATA QUALITY CONTROL SUMMARY REPORT

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CONTENTS

CONTENTS.....	G-iii
TABLES	G-v
ACRONYMS.....	G-v
G1.0 PURPOSE OF THIS REPORT	G-1
G2.0 QUALITY ASSURANCE PROGRAM.....	G-1
G2.1 MONTHLY PROGRESS REPORTS	G-2
G2.2 DAILY QUALITY CONTROL REPORTS	G-2
G2.3 LABORATORY “DEFINITIVE” LEVEL DATA REPORTING.....	G-2
G3.0 DATA VERIFICATION	G-3
G3.1 FIELD DATA VERIFICATION	G-3
G3.2 LABORATORY DATA VERIFICATION	G-3
G3.3 DEFINITION OF DATA QUALIFIERS (FLAGS)	G-4
G3.4 DATA ACCEPTABILITY	G-5
G4.0 DATA QUALITY EVALUATION	G-7
G4.1 METALS.....	G-7
G4.1.1 Soils and Sediments	G-7
G4.1.2 Waters and Field Quality Control Samples.....	G-7
G4.2 VOLATILE ORGANIC ANALYSES.....	G-7
G4.2.1 Soils and Sediments	G-7
G4.2.2 Waters and Field Quality Control Samples.....	G-8
G4.3 SEMIVOLATILE ORGANIC ANALYSES	G-8
G4.3.1 Soils and Sediments	G-8
G4.3.2 Waters and Field Quality Control Samples.....	G-8
G4.4 PESTICIDE/POLYCHLORINATED BIPHENYL ANALYSES	G-9
G4.4.1 Soils and Sediments	G-9
G4.4.2 Waters and Field Quality Control Samples.....	G-9
G4.5 EXPLOSIVE ANALYSES	G-10
G4.5.1 Soils and Sediments	G-10
G4.5.2 Waters and Field Quality Control Samples.....	G-10
G4.6 NITROGLYCERINE, NITROQUANIDINE, AND NITROCELLULOSE ANALYSES.....	G-10
G4.6.1 Soils and Sediments	G-10
G4.6.2 Waters and Field Quality Control Samples.....	G-11
G4.7 CYANIDE ANALYSES.....	G-11
G4.8 PRECISION	G-11
G4.9 SENSITIVITY	G-13
G4.10 REPRESENTATIVENESS AND COMPARABILITY	G-14
G4.11 COMPLETENESS.....	G-17
G5.0 DATA QUALITY ASSESSMENT SUMMARY	G-17

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TABLES

G-1	Ravenna Erie Burning Grounds – 2003 Investigation.....	G-5
G-2	Ravenna – Primary, Duplicate, and Split Sample Correlation Table Erie Burning Grounds – 2003 Investigation	G-6
G-3	Ravenna Erie Burning Grounds – 2003 Investigation Summary of Rejected Analytes (Laboratory) (grouped by medium and analysis group).....	G-6
G-5	Container Requirements for Soil and Sediment Samples at Ravenna Army Ammunition Plant, Ravenna, Ohio	G-15

ACRONYMS

AOC	area of concern
BHC	benzene hexachloride
DDT	dichlorodiphenyltrichloroethene
DNT	dinitrotoluene
DQA	data quality assessment
DQCR	Daily Quality Control Report
DQO	data quality objective
EBG	Erie Burning Grounds
EPA	U. S. Environmental Protection Agency
GPL	GPL Laboratories, Inc.
LCS	laboratory control sample
MDL	method detection level
MPR	monthly progress report
MS	matrix spike
MSD	matrix spike duplicate
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
REIMS	Ravenna Environmental Information Management System
RI	remedial investigation
RPD	relative percent difference
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SDG	sample delivery group
SVOC	semivolatile organic compound
USACE	U. S. Army Corps of Engineers
VOC	volatile organic compound

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G1.0 PURPOSE OF THIS REPORT

Environmental data must always be interpreted relative to its known limitations and its intended use. As can be expected in environmental media of this type, there are areas and data points where the user needs to be cautioned relative to the quality of the project information presented. The data verification process and this data quality assessment (DQA) are intended to provide current and future data users assistance throughout the interpretation of these data.

The purpose of this DQA Report is (1) to describe the quality control (QC) procedures followed to ensure data generated by Science Applications International Corporation (SAIC) during these investigations at the Ravenna Army Ammunition Plant (RVAAP) would meet project requirements, (2) to describe the quality of the data collected, and (3) to describe problems encountered during the course of the study and their solutions. A separate Chemical Quality Assessment Report will be completed by the U. S. Army Corp of Engineers (USACE) quality assurance (QA) representative and will cover data generated from QA split samples remanded to their custody.

This report provides an assessment of the analytical information gathered during the course of the RVAAP Phase II remedial investigation (RI) for the Erie Burning Grounds (EBG) area performed during 2003. It documents that the quality of the data employed for the RI report and evaluation met their objectives. Evaluation of field and laboratory QC measures will constitute the majority of this assessment; however, references will also be directed toward those QA procedures that establish data credibility. The primary intent of this assessment is to illustrate that data generated for these studies can withstand scientific scrutiny, are appropriate for their intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy.

Multiple activities were performed to achieve the desired data quality for this project. As discussed in the report, decisions were made during the initial scoping of the RI to define the quality and quantity of data required. Data quality objectives (DQOs) were established to guide the implementation of the field sampling and laboratory analysis [refer to the EBG Phase II RI Sampling and Analysis Plan (SAP) Addendum No. 1 (USACE 2003)]. A QA Program was established to standardize procedures and to document activities [refer to the RVAAP Facility-wide Quality Assurance Project Plan (QAPP) (USACE 2001) and the Phase II RI SAP Addendum No. 1]. This program provided a means to detect and correct any deficiencies in the process. Upon receipt by the project team, data were subjected to verification and validation review to identify and qualify problems related to the analysis. These review steps contributed to this final DQA where data used in the investigation are identified as having met the criteria and are being employed appropriately.

G2.0 QUALITY ASSURANCE PROGRAM

A Facility-wide QAPP and a Phase II RI QAPP Addendum for the EBG area were developed to guide the investigation. These plans are found in Part II of the Facility-wide SAP (USACE 2001) and the Phase II RI SAP Addendum No. 1 (USACE 2003). The purpose of these documents was to enumerate the quantity and type of samples to be taken to inspect the area of concern (AOC), and to define the quantity and type of QA/QC samples to be used to evaluate the quality of the data obtained.

The QAPP established requirements for both field and laboratory QC procedures. In general, field QC duplicates and QA split samples were required for each environmental sample matrix collected in the area being investigated; volatile organic compound (VOC) trip blanks were to accompany each cooler containing

water samples for VOC determinations; and analytical laboratory QC duplicates, matrix spikes (MSs), laboratory control samples (LCSs), and method blanks were required for every 20 samples or less of each matrix and analyte.

A primary goal of the RVAAP QA Program was to ensure that the quality of results for all environmental measurements were appropriate for their intended use. To this end, the QAPP and standardized field procedures were compiled to guide the investigation. Through the process of readiness review, training, equipment calibration, QC implementation, and detailed documentation, the project has successfully accomplished the goals set for the QA Program. Surveillances were conducted to determine the adequacy of field performance as evaluated against the QA plan and procedures.

G2.1 MONTHLY PROGRESS REPORTS

Monthly Progress Reports (MPRs) were completed by the SAIC Project Manager for the duration of the project. The MPRs contained the following information: work completed, problems encountered, corrective actions/solutions, summary of findings, and upcoming work. These reports were issued to the USACE, Louisville District Project Manager with copies forwarded to RVAAP and the Ohio Environmental Protection Agency. Access to these reports can be obtained through the USACE Project Manager.

G2.2 DAILY QUALITY CONTROL REPORTS

The Field Team Leader produced all Daily Quality Control Reports (DQCRs). These include information such as, but not limited to, sub-tier contractors on-site, equipment on-site, work performed summaries, QC activities, health and safety activities, problems encountered, and corrective actions. The DQCRs were submitted to the USACE, Louisville District Project Manager and may be obtained through his office.

G2.3 LABORATORY “DEFINITIVE” LEVEL DATA REPORTING

The QAPP for this project identified requirements for laboratory data reporting and identified GPL Laboratory (GPL), Gaithersburg, Maryland, as the laboratory for the project. During the execution of the project, the GPL facility performed all of the analyses. Environmental Protection Agency (EPA) “definitive” data have been reported, including the following basic information:

- a. laboratory case narratives
- b. sample results (soils/sediments reported per dry weight)
- c. laboratory method blank results
- d. LCS results
- e. laboratory sample MS recoveries
- f. laboratory duplicate results
- g. surrogate recoveries [VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and explosives)

- h. sample extraction dates
- i. sample analysis dates

This information from the laboratory, along with field information, provides the basis for subsequent data evaluation relative to sensitivity, precision, accuracy, representativeness, and completeness. These have been presented in Chapter 4.0.

G3.0 DATA VERIFICATION

The objective when evaluating the project data quality is to determine its usability. The evaluation is based on the interpretation of laboratory QC measures, field QC measures, and the project DQOs. This project implemented checklists to facilitate laboratory data review. These checklists were completed by the project-designated verification staff and were reviewed by the project laboratory coordinator. Data verification checklists for each laboratory sample delivery group (SDG) have been retained with laboratory data deliverables in the project files, with a copy of all checklists being forwarded to the USACE, Louisville District Project Chemist.

G3.1 FIELD DATA VERIFICATION

DQCRs were completed by the Field Team Leader. The DQCRs and other field-generated documents such as sampling logs, boring logs, daily health and safety summaries, daily safety inspections, equipment calibration and maintenance logs, and sample management logs were peer reviewed on-site. These logs and all associated field information have been delivered to the USACE, Louisville District Project Manager and can be obtained through his office.

G3.2 LABORATORY DATA VERIFICATION

Analytical data generated for this project have been subjected to a process of data verification and review. The following describes this systematic process and the evaluation activities performed. Several criteria have been established against which the data were compared and from which a judgment was rendered regarding the acceptance and qualification of the data. Because it is beyond the scope of this report to cite those criteria, the reader is directed to the following documents for specific detail:

- SAIC Technical Support Contractor QA Technical Procedure (TP-DM-300-7) Data Verification and Validation;
- EPA – National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013, February 1994;
- EPA – National Functional Guidelines for Organic Data Review, EPA-540/R-99/008, October 1999; and
- Phase II RI at the EBG at RVAAP, Ravenna, Ohio, SAP Addendum, SAIC, August 2003.

Upon receipt of field and analytical data, verification staff performed a systematic examination of the reports, following standardized data package checklists to ensure the content, presentation, and administrative validity

of the data. Discrepancies identified during this process were recorded and documented utilizing the checklists. As part of data verification, standardized laboratory electronic data deliverables were subjected to review. This technical evaluation ensured that all contract-specified requirements had been met, and that electronic information conformed to reported hardcopy data. QA Program Nonconformance Report and Corrective Action systems were implemented as required.

During the verification phase of the review and evaluation process, data were subjected to a systematic technical review by examining all field and analytical QC results and laboratory documentation, following EPA functional guidelines and SAIC internal procedures for laboratory data review. These data review guidelines define the technical review criteria, methods for evaluation of the criteria, and actions to be taken resulting from the review of these criteria. The primary objective of this phase was to assess and summarize the quality and reliability of the data for the intended use and to document factors that may affect the usability of the data. This process did not include in-depth review of raw data instrument out-put or recalculation of results from the primary instrument out-put. This data verification, validation, and analytical review process included, but was not necessarily limited to, the following parameters:

- data completeness;
- analytical holding times and sample preservation;
- calibration (initial and continuing);
- method blanks;
- sample results verification;
- surrogate recovery;
- LCS analysis;
- internal standard performance;
- MS recovery;
- duplicate analysis comparison;
- reported detection limits;
- compound, element, and isotope quantification;
- reported detection levels; and
- secondary dilutions.

As an end result of this phase of the review, the data were qualified based on the technical assessment of the verification/validation criteria. Qualifiers were applied to each field and analytical result to indicate the usability of the data for its intended purpose.

G3.3 DEFINITION OF DATA QUALIFIERS (FLAGS)

During the data verification process, all laboratory data were assigned appropriate data qualification flags and reason codes. Qualification flags are defined as follows:

- “U” Indicates the analyte was analyzed for, but not detected above, the level of the associated value.
- “J” Indicates the analyte was positively identified; however, the associated numerical value is an approximate concentration of the analyte in the sample.
- “UJ” Indicates the analyte was analyzed for, but not detected above, the associated value; however, the reported value is an estimate and demonstrates a decreased knowledge of its accuracy or precision.

- “R” Indicates the analyte value reported is unusable. The integrity of the analyte’s identification, accuracy, precision, or sensitivity has raised significant questions as to the reality of the information presented.
- “=” Indicates the analyte has been validated, the analyte has been positively identified, and the associated concentration value is accurate.

SAIC qualification reason codes have been provided as Attachment 1, while copies of verification/validation checklists and qualified data forms are on file with the analytical laboratory deliverable.

G3.4 DATA ACCEPTABILITY

Over 40 environmental soil, sediment, surface water, groundwater, and field QC samples were collected with approximately 8,000 discrete analyses (i.e., analytes) being obtained, reviewed, and integrated into the assessment (these totals do not include field measurements and field descriptions). The project produced acceptable results for over 99% of the sample analyses performed and successfully collected investigation samples under the direction of the SAP and the USACE, Louisville District. Data that were rejected are relegated primarily to delta-benzene hexachloride (BHC) and nitrocellulose non-detect levels in waters and sediments and a few 1,3,5-trinitrobenzene determinations in water samples.

Table G-1 presents a summary of the collected investigation samples. It tallies the successful collection of all targeted field QC and QA split samples, while Table G-2 identifies a cross reference for duplicate and QA split sample pair numbers. Table G-3 provides a summary of rejected analyses grouped by media and analyte category. The majority of estimated values were based on values observed between the laboratory method detection levels (MDLs) and the project reporting levels. Values determined in this region have an inherently higher variability and need to be considered estimated, at best.

Table G-1. Erie Burning Grounds Phase II RI Sample Summary

Area	Media	Environmental Samples	Field Duplicates	Trip Blanks	Equipment Rinsate Blanks	Site Source Water Blanks	USACE Split Samples
Laboratory	Soils	15	1	-	1	-	1
Analyses	Sediment	12	1	-	1	-	1
	Surface Waters	8	1	2	-	1	1
	Groundwater	8	1	3	1	1	1
	Waste Materials	3	-	2	-	-	-
Totals		46	4	7	3	2	4

RI = Remedial investigation.
 USACE = U. S. Army Corps of Engineers.

Table G-2. Primary, Duplicate, and Split Sample Correlation Table Erie Burning Grounds Phase II RI

Media	Station #	Sample #	Duplicate #	Laboratory SDG #	Split #
Surface Soil	EBG-132	EBG292	EBG330	310186	EBG331
Sediment	EBG-147	EBG307	EBG332	310186	EBG333
Surface Water	EBG-155	EBG319	EBG328	310186	EBG329
Groundwater	EBGmw-126	EBG286	EBG326	311141	EBG327

RI = Remedial investigation.
SDG = Sample delivery group.

**Table G-3. Erie Burning Grounds Phase II RI Summary of Rejected Analytes (Laboratory)
(grouped by medium and analysis group)**

Media	Analysis Group	Rejected/	Total	Percent Rejected
Soil (surface and subsurface)	Metals	0/	368	0.0
	Volatile Organics	0/	105	0.0
	Semivolatile Organics	0/	1,056	0.0
	Pesticides/PCBs	3/	84	3.6
	Explosives	0/	272	0.0
	Miscellaneous	0/	17	0.0
	Subtotal	3/	1,902	0.2
Sedimen	Metals	0/	299	0.0
	Volatile Organics	0/	245	0.0
	Semivolatile Organics	0/	858	0.0
	Pesticides/PCBs	7/	364	1.9
	Explosives	10/	221	4.5
	Miscellaneous	0/	19	0.0
	Subtotal	17/	2,006	0.8
Surface Water, Groundwater, and QC	Metals	0/	529	0.0
	Volatile Organics	0/	1,050	0.0
	Semivolatile Organics	0/	1,518	0.0
	Pesticides/PCBs	18/	644	2.8
	Explosives	6/	391	1.5
	Miscellaneous	0/	23	0.0
	Subtotal	24/	4,155	0.6
Project Total		44/	8,063	0.5

PCB = Polychlorinated biphenyl.
RI = Remedial investigation.
QC = Quality control.

For this RVAAP study, a total of four field duplicates were analyzed for soil, sediment, groundwater, and surface water media. Three equipment rinsates were collected and analyzed for this project. One site potable water source was sampled as EBG338 and one DI water source sample was collected as EBG339. Trip blanks for VOC determinations were analyzed relative to each shipment of VOC water samples, totaling seven analyses for this report.

G4.0 DATA QUALITY EVALUATION

G4.1 METALS

G4.1.1 Soils and Sediments

Analytical holding times were met for all samples. Initial calibration and continuing calibration criteria were achieved for all elements analyzed. Minor method blank levels or continuing calibration blank levels did result in qualification of selenium and thallium values as non-detect or estimated non-detect “U or UJ” in certain instances. Antimony concentrations were consistently qualified as estimated “J, UJ” due to low MS results; however, none of the values were rejected. Manganese was qualified as estimated in SDG 311030 for low MS results, while magnesium and potassium were qualified as estimated “J” due to MS recoveries being above criteria. Other metals exhibited acceptable recoveries and were not qualified. Occasional serial dilution variations caused zinc levels to be estimated in samples. LCS determinations were considered acceptable throughout the data set. Reporting levels are considered to be consistent with the QAPP goals. Laboratory duplicate comparisons were elevated for manganese and caused its data to be estimated as “J or UJ.” Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. None of the metal soil results were rejected. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in the Ravenna Environmental Information Management System (REIMS).

G4.1.2 Waters and Field Quality Control Samples

Analytical holding times were met for all samples. Initial calibration and continuing calibration criteria were achieved for all elements analyzed. Method blank levels and continuing calibration blank levels did result in the qualification of aluminum, barium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, lead, selenium, sodium, thallium, and zinc concentrations in samples as non-detect or estimated non-detect “U or UJ.” These qualifications did not impact the project’s ability to consistently meet project reporting levels. MS recoveries were satisfactory for all data and did not cause qualification of the data. Serial dilution variations caused potassium levels to be estimated in SDG 310186 samples. Variability in duplicate silver values caused its qualification as estimated “J or UJ” in SDG 311002. LCS determinations were considered acceptable throughout the data set. Reporting levels are considered to be consistent with the QAPP goals. Some data were qualified as estimated; however, none of the deviations were considered severe enough to reject any of the data. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.2 VOLATILE ORGANIC ANALYSES

G4.2.1 Soils and Sediments

Analytical holding times were met for all samples. All surrogate recoveries were acceptable with the exception of slightly low recoveries observed in samples EBG291, EBG306, EBG307, EBG310, and EBG332. This resulted in associated compound values being qualified as estimated “J or UJ” accordingly. Internal standard area counts and compound retention times were acceptable throughout the data analyses. Initial calibration criteria and continuing calibration criteria were met for all compounds. Method blanks were clear of contamination with the exception of acetone at levels of 10 µg/L and methylene chloride at levels of

6 to 8 µg/L. Associated sample results were qualified as non-detect “U,” as required. LCS and MS evaluations included all project-targeted analytes. All LCS recoveries were within criteria. MS recoveries and MS/matrix spike duplicate (MSD) relative percent difference (RPD) values were also acceptable. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.2.2 Waters and Field Quality Control Samples

Analytical holding times were met for all samples. All surrogate recoveries and internal standard areas were acceptable. Initial calibration criteria and continuing calibration criteria were met for all. Method blanks and trip blanks were clear of contamination with the exception of measurable levels of acetone, methylene chloride, and carbon disulfide. Observed blank values were at levels of 3 µg/L or less. Sample data for observed low acetone, methylene chloride, and carbon disulfide concentrations were, therefore, qualified as non-detect “U” based on 5 or 10 times the action level for these compounds. LCS and MS/MSD evaluations included all project-targeted analytes. All LCS recoveries were within criteria. MS recoveries and MS/MSD RPD values were acceptable for the water matrices. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.3 SEMIVOLATILE ORGANIC ANALYSES

G4.3.1 Soils and Sediments

Analytical holding times were met for all samples. Surrogate recoveries and internal standard area counts were acceptable with the exception of low surrogate recoveries for phenolic compounds in samples EBG303, EBG034, EBG305, and EBG313; associated compound analyses were estimated “UJ.” Continuing calibration verification percent differences greater than 25 caused 3,3'-dichlorobenzidine; pyrene; and bis(2-ethylhexyl)phthalate concentrations in soils to be estimated “J or UJ.” All other initial calibration criteria and continuing calibration criteria were met for all compounds. Method blanks were clear of contamination. LCS and MS/MSD evaluations included all project-targeted analytes. Pyrene was estimated “J or UJ” in samples due to elevated LCS recoveries. Other LCS recoveries were within criteria. MS recoveries were considered acceptable. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.3.2 Waters and Field Quality Control Samples

Analytical holding times were met for all samples. Surrogate recoveries, internal standard area counts, and retention times were acceptable throughout the data set. Initial calibration criteria and continuing calibration criteria were met, with the exception of slightly elevated initial relative standard deviations for benzaldehyde resulting in its qualification as estimated “UJ.” Bis(2-ethylhexyl)phthalate and di-n-butylphthalate levels of 1 to 5 µg/L were observed in method blanks resulting in qualification of these compounds as non-detect “U” when observed in samples. LCS and MS/MSD evaluations included all project-targeted analytes. Low LCS recovery information did result in the qualification of 1,4-dichlorobenzene data as estimated “UJ.” Other LCS and MS water matrix recoveries were within criteria. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered

technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.4 PESTICIDE/POLYCHLORINATED BIPHENYL ANALYSES

G4.4.1 Soils and Sediments

Analytical holding times were met for all samples. Surrogate recoveries were acceptable with this data set. Continuing calibration verification percent differences greater than 25 caused the qualification of heptachlor; 4,4'-dichlorodiphenyldichloroethene; 4,4'-dichlorodiphenyltrichloroethene (DDT); methoxychlor; endrin; endrin ketone; alpha-BHC; and endosulfan I as estimated "UJ" in soils. All other initial calibration criteria and continuing calibration criteria were met for compounds. Method blanks were clear of contamination. LCS and MS/MSD evaluations included the project-targeted pesticides; however, PCB evaluations only included aroclors 1016 and 1260. PCBs LCS and MS/MSD results were acceptable for the data set. LCS recoveries were low for alpha-BHC, delta-BHC, and endosulfan sulfate and slightly elevated for endosulfan II and endrin aldehyde, causing data to be estimated "UJ." Very low LCS recoveries for delta-BHC resulted in rejection "R" of this compound in samples EBG291, EBG292, EBG306, EBG307, EBG308, EBG309, EBG310, EBG311, EBG330, and EBG332. Poor MS recovery for delta-BHC also caused its rejection in sample EBG292. Other LCS and MS recoveries were acceptable. Positive pesticide compound results for endrin in sample EBG317 and methoxychlor in sample EBG308 were qualified as estimated "J" based on the percent difference between the primary column quantification and the secondary column quantification. While some of these data were qualified as estimated, only ten data points exhibited enough significant deviations to be rejected. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.4.2 Waters and Field Quality Control Samples

Analytical holding times were met for all samples. All surrogate recoveries were acceptable. All initial calibration criteria and continuing calibration criteria were met for all compounds with the exception of elevated continuing calibration verification percent differences for PCBs in SDGs 31002 and 31005, and endosulfan I in SDG 311148. Associated data were qualified as estimated "UJ." Method blanks were clear of contamination. LCS and MS/MSD evaluations included the project-targeted pesticides; however, PCB evaluations only included aroclors 1016 and 1260. Water LCS recoveries were within criteria with the exception of elevated recoveries for beta-BHC, endosulfan II, and endrin aldehyde, and low recoveries for dieldrin, endosulfan sulfate, and endrin ketone. These compounds were appropriately qualified as estimated "UJ." Low LCS recoveries for 11 pesticide compounds caused most pesticide data for SDG 312038 to be estimated "UJ." In addition, very low LCS recoveries for delta-BHC resulted in rejection "R" of this compound in samples EBG283, EBG284, EBG285, EBG288, EBG289, EBG318, EBG319, EBG320, EBG321, EBG322, EBG323, EBG324, EBG325, EBG328, EBG334, EBG335, EBG338, and EBG339. MS information was acceptable with the exception of delta-BHC being very low. This compound had already been qualified as rejected in all associated samples. Positive pesticide compound results for 4,4'-DDT in SDG 311141 and endrin aldehyde in SDG 311003 were qualified as estimated "J" based on the percent difference between the primary column quantification and the secondary column quantification. While some of these data were qualified as estimated, only 18 data points exhibited enough significant deviations to be rejected. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.5 EXPLOSIVE ANALYSES

G4.5.1 Soils and Sediments

Analytical holding times were met for all samples. Continuing calibration verification percent differences greater than 25 caused hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) values in SDG 311030 to be estimated "UJ." All other initial calibration criteria and continuing calibration criteria were met for all compounds. None of the method blanks exhibited any explosive compound concentrations. Surrogate compound recoveries were acceptable for all analyses. LCS recoveries were elevated for 2,4-dinitrotoluene (DNT) and 4-amino-2,6-DNT causing their data to be estimated "UJ." MS results were also elevated for 4-amino-2,6-DNT resulting in its estimation. Other LCS and MS/MSD recoveries were within criteria. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.5.2 Waters and Field Quality Control Samples

Analytical holding times were met for samples. All initial calibration criteria and continuing calibration criteria were met for all compounds. Method blanks were clear of contamination. Surrogate compound recoveries were acceptable with the exception of low recoveries in samples EBG322 and EBG323, resulting in qualification of data as estimated "UJ" for these analyses. LCS evaluations for water analyses varied, with tetryl recoveries being low in SDGs 310186, 311002, and 311005. 2,4-DNT; RDX; 3-nitrotoluene; and 4-amino-2,6-DNT were elevated in SDGs 311003, 311141, 311148, 311169, and 312038. 2,4,6-Trinitrotoluene; 4-amino-2,6-DNT; and tetryl were low in SDG 311169. All associated results were qualified as estimated "UJ." Very low LCS recovery for 1,3,5-trinitrobenzene in SDG 311169 caused its values to be rejected "R" in samples EBG283, EBG284, EBG288, and EBG289. Other LCS and MS recoveries were within criteria. While some of these data were qualified as estimated, only four data points exhibited enough significant deviations to be rejected. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.6 NITROGLYCERINE, NITROQUANIDINE, AND NITROCELLULOSE ANALYSES

G4.6.1 Soils and Sediments

Analytical holding times were met for all samples. Continuing calibration verification percent differences greater than 25 caused nitroglycerine and nitrocellulose values in SDG 311030 and nitrocellulose values in SDGs 310186, 311002, and 311005 to be estimated "UJ." All other initial calibration criteria and continuing calibration criteria were met for all compounds. None of the method blanks exhibited any target compound concentrations. LCS recoveries were acceptable for nitroglycerine and nitroquanidine; however, very low recoveries in conjunction with reported non-detect values resulted in the rejection "R" of nitrocellulose for samples EBG308, EBG309, EBG310, EBG311, EBG312, EBG313, EBG314, EBG315, EBG316, and EBG317. MS results were acceptable for nitroquanidine, elevated for nitroglycerine in SDG 311030 causing data to be estimated, and low for nitrocellulose contributing to its rejection for non-detect sample results. Reporting levels were met with the exception of nitroglycerine being reported at 10 mg/kg versus the project goal of 3 mg/kg. Some analyses were qualified as estimated and ten nitrocellulose non-detect values were

rejected. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.6.2 Waters and Field Quality Control Samples

Analytical holding times were met for most samples. Nitroquanidine holding times exceeded the SVOC limits slightly and were qualified as estimated “UJ” for all water analyses. Continuing calibration verification percent differences greater than 25 caused nitrocellulose values in all SDGs to be estimated “UJ.” All other initial calibration criteria and continuing calibration criteria were met for compounds. None of the method blanks exhibited any target compound concentrations. LCS recoveries were acceptable for nitroglycerine and nitroquanidine; however, low recoveries resulted in all nitrocellulose values to be estimated “UJ,” and very low recoveries in SDG 310186 in conjunction with reported non-detect values resulted in the rejection “R” of nitrocellulose for samples EBG318 and EBG328. MS results were acceptable for nitroquanidine and nitroglycerine. Low MS recoveries for nitrocellulose contributed to its estimation in SDG 311002. Reporting levels were met with the exception of nitroglycerine being reported at 16 µg/L versus the project goal of 3 µg/L. Some analyses were qualified as estimated and two nitrocellulose non-detect values were rejected. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.7 CYANIDE ANALYSES

Analytical holding times were exceeded for SDGs 310186, 311030, 311002, 311005, 311169, and 312038 cyanide determinations. Analyses performed outside holding times were qualified as estimated “J or UJ.” Initial calibration criteria and continuing calibration criteria were met for all analyses. All method blanks were clear of contamination for cyanide. MS data were satisfactory. LCS recoveries were consistently within criteria. While some of these data were qualified as estimated, only a few data points exhibited enough significant deviations to be rejected. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the EBG Phase II RI report, and can be found in REIMS.

G4.8 PRECISION

Field duplicate samples were collected to ascertain the contribution to variability (i.e., precision) due to the combination of environmental media, sampling consistency, and analytical precision. Field duplicate samples were collected from the same spatial and temporal conditions as the primary environmental sample. Soil and sediment samples were collected from the same sampling device, after homogenization for all analytes except VOCs.

Field duplicate comparison information in Table G-4 presents the absolute difference or RPD for field duplicate measurements, by analyte. RPD was calculated only when both samples were > 5 times the reporting level. When one or both sample values were between the reporting level and 5 times the reporting level, the absolute difference was evaluated. If both samples were not detected for a given analyte, precision was considered acceptable. To review information, this DQA has implemented general criteria for comparison of absolute difference measurements and RPDs. RPD criteria were set at 50 and absolute difference criteria were set at 3 times the reporting level.

Table G-4. Field Duplicate Comparison, Erie Burning Grounds Phase II RI

Analysis	EBG292/EBG330 Surface Soil RPD	EBG307/EBG332 Sediment RPD	EBG319/EBG328 Surface Water RPD	EBG286/EBG326 Ground Water RPD
<i>Metals</i>				
Aluminum	1	18	30	*
Antimony	*	*	*	*
Arsenic	11	13	*	2
Barium	5	12	1	0
Beryllium	9	*	*	*
Cadmium	*	*	*	*
Calcium	24	62	5	1
Chromium	10	17	*	*
Cobalt	0	7	*	*
Copper	8	23	*	*
Iron	3	68	12	9
Lead	3	27	*	*
Magnesium	1	23	4	1
Manganese	22	64	6	2
Mercury	*	*	*	*
Nickel	13	12	*	6
Potassium	19	30	28	2
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	4	9	7	3
Thallium	*	*	*	*
Vanadium	5	18	*	*
Zinc	6	24	*	1
<i>Cyanide</i>				
	*	na	*	*
<i>Volatile Organic Compounds</i>				
All compounds	*	*	*	*
<i>Semivolatile Organic Compounds</i>				
All compounds	*	*	*	*
<i>Explosive Compounds</i>				
All compounds	*	*	*	*
<i>Pesticide/PCB Compounds</i>				
All compounds	*	*	*	*

* = At least one value is <5 times the reporting level, and duplicate comparison is within 3 times the reporting level.

na = Not applicable.

PCB = Polychlorinated biphenyl.

RI = Remedial investigation.

RPD = Relative percent difference.

RVAAP = Ravenna Army Ammunition Plant.

UNAC = At least one value is < 5 times the reporting level, and duplicate comparison is NOT within 3 times the reporting level.

Field duplicate metal comparisons are considered good. Of 50 RPD observations in field duplicates, 47 (94%) were < 50 or had acceptable absolute differences. Explosive, VOC, SVOC, pesticide, PCB, and cyanide field duplicate comparisons were all acceptable.

G4.9 SENSITIVITY

Determination of minimum detectable values allows the investigation to assess the relative confidence that can be placed in a value relative to the magnitude or level of analyte concentration observed. The closer a measured value comes to the minimum detectable concentration, the less confidence and more variation the measurement will have. Project sensitivity goals were expressed as quantitation level goals in the QAPP. These levels were achieved or exceeded throughout the analytical process, with the exception of thallium in water and nitroglycerine in soil and water. Actual laboratory MDLs achieved during this investigation achieved project quantitation level goals. Individual analyte reporting levels varied due to matrix differences and contaminant analyte concentrations. Reporting levels were elevated in soils and sediments due to inherent moisture content variability and results being reported in the standard dry weight format. Reporting level variations have been considered during data interpretation and statistical applications.

Method blank determinations were performed with each analytical sample batch for each analyte under investigation. These blanks were evaluated during data review to determine their potential impact on individual data points, if any. Review action levels are set at 5 times the reporting level for all analytes, except those designated as common laboratory contaminants (i.e., methylene chloride, acetone, toluene, 2-butanone, and phthalate compounds) with action levels set at 10 times the reporting levels. During data review, reported sample concentrations are assessed against method blank action levels and the following qualifications are made when reportable quantities of analytes were observed in the associated method blank.

- When the analyte sample concentration is above 5 or 10 times the action level, the data are not qualified and it is considered a positive value. It will receive a validation reason code of “F01, F08.”
- When the analyte sample concentration is determined below 5 or 10 times the action level but above the reporting level, the data are considered impacted by the method blank and the value reported is qualified as a non-detect at the analyte value reported. These data are then qualified as “U” with a reason code of “F01, F07.”
- When the analyte sample concentration is determined below 5 or 10 times the action level and below the reporting level, the data are considered impacted by the method blank and the value reported is qualified as a non-detect at the reporting level. These data are then qualified as “U” with a reason code of “F01, F06.”

No data were rejected as a result of method blank contamination; however, various analytes were qualified as non-detect “U,” according to the above validation reason codes.

Evaluation of overall project sensitivity can be gained through review of field blank information. These actual sample analyses may provide a comprehensive look at the combined sampling and analysis sensitivity attained by the project. Field QC blanks obtained during sampling activities at RVAAP included samples of VOC trip blank waters and a site potable water source.

There were only minor concentrations of the VOCs carbon disulfide, bromomethane, chloromethane, and 2-butanone detected in project trip blanks. The concentrations observed were carbon disulfide from 0.34 to 3.5 J µg/L (reporting level at 1 µg/L); 2-butanone at 2.4 µg/L (reporting level at 5 µg/L); bromomethane at

0.38 J $\mu\text{g/L}$ (reporting level at 1 $\mu\text{g/L}$); and chloromethane at 0.36 $\mu\text{g/L}$ (reporting level at 1 $\mu\text{g/L}$). The impact of these values has been assessed during data review and values have been qualified where necessary. It is, therefore, determined that VOC analyses were not affected through the transportation and storage process, and that the procedures and precautions employed were effective in preserving the integrity of the sample analysis.

Equipment rinsate samples (EBG334, EBG335, and EBG336) did not exhibit any concentration of VOCs. They showed traces of the SVOC bis(2-ethylhexyl)phthalate at 1.7 J $\mu\text{g/L}$, minor levels of the explosives RDX at 0.46 $\mu\text{g/L}$, 1,3-DNT at 0.12 $\mu\text{g/L}$, 2,6-DNT at 0.19 $\mu\text{g/L}$, and 2,4,6-trinitrotoluene at 0.09 $\mu\text{g/L}$. Minor levels of calcium, sodium, lead, nickel, and zinc were also observed. All rinsates were associated with soil sampling equipment cleaning operations and none of the contaminant levels impacted the sample values being reported.

Field source water blank EBG339 (DI water source) exhibited a few analyte levels similar to those observed in the equipment blanks. Source water blank EBG338 (potable water source) contained normal levels of barium, calcium, copper, iron, lead, magnesium, potassium, sodium, and zinc for this type of water source, with minor concentrations of 1,1,2,2-tetrachloroethane at 1.8 $\mu\text{g/L}$ and bis(2-ethylhexyl)phthalate at 10J $\mu\text{g/L}$. There is no indication that the source waters impacted associated sample levels.

G4.10 REPRESENTATIVENESS AND COMPARABILITY

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental site and is the qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include proper preservation, holding times, use of standard sampling and analytical methods, and determination of matrix or analyte interferences. Samples were delivered to the laboratory by overnight express courier, were received in good condition, and at appropriate temperature. Some analyses were conducted outside the holding time because of delays or the need for re-extraction and re-analysis due to analytical difficulties or low surrogate recoveries. These data were qualified accordingly as outside of the holding time, per EPA protocol. These instances occurred when initial QC results required the laboratory to repeat analyses beyond the standard holding time, but within the direction and guidance of the analytical methodology. Sample preservation, analytical methodologies, and soil sampling methodologies were documented to be adequate and consistently applied. Estimated values qualified as being outside of the holding time were utilized with the requisite precautions in some of the report data interpretations. Use of these data might result in some additional uncertainty in specific interpretations where the values were incorporated, but are not believed to have detracted from achieving the overall project DQOs.

Comparability, like representativeness, is a qualitative term relative to an individual project data set. These RVAAP AOC investigations employed appropriate sampling methodologies, site surveillance, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through the proper implementation and documentation of these standard practices, the project has established the confidence that the data will be comparable to other project and programmatic information. Table G-5 presents the standardized parameter groups, analytical methods, sample containers, preservation techniques, and associated holding times.

Table G-5. Container Requirements for Soil and Sediment Samples at Ravenna Army Ammunition Plant, Ravenna, Ohio

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds 5030/8260B	One 2-oz glass jar with Teflon [®] -lined cap (no headspace)	20 g	Cool, 4°C	14 day
Semivolatile Organic Compounds 3540/8270C	One 8-oz glass jar with Teflon [®] -lined cap	60 g	Cool, 4°C	14 day (extraction) 40 day (analysis)
Pesticide Compounds 3540/8081A	Include in SVOC container	60 g	Cool, 4°C	14 day (extraction) 40 day (analysis)
PCBs 3540/8082	Include in SVOC container	60 g	Cool, 4°C	14 day (extraction) 40 day (analysis)
Explosive Compounds 8330	One 4-oz glass jar with Teflon [®] -lined cap	60 g	Cool, 4°C	14 day (extraction) 40 day (analysis)
Propellant Compounds 8330, 353.2, and UV-HPLC	One 4-oz glass jar with Teflon [®] -lined cap	60 g	Cool, 4°C	14 day (extraction) 40 day (analysis)
Metals 6010B and 7471	One 4-oz glass jar with Teflon [®] -lined cap	50 g	Cool, 4°C	180 day; Hg @ 28 day
Cyanide 9012A	Include in metals container	25 g	Cool, 4°C	14 day
Hexavalent Chromium 7196A	Include in metals container	25 g	Cool, 4°C	24 hr

Table G-5. Container Requirements for Water Samples at Ravenna Army Ammunition Plant, Ravenna, Ohio (continued)

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds 5030/8260B	Three 40-mL glass vials with Teflon [®] -lined septum (no headspace)	80 mL	HCl to pH <2 Cool, 4°C	14 day
Semivolatile Organic Compounds 3520/8270C	Two 1-L amber glass bottle with Teflon [®] -lined lid	1000 mL	Cool, 4°C	7 day (extraction) 40 day (analysis)
Pesticide Compounds 3520/8081A	One 1-L amber glass bottle with Teflon [®] -lined lid	1000 mL	Cool, 4°C	7 day (extraction) 40 day (analysis)
PCBs 3520/8082	One 1-L amber glass bottle with Teflon [®] -lined lid	1000 mL	Cool, 4°C	7 day (extraction) 40 day (analysis)
Explosive Compounds 8330	One 1-L amber glass bottle with Teflon [®] -lined lid	1000 mL	Cool, 4°C	7 day (extraction) 40 day (analysis)
Propellant Compounds 8330, 353.2, and UV-HPLC	One 1-L amber glass bottle with Teflon [®] -lined lid	1000 mL	Cool, 4°C	7 day (extraction) 40 day (analysis)
Metals 6010A and 7470	One 1-L polybottle	500 mL	HNO ₃ to pH <2 Cool, 4°C	180 day; Hg @ 28 day
Cyanide 9012A	500-mL polybottle	500 mL	NaOH to pH >12 Cool, 4°C	14 day
Anions (Br, Cl, F, SO ₄) 300.0	250-mL polybottle	250 mL	Cool, 4°C	28 day
Nitrate-Nitrite 353.2	250-mL polybottle	100 mL	H ₂ SO ₄ to pH <2 Cool, 4°C	28 day
TSS/TDS 160.2 and 160.1	500-mL polybottle	100 mL ea.	Cool, 4°C	28 day

PCB = Polychlorinated biphenyl.

RVAAP = Ravenna Army Ammunition Plant.

SVOC = Semivolatile organic compound.

TDS = Total dissolved solids.

TSS = Total suspended solids.

G4.11 COMPLETENESS

Usable data are defined as those data that pass individual scrutiny during the verification and validation process and are accepted for unrestricted application to the human health risk assessment evaluation or equivalent-type applications. It has been determined that estimated data are acceptable for RVAAP project objectives.

DQOs for the EBG Phase II RI data have been achieved. The project produced usable results for over 99% of the sample analyses performed and successfully collected all the samples planned.

G5.0 DATA QUALITY ASSESSMENT SUMMARY

The overall quality of RVAAP EBG Phase II RI information meets or exceeds the established project objectives. Through proper implementation of the project data verification and assessment process, project information has been determined to be acceptable for use.

Data, as presented, have been qualified as usable, estimated “J or UJ,” or rejected “R.” Data that have been estimated provide indications of either accuracy, precision, or sensitivity being less than desired but adequate for interpretation. Data that are not acceptable for use have been rejected. Qualifiers have been applied to data when necessary.

Data produced for this project demonstrate that they can withstand scientific scrutiny, are appropriate for its intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy. Data integrity has been documented through proper implementation of QA and QC measures. The environmental information presented has an established confidence that allows utilization for the project objectives and provides data for future needs.

G6.0 REFERENCES

USACE (U. S. Army Corps of Engineers) 2001. *Facility-wide Sampling and Analysis Plan (SAP) for the Ravenna Army Ammunition Plant, Ravenna, Ohio*, DACA62-00-D-0001, DO CY 02, March.

USACE (U. S. Army Corps of Engineers) 2003. *Sampling and Analysis Plan Addendum No. 1 for the Phase II Remedial Investigation of Erie Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, F44650-99-D-0007, ECAS 186, October.

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ATTACHMENT 1
SAIC DATA VALIDATION FLAGGING CODES

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DATA VALIDATION REASON CODES

Organic, Inorganic, and Radiological Analytical Data

Holding Times

- A01 Extraction holding times were exceeded.
- A02 Extraction holding times were grossly exceeded.
- A03 Analysis holding times were exceeded.
- A04 Analysis holding times were grossly exceeded.
- A05 Samples were not preserved properly.
- A06 Professional judgment was used to qualify the data.

GC/MS Tuning

- B01 Mass calibration was in error, even after applying expanded criteria.
- B02 Mass calibration was not performed every 12 hrs.
- B03 Mass calibration did not meet ion abundance criteria.
- B04 Professional judgment was used to qualify the data.

Initial/Continuing Calibration – Organics

- C01 Initial calibration RRF was < 0.05.
- C02 Initial calibration RDS was > 30%.
- C03 Initial calibration sequence was not followed as required.
- C04 Continuing calibration RRF was < 0.05.
- C05 Continuing calibration %D was > 25%.
- C06 Continuing calibration was not performed at the required frequency.
- C07 Resolution criteria were not met.
- C08 RPD criteria were not met.
- C09 RDS criteria were not met.
- C10 Retention time of compounds was outside windows.
- C11 Compounds were not adequately resolved.
- C12 Breakdown of endrin or DDT was > 30%.
- C13 Combined breakdown of endrin/DDT was > 30%.
- C14 Professional judgment was used to qualify the data.

Initial/Continuing Calibration – Inorganics

- D01 ICV or CCV were not performed for every analyte.
- D02 ICV recovery was above the upper control limit.
- D03 ICV recovery was below the lower control limit.
- D04 CCV recovery was above the upper control limit.
- D05 CCV recovery was below the lower control limit.
- D06 Standard curve was not established with the minimum number of standards.
- D07 Instrument was not calibrated daily or each time the instrument was set up.
- D08 Correlation coefficient was < 0.995.
- D09 Mid range cyanide standard was not distilled.
- D10 Professional judgment was used to qualify the data.

ICP and Furnace Requirements

- E01 Interference check sample recovery was outside the control limit.
- E02 Duplicate injections were outside the control limit.
- E03 Post-digestion spike recovery was outside the control limit.
- E04 MSA was required but not performed.
- E05 MSA correlation coefficient was < 0.995 .
- E06 MSA spikes were not at the correct concentration.
- E07 Serial dilution criteria were not met.
- E08 Professional judgment was used to qualify the data.

Blanks

- F01 Sample data were qualified as a result of the method blank.
- F02 Sample data were qualified as a result of the field blank.
- F03 Sample data were qualified as a result of the equipment rinsate.
- F04 Sample data were qualified as a result of the trip blank.
- F05 Gross contamination exists.
- F06 Concentration of the contaminant was detected at a level below the CRQL.
- F07 Concentration of the contaminant was detected at a level less than the action limit, but greater than the CRQL.
- F08 Concentration of the contaminant was detected at a level that exceeds the action level.
- F09 No laboratory blanks were analyzed.
- F10 Blank had a negative value > 2 times the IDL.
- F11 Blanks were not analyzed at required frequency.
- F12 Professional judgment was used to qualify the data.

Surrogate/Radiological Chemical Recovery

- G01 Surrogate/radiological chemical recovery was above the upper control limit.
- G02 Surrogate/radiological chemical recovery was below the lower control limit.
- G03 Surrogate recovery was $< 10\%$.
- G04 Surrogate recovery was zero.
- G05 Surrogate/radiological chemical recovery data were not present.
- G06 Professional judgment was used to qualify the data.
- G07 Radiological chemical recovery was $< 20\%$.
- G08 Radiological chemical recovery was $> 150\%$.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

- H01 MS/MSD recovery was above the upper control limit.
- H02 MS/MSD recovery was below the lower control limit.
- H03 MD/MSD recovery was $< 10\%$.
- H04 MS/MSD pairs exceed the RPD limit.
- H05 No action was taken on MS/MSD limit.
- H06 Professional judgment was used to qualify the data.
- H07 Radiological MS/MSD recovery was $< 20\%$.
- H08 Radiological MS/MSD recovery was $> 160\%$.
- H09 Radiological MS/MSD samples were not analyzed at the required frequency.

Matrix Spike

- I01 MS recovery was above the upper control limit.
- I02 MS recovery was below the lower control limit.
- I03 MS recovery was < 30%.
- I04 No action was taken on MS data.
- I05 Professional judgment was used to qualify the data.

Laboratory Duplicate

- J01 Duplicate RPD/radiological duplicate error ratio (DER) was outside the control limit.
- J02 Duplicate sample results were > 5 times the CRDL.
- J03 Duplicate sample results were < 5 times the CRDL.
- J04 Professional judgment was used to qualify the data.
- J05 Duplicate was not analyzed at the required frequency.

Internal Area Summary

- K01 Area counts were outside the control limits.
- K02 Extremely low area counts or performance was exhibited by a major drop off.
- K03 IS retention time varied by more than 30 seconds.
- K04 Professional judgment was used to qualify the data.

Pesticide Cleanup Checks

- L01 10% recovery was obtained during either check.
- L02 Recoveries during either check were > 120%.
- L03 GPC cleanup recoveries were outside the control limits.
- L04 Florisil cartridge cleanup recoveries were outside the control limits.
- L05 Professional judgment was used to qualify the data.

Target Compound Identification

- M01 Incorrect identifications were made.
- M02 Qualitative criteria were not met.
- M03 Cross contamination occurred.
- M04 Confirmatory analysis was not performed
- M05 No results were provided.
- M06 Analysis occurred outside 12-hr GC/MS window.
- M07 Professional judgment was used to qualify the data.
- M08 The %D between the two pesticide/PCB column checks was > 25%.

Compound Quantitation and Reported CRQLs

- N01 Quantitation limits were affected by large off-scale peaks.
- N02 MDLs reported by the laboratory exceeded corresponding CRQLs.
- N03 Professional judgment used to qualify the data.

Tentatively Identified Compounds (TICs)

- O01 Compound was suspected laboratory contaminant and was not detected in the blank.
- O02 TIC result was not above 10 times the level found in the blank.
- O03 Professional judgment was used to qualify analytical data.

Laboratory Control Samples (LCSs)

- P01 LCS recovery was above upper control limit.
- P02 LCS recovery was below lower control limit.
- P03 LCS recovery was < 50%.
- P04 No action was taken on the LCS data.
- P05 LCS was not analyzed at required frequency.
- P06 Radiological LCS recovery was < 50% for aqueous samples; < 40% for solid samples.
- P07 Radiological LCS recovery was > 150% for aqueous samples; > 160% for solid samples.
- P08 Professional judgment was used to qualify the data.

Field Duplicate

- Q01 Field duplicate RPDs were > 30% for waters and/or > 50% for soils.
- Q02 Radiological field duplicate error ratio (DER) was outside the control limit.
- Q03 Duplicate sample results were > 5 times the CRDL.
- Q04 Duplicate sample results were < 5 times the CRDL.

Radiological Calibration

- R01 Efficiency calibration criteria were not met.
- R02 Energy calibration criteria were not met.
- R03 Resolution calibration criteria were not met.
- R04 Background determination criteria were not met.
- R05 Quench curve criteria were not met.
- R06 Absorption curve criteria were not met.
- R07 Plateau curve criteria were not met.
- R08 Professional judgment was used to qualify the data.

Radiological Calibration Verification

- S01 Efficiency verification criteria were not met.
- S02 Energy verification criteria were not met.
- S03 Resolution verification criteria were not met.
- S04 Background verification criteria were not met.
- S05 Cross-talk verification criteria were not met.
- S06 Professional judgment was used to qualify the data.