

APPENDIX G
QUALITY CONTROL SUMMARY REPORT

Phase II Remedial Investigation of Load Line 1

at the
Ravenna Army Ammunition Plant
Ravenna, Ohio

March 2001

1.0 PURPOSE OF THIS REPORT

The purpose of this Quality Control Summary Report (QCSR) is (1) to describe the Quality Control (QC) procedures followed to ensure data generated by SAIC during these investigations at 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 (CQAR) will be completed by USACE's QA representative covering 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 RI for LL1 performed during 2000. It documents that the quality of the data employed for the RI report and evaluation met the project 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 must be performed to achieve the desired data quality in 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. DQOs were established to guide the implementation of the field sampling and laboratory analysis (refer to the RVAAP SAP Addendum September 2000). A QA program was established to standardize procedures and to document activities (refer to the RVAAP Facility-Wide QAPjP April 1996 and the Addendum of October 1999). This program provided a means to detect and correct any deficiencies in the process. Upon receipt by the project team, data was subjected to verification and validation review that identified and qualified problems related to the analysis. The findings of these review steps contribute to this final data quality assessment, which defines that data used in the investigation met the criteria and are employed appropriately.

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2.0 QUALITY ASSURANCE PROGRAM

A Facility-Wide Quality Assurance Project Plan (QAPjP) and a Phase II RI QAPjP Addendum for the Load Line 1 Area were developed to guide the investigation. These plans are found in Part II of the Facility-Wide SAP (SAIC, April 1996) and the Phase II Remedial Investigation of Load Line 1, SAP Addendum No. 2 (SAIC, September 2000) for the RVAAP, Ravenna, Ohio. The purposes of these documents were to enumerate the quantity and type of samples to be taken to investigate the AOC and to define the quantity and type of QA/QC samples to be used to evaluate the quality of the data obtained.

The QAPjP 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; VOC trip blanks were to accompany each cooler containing water samples for VOC determinations; and analytical laboratory QC duplicates, matrix spikes, laboratory control samples, and method blanks were required for every 20 samples or less of each matrix and analyte.

A primary goal of the RVAAP QA program is to ensure that the quality of results for all environmental measurements are appropriate for their intended use. To this end, the QAPjP 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.

2.1 MONTHLY PROGRESS REPORTS

Monthly Progress Reports (MPRs) were completed by the SAIC project manager for each month of the project's duration. 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 the Ohio EPA. Access to these reports can be obtained through the Corp project manager.

2.2 DAILY QUALITY CONTROL REPORTS (DQCRS)

The field team leader produced all Daily Quality Control Reports. These include information such as, but not limited to, on-site sub-tier contractors, on-site equipment, 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.

2.3 LABORATORY "DEFINITIVE" LEVEL DATA REPORTING

The QAPjP for this project identified requirements for laboratory data reporting and identified Severn Trent Laboratories (STL) of North Canton, Ohio, as the lab for the project. During the execution of the project, the North Canton facility took the lead and performed the majority of the analyses, while STL, Knoxville performed explosives by High Pressure Liquid Chromatography (HPLC) and STL, Sacramento performed nitroguanidine and nitrocellulose determinations. EPA "definitive" data have been reported, including the following basic information:

1. laboratory case narratives

2. sample results (soils/sediments reported per dry weight)
3. laboratory method blank results
4. laboratory control standard results
5. laboratory sample matrix spike recoveries
6. laboratory duplicate results
7. surrogate recoveries (VOCs, SVOCs, PCBs, Explosives)
8. sample extraction dates
9. 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.

3.0 DATA VERIFICATION

When evaluating the project data quality, the objective 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 data verification checklists to facilitate laboratory data verification. 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.

3.1 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 Louisville Corp project manager and can be obtained through his office.

3.2 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-94/012, February 1994; and
- Phase II Remedial Investigation at Load Line 1 at the RVAAP, Ravenna, Ohio, Sampling and Analysis Plan Addendum No. 2, SAIC, September 2000.

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 hard-copy data. QA program NCR 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 validation. These data validation

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 output or recalculation of results from the primary instrument output. This data verification 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
- Laboratory control standard (LCS) analysis
- Internal standard performance
- Matrix spike (MS) recovery
- Duplicate analysis comparison
- Reported detection limits
- Compound, element, isotope quantification
- Reported detection levels
- Secondary dilutions.

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

3.3 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 reviewed and 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.

3.4 DATA ACCEPTABILITY

More than 450 environmental soil, sediment, surface water, groundwater, and field QC samples were collected with approximately 24,000 discrete analyses (i.e., analytes) being obtained, reviewed, and integrated into the assessment (these totals do not include field measurements and field descriptions). The on-site field laboratory processed more than 380 soil and sediment samples to produce more than 660 trinitrotoluene and RDX screening measurements. A hand-held field XRF unit collected in-situ metal data at 126 locations, providing screening results for more than 12,000 elemental data points, while more than 11,000 elemental determinations were performed on prepared composite samples from the area. The project produced acceptable results for more than 99 percent 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 a few SVOC compound determinations.

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.

For this RVAAP study, a total of 41 field duplicates were analyzed for soil, sediment, groundwater, and surface water media. One equipment rinsate was collected and analyzed for this project. The site potable water source was sampled as LL11152. Trip blanks for VOC determinations were analyzed relative to each shipment of VOC water samples, totaling six analyses for this report.

SVOCs (3,3'-dichlorobenzidine, 4-chlorobenzenamine, and hexachlorocyclopentadiene) results in several soil and a few water samples were rejected due to sample matrix interferences as demonstrated by very poor matrix spike recoveries. Two hexavalent chromium values, two nitrocellulose concentrations, and one PCB result were also rejected during the verification process. These deviations increase the possibility of false negative results and warrant rejection of these low and undetected values.

The majority of estimated values were based on values observed between the laboratory method detection levels 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. Ravenna Load Line 1 – 2000 Investigation

Area	Media	Environmental Samples	Field Duplicates	Trip Blanks	Equipment Rinsate Blanks	Site Source Water Blanks	USACE Split Samples
Load Line 1							
Laboratory Analyses	Soils	335	33	-	-	-	33
	Sediment	45	5	-	-	-	5
	Surface Water	16	2	4	1	1	2
	Groundwater	13	1	2	-	-	1
TOTALS		409	41	6	1	1	41
Field Analyses	In-situ XRF	504	-	-	-	-	-
	Ex-situ XRF	426	43	-	-	-	-
	Explosives	352	35	-	-	-	-

USACE = U. S. Army Corps of Engineers.
XRF = x-ray fluorescence.

Table G-2. Ravenna Load Line 1 – Primary, Duplicate, and Split Sample Correlation Table

Media	Station #	Sample #/ Duplicate #	SDG # Metals, etc.	SDG # Explosives	SDG # Propellants	Split #
Surface Soil	LL1-276	LL11004 LL11107	A0I190150 A0I190150	A0I190150 A0I190150	A0I190234 A0I190234	LL11157
Surface Soil	LL1-143	LL10799 LL11111	A0I190199 A0I190215	A0I210169 A0I190215	A0I210223 A0I190246	LL11161
Surface Soil	LL1-186	LL10893 LL11110	A0I190215 A0I190215	A0I270155 A0I2190215	A0I270168 A0I190246	LL11160
Surface Soil	LL1-198	LL10907 LL11119	A0I280137 A0I280137	NONE NONE	NONE NONE	LL11169
Sediment	LL1-050	LL11052 LL11134	A0I190190 A0I190190	A0I210169 A0I190190	A0I210223 A0I190234	LL11184
Surface Soil	LL1-171	LL10872 LL11114	A0I210168 A0I210168	A0I210168 A0I210168	A0I210230 A0I210230	LL11164
Surface Soil	LL1-011	LL10838 LL11115	A0I210211 A0I210211	A0I210211 A0I210211	A0I210230 A0I210230	LL11165
Sediment	LL1-048	LL11050 LL11135	A0I190226 A0I190226	A0I270144 A0I190226	A0I270168 A0I190246	LL11184
Sediment	LL1-310	LL11040 LL11139	A0I210211 A0I210211	A0I210211 A0I210211	A0I210230 A0I210230	LL11189
Subsurface Soil	LL1-008	LL10818 LL11113	A0I210169 A0I210169	A0I270155 A0I210169	A0I210168 A0I210223	LL11163
Surface Soil	LL1-345	LL11242 LL11130	A0I300105 A0I300105	A0J030154 A0I300105	A0J030188 A0I300108	LL11180
Surface Soil	LL1-213	LL10926 LL11123	A0I280176 A0I280176	A0J030146 A0I280176	A0J030180 A0I280184	LL11173
Surface Soil	LL1-099	LL10740 LL11118	A0I280137 A0I280137	A0I300101 A0I280137	A0I300107 A0I280184	LL11168
Surface Soil	LL1-108	LL10753 LL11120	A0I270155 A0I270155	A0I300101 A0I270155	A0I300107 A0I270168	LL11170
Surface Soil	LL1-024	LL10981 LL11112	A0I270155 A0I270155	A0I300101 A0I270155	A0I300107 A0I270168	LL11162
Surface Water	LL1-053	LL11071 LL11140	A0I210169 A0I210169	A0I210169 A0I210169	A0I210223 A0I210223	LL11190
Surface Soil	LL1-088	LL10724 LL11117	A0I270144 A0I270144	A0J030154 A0I270144	A0J030188 A0I270168	LL11167
Surface Soil	LL1-199	LL10908 LL11125	A0I300101 A0I300101	A0J030146 A0I300101	A0J030180 A0I300107	LL11175
Surface Soil	LL1-406	LL11249 LL11280	A0J030154 A0J030154	A0J050176 A0J030154	A0J050213 A0J030188	LL11287
Surface Soil	LL1-368	LL11258 LL11128	A0I300103 A0I300103	A0J030140 A0I300103	A0J030173 A0I300108	LL11178
Surface Soil	LL1-385	LL11237 LL11278	A0I300103 A0I300103	A0J030146 A0I300103	A0J030180 A0I300108	LL11285
Surface Soil	LL1-129	LL10782 LL11116	A0I300102 A0I300102	A0I300102 A0I300102	A0I300108 A0I300107	LL11166
Surface Soil	LL1-130	LL10783 LL11121	A0I300102 A0I300102	A0I300102 A0I300102	A0I300107 A0I300108	LL11171

Table G-2. Ravenna Load Line 1 – Primary, Duplicate, and Split Sample Correlation Table (continued)

Media	Station #	Sample #/ Duplicate #	SDG # Metals, etc.	SDG # Explosives	SDG # Propellants	Split #
Surface Soil	LL1-125	LL10777 LL11122	A0I300102 A0I300102	A0J030140 A0I300102	A0J030173 A0I300108	LL11172
Subsurface Soil	LL1-325	LL11245 LL11133	A0J030133 A0J030133	A0J030133 A0J030133	A0J030161 A0J030161	LL11183
Surface Soil	LL1-358	LL11314 LL11129	A0J030140 A0J030140	A0J050176 A0J030140	A0J050205 A0J030173	LL11179
Subsurface Soil	LL1-265	LL11233 LL11279	A0J030140 A0J030140	A0J030140 A0J030140	A0J030173 A0J030173	LL11286
Surface Soil	LL1-327	LL11199 LL11109	A0I190199 A0I190199	A0I210169 A0I190199	A0I210223 A0I190246	LL11159
Sediment	LL1-397	LL11274 LL11136	A0I300101 A0I300101	A0J050176 A0I300101	A0J050213 A0I300107	LL11186
Surface Soil	LL1-210	LL10921 LL11124	A0I300101 A0I300101	A0J030146 A0I300101	A0J030180 A0I300107	LL11174
Subsurface Soil	LL1-241	LL11339 LL11293	A0J050176 A0J050153	A0J050176 A0J050153	A0J050205 A0J050205	LL11296
Subsurface Soil	LL1-242	LL11338 LL11294	A0J050176 A0J050153	A0J050176 A0J050153	A0J050205 A0J050205	LL11297
Groundwater	LL1MW- 065	LL11082 LL11145	A0J050153 A0J050153	A0J050153 A0J050153	A0J050205 A0J050205	LL11194
Surface Soil	LL1-190	LL10897 LL11132	A0I300104 A0I300104	A0J030146 A0I300104	A0J030180 A0I300108	LL11182
Surface Soil	LL1-362	LL11333 LL11281	A0J050153 A0J050153	A0J050153 A0J050153	A0J050205 A0J050205	LL11288
Surface Soil	LL1-195	LL10903 LL11126	A0I300104 A0I300104	A0J030146 A0I300104	A0J030180 A0I300108	LL11176
Surface Soil	LL1-196	LL10905 LL11127	A0I300104 A0I300104	NONE A0I300104	NONE A0I300108	LL11177
Surface Soil	LL1-375	LL11223 LL11131	A0I300105 A0I300104	A0J050176 A0I300104	A0J050213 A0I300108	LL11181
Subsurface Soil	LL1-243	LL11337 LL11292	A0J050176 A0J050153	A0J050176 A0J050153	A0J050205 A0J050205	LL11295
Sediment	LL1-323	LL11103 LL11137	A0K080133 A0K080133	A0K080133 A0K080133	A0K080153 A0K080153	LL11187
Surface Water	LL1-323	LL11097 LL11142	A0K080133 A0K080133	A0K080133 A0K080133	A0K080153 A0K080153	LL11192

**Table G-3. Ravenna Load Line 1 – 2000 Investigation
Summary of Rejected Analytes (Laboratory)
(grouped by medium and analysis group)**

Media	Analysis Group	Rejected/ Total	Percent Rejected
Soil (surface and subsurface)	Metals	0/ 8,418	0.0
	Volatile Organics	0/ 1,330	0.0
	Semivolatile Organics	20/ 2,432	0.8
	Pesticides/PCBs	1/ 1,064	0.1
	Explosives	2/ 3,213	0.1
	Miscellaneous	2/ 205	1.0
	Subtotal	25/ 16,662	0.2
Sediment	Metals	0/ 1,127	0.0
	Volatile Organics	0/ 315	0.0
	Semivolatile Organics	0/ 576	0.0
	Pesticides/PCBs	0/ 252	0.0
	Explosives	0/ 408	0.0
	Miscellaneous	0/ 55	0.0
	Subtotal	0/ 2,733	0.0
Surface Water, Groundwater, and QC	Metals	0/ 782	0.0
	Volatile Organics	0/ 1,015	0.0
	Semivolatile Organics	16/ 1,472	1.1
	Pesticides/PCBs	0/ 644	0.0
	Explosives	0/ 629	0.0
	Miscellaneous	0/ 34	0.0
	Subtotal	16/ 4,576	0.3
Project Total		41/ 23,971	0.2

QC = quality control.

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4.0 DATA QUALITY EVALUATION

4.1 METALS

4.1.1 Soils and Sediments

Analytical holding times were met for all samples. Initial calibration and continuing calibration criteria were achieved for the majority of the data, although a few thallium and manganese values were qualified as estimated “J or UJ” due to continuing calibration verification results being slightly elevated. Minor method blank levels did result in qualification of sodium and beryllium values in many samples as non-detect or estimated non-detect “U or UJ.” Occasionally, aluminum, cadmium, calcium, mercury, potassium, thallium, and zinc concentrations were also qualified as non-detect or estimated due to method blank levels. Antimony concentrations were consistently qualified as estimated “J, UJ” due to low matrix spike results. Most of the other metals were occasionally estimated due to matrix spike values being low or high relative to criteria. None of these deviations were considered significant enough to reject any of the data. Post-digestion spike recoveries for thallium contributed to its consistent estimation “J or UJ” in the soil and sediment data. Occasional serial dilution variations caused aluminum, beryllium, calcium, iron, lead, magnesium, manganese, nickel, potassium, selenium, vanadium, and zinc levels to be estimated in various samples. Laboratory Control Sample (LCS) determinations were considered acceptable, with the exception of slightly elevated iron in one sample delivery group. This caused a few positive iron values to be qualified as estimated “J.” Reporting levels are considered to be consistent with the QAPP goals. Some of this 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 main text for the LL1 report.

4.1.2 Groundwater, Surface Water, and Field QC Samples

Analytical holding times were met for all samples. Initial calibration and continuing calibration criteria were achieved. Minor method blank levels did result in the occasional qualification of aluminum, barium, beryllium, calcium, chromium, magnesium, manganese, nickel, potassium, sodium, and zinc concentrations in samples as non-detect or estimated non-detect “U or UJ.” Thallium concentrations were consistently qualified as estimated “J, UJ” due to low matrix spike results. Antimony and mercury were occasionally estimated due to matrix spike values being low or high relative to criteria. None of these deviations were considered significant enough to reject any of the data. Post-digestion spike recoveries for thallium contributed to its consistent estimation “J or UJ” in the water data. Occasional serial dilution variations caused potassium and zinc levels to be estimated in various samples. LCS determinations were considered acceptable throughout the data set. Reporting levels are considered to be consistent with the QAPP goals. Some of this 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 main text for the LL1 report.

4.2 VOLATILE ORGANIC ANALYSES

4.2.1 Soils and Sediments

Analytical holding times were met for all samples. All surrogate recoveries were acceptable with the exception of one sample 1,2-dichloroethene recovery. This only qualified results as estimated for a few compounds in one sample. Internal standard area counts were acceptable with the exception of a few samples 1,1,2,2-tetrachloroethane results, causing these compound values to be qualified as estimated “J or UJ.” Initial calibration criteria and continuing calibration criteria were met for all compounds. Method blanks were clear of contamination with the exception of measurable levels of acetone and methylene chloride. Sample data for most observed low acetone and methylene chloride concentrations were therefore qualified as non-detect “U” based on a 5× action level for these compounds. LCS and MS/MSD evaluations included the project-targeted analytes. Consistently elevated LCS recoveries were observed for acetone, 2-butanone, 2-hexanone, 4-methyl-2-pentanone, and styrene, while there were occasional low LCS recoveries for chloroethane and methylene chloride. Associated compound values were qualified as estimated “J or UJ.” All other LCS recoveries were within criteria. MS recoveries and MS/MSD RPD values were acceptable with the exception of a few instances for trans-1,2-dichloroethene, trichloroethene, acetone, and toluene. Associated values were estimated “J or UJ,” as required. 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.

4.2.2 Groundwater, Surface Water, and Field QC 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 compounds. Method blanks and trip blanks were clear of contamination with the exception of measurable levels of acetone and toluene. Sample data for most observed low acetone and toluene concentrations were therefore qualified as non-detect “U” based on a 5× action level for these compounds. LCS and MS/MSD evaluations included the project-targeted analytes. Occasionally, elevated LCS recoveries were observed for carbon disulfide and chloroethane. Associated compound values were qualified as estimated “J or UJ.” All other 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.

4.3 SEMIVOLATILE ORGANIC ANALYSES

4.3.1 Soils and Sediments

Analytical holding times were met for all samples, with the exception of the need for re-analyses of sample LL11211 when initial analyses surrogate recoveries failed. All surrogate recoveries and internal standard area counts were acceptable with the exception of an elevated surrogate for polyaromatic hydrocarbon compounds in a few samples, causing values to be estimated. Continuing calibration verification percent differences greater than 25 caused several 2,4-dinitrophenol and 2,2-oxybis(1-chloropropane) concentrations to be estimated. 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 the project-targeted analytes. 4-Chloroaniline and 3,3'-dichlorobenzidine were estimated “UJ” in a few samples due to elevated LCS recoveries. Other LCS recoveries were within criteria. Poor MS recoveries caused data for seven compounds in sample LL11106 and 3,3'-dichlorobenzidine values in samples LL10753 and LL10981 to be rejected “R.” Other soil MS recoveries were acceptable. While some of this 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.

4.3.2 Groundwater, Surface Water, and Field QC Samples

Analytical holding times were met for all samples. All surrogate recoveries and internal standard area counts were acceptable. All initial calibration criteria and continuing calibration criteria were met for all compounds. Method blanks were clear of contamination. LCS and MS/MSD evaluations included the project-targeted analytes. Poor LCS or MS recovery information did create the need to reject “R” many 3,3'-dichlorobenzidine, hexachlorocyclopentadiene, and 4-chlorobenzamine values in multiple samples. Rejected results for all analyses are itemized in Table G-4. Other LCS and MS water matrix recoveries were within criteria. While some of this water 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.

4.4 PESTICIDE/PCB ANALYSES

4.4.1 Soils and Sediments

Analytical holding times were met for all samples. Surrogate recoveries were predominantly acceptable, with the exception of an elevated surrogate for PCBs in one sample, causing values to be estimated. Continuing calibration verification percent differences greater than 25 caused sporadic qualification of pesticide compounds as estimated “J or UJ” in the data set. 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 the project-targeted pesticides; however, PCB evaluations only included Aroclors 1016 and 1260. Dieldrin, endrin, 4,4-DDT, 4,4-DDD, and alpha-BHC were estimated “UJ” in a few samples due to elevated LCS recoveries. Other LCS recoveries were within criteria. Poor MS recoveries caused Aroclor-1016 data in sample LL10753 to be rejected “R.” Other soil MS recoveries were acceptable. Positive compound results were consistently qualified as estimated “J” based on the percent difference between the primary column quantification and the secondary column quantification. While some of this data was 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.

4.4.2 Groundwater, Surface Water, and Field QC Samples

Analytical holding times were met for all samples. All surrogate recoveries were acceptable with the exception of the PCB surrogate in sample LL11150. PCB values in this sample were estimated “J or UJ.” All initial calibration criteria and continuing calibration criteria were met for all compounds, with the exception of elevated CCV percent differences in two instances. Toxaphene and alpha-BHC data were estimated “UJ” in these isolated cases. 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 and MS 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.

4.5 EXPLOSIVE ANALYSES

4.5.1 Soils and Sediments

Analytical holding times were met for all samples. Continuing calibration verification percent differences greater than 25 caused a few isolated qualifications of tetryl, 2,6-dinitrotoluene, 4-nitrotoluene, and 2-amino-4,6-dinitrotoluene as estimated “J or UJ” in the data set. All other initial calibration criteria and continuing calibration criteria were met for all compounds. A few method blanks contained low concentrations of 2,4,6-trinitrotoluene or 2,4-dinitrotoluene. This resulted in some low concentrations of these compounds to be qualified as undetected “U.” All other method blanks were clear of contamination. Surrogate compound recoveries were acceptable for all analyses. LCS and MS/MSD evaluations included the project-targeted analytes, with the exception of nitroglycerine. 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.

4.5.2 Groundwater, Surface Water, and Field QC Samples

Analytical holding times were met for all 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 for all analyses. LCS and MS/MSD evaluations included the project-targeted analytes, with the exception of nitroglycerine. Water LCS and MS 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.

4.6 NITROGUANIDINE AND NITROCELLULOSE ANALYSES

4.6.1 Soils and Sediments

Analytical holding times were met for most samples. There were a few instances when holding times were slightly exceeded; however, these were not considered exceptional, and associated nitrocellulose/nitroguanidine data were simply estimated “J or UJ.” Initial calibration criteria and continuing calibration criteria were met for all analyses. Several method blanks contained low concentrations of nitrate, which resulted in similar low concentrations of nitrocellulose being qualified as undetected “U.” All other method blanks were clear of contamination for both compounds. There were a few instances of elevated LCS or MS recoveries for nitroguanidine that caused estimation “J” of associated data. Two nitrocellulose values were rejected “R” due to very low MS recoveries. These were in samples LL11132 and LL11247. All other LCS and MS/MSD recoveries were within criteria. While some of this data was 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.

4.6.2 Groundwater, Surface Water, and Field QC Samples

Analytical holding times were met for most samples. There were a few instances when holding times were slightly exceeded; however, these were not considered exceptional, and associated nitrocellulose/nitroguanidine data were simply estimated “J or UJ.” Initial calibration criteria and continuing calibration criteria were met for all analyses. All method blanks were clear of contamination for both compounds. All 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.

4.7 MISCELLANEOUS ANALYSES

4.7.1 Soils, Sediments, Groundwaters, Surface Waters, and Field QC Samples

Analytical holding times were met for all TOC determinations and for most cyanide analyses. Hexavalent chromium analyses were predominantly run outside holding time. 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 these analytes. There were a few instances of elevated MS recoveries or RDP values for cyanide and TOC that caused estimation “J” of the associated data. Two hexavalent chromium values were rejected “R” due to very low MS recoveries, while other hexavalent chromium MS recoveries caused associated data to be consistently estimated “J or UJ.” Hexavalent chromium for samples LL10753 and LL11124 were rejected. LCS recoveries were consistently within criteria. While some of this 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.

4.8 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 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 quantitation 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. In order to review information, this data quality assessment 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.

Field duplicate metal comparisons are considered good. Of 690 RPD observations in surface soil duplicates, 647 (95 percent) were <50 or had acceptable absolute differences, while all of the 69 RPD observations for subsurface soil duplicates were <50 or had acceptable absolute differences. Only 2 percent of the surface soil RPD comparisons were >100, and only 3 percent were >50. Nine of the >100 RPD comparisons were within the one duplicate set of samples LL11199 and LL11109. Sediment duplicate metal comparisons were also good, with 89 percent of the RPDs <50 or with acceptable absolute differences. Only 1 percent of the sediment RPD comparisons were >100, and 10 percent were >50. Nine of the >50 RPD comparisons were within the one duplicate set of samples LL11103 and LL11137.

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000

Analysis	LL11004/LL11107 Surface Soil RPD	LL10799/LL11111 Surface Soil RPD	LL10893/LL11110 Surface Soil RPD	LL10907/LL11119 Surface Soil RPD
Metals				
Aluminum	6	19	1	6
Antimony	*	*	*	*
Arsenic	4	4	10	18
Barium	*	*	*	*
Beryllium	*	*	*	*
Cadmium	*	*	UNAC	*
Calcium	*	*	42	*
Chromium	7	13	5	11
Cobalt	*	*	*	*
Copper	*	31	1	*
Iron	1	8	16	23
Lead	0	83	15	2
Magnesium	6	14	74	10
Manganese	1	19	1	8
Mercury	*	*	*	*
Nickel	*	9	*	*
Potassium	*	24	*	*
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	*	*	*	*
Zinc	4	36	16	5
Cyanide	na	*	na	*
Volatile Organic Compounds				
all compounds	na	na	na	na
Semivolatile Organic Compounds				
all compounds	na	na	na	na
Explosive Compounds				
all compounds	*	*	*	na
Hexavalent Chromium	na	na	na	*
Pesticide/PCB Compounds				
all compounds	na	na	na	na

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL10872/LL11114 Surface Soil RPD	LL10838/LL11115 Surface Soil RPD	LL11242/LL11130 Surface Soil RPD	LL10926/LL11123 Surface Soil RPD
Metals				
Aluminum	11	23	2	1
Antimony	*	*	*	*
Arsenic	12	13	6	3
Barium	*	*	*	*
Beryllium	*	*	*	*
Cadmium	*	*	*	*
Calcium	UNAC	UNAC	*	*
Chromium	67	7	3	2
Cobalt	*	*	*	*
Copper	12	13	18	*
Iron	19	16	14	0
Lead	74	30	9	7
Magnesium	*	*	*	4
Manganese	16	24	7	2
Mercury	*	*	*	*
Nickel	*	*	*	0
Potassium	*	*	*	*
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	*	*	*	*
Zinc	31	20	10	3
Cyanide	na	*	na	*
Volatile Organic Compounds				
all compounds	na	na	na	na
Semivolatile Organic Compounds				
all compounds	na	na	na	na
Explosive Compounds				
all compounds	*	*	*	*
except 2,4,6-TNT	34	0	*	*
Hexavalent Chromium				
	*	na	na	na
Pesticide/PCB Compounds				
all compounds	na	na	na	na

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL10921/LL11124 Surface Soil RPD	LL11339/LL11293 Surface Soil RPD	LL11338/LL11294 Surface Soil RPD	LL10897/LL11132 Surface Soil RPD
Metals				
Aluminum	14	30	63	44
Antimony	*	*	*	*
Arsenic	20	22	4	1
Barium	*	*	*	*
Beryllium	*	*	*	*
Cadmium	*	*	*	*
Calcium	*	74	130	18
Chromium	3	7	3	35
Cobalt	*	*	*	*
Copper	*	*	*	*
Iron	16	20	17	14
Lead	8	35	21	5
Magnesium	10	52	UNAC	*
Manganese	2	31	28	36
Mercury	*	*	*	*
Nickel	*	*	*	*
Potassium	*	*	*	*
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	4	*	*	*
Zinc	14	11	5	31
Cyanide	*	na	na	*
Volatile Organic Compounds				
all compounds	na	na	na	na
Semivolatile Organic Compounds				
all compounds	na	na	na	na
Explosive Compounds				
all compounds	*	*	*	*
Hexavalent Chromium	*	na	na	na
Pesticide/PCB Compounds				
all compounds	na	na	na	na

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL11223/LL11131 Surface Soil RPD	LL10753/LL11120 Surface Soil RPD	LL10981/LL11112 Surface Soil RPD	LL10783/LL11121 Surface Soil RPD
Metals				
Aluminum	7	27	43	9
Antimony	*	*	*	*
Arsenic	0	16	16	9
Barium	*	*	*	*
Beryllium	*	*	*	*
Cadmium	*	*	*	7
Calcium	*	72	5	5
Chromium	1	15	7	11
Cobalt	*	*	*	*
Copper	3	36	0	9
Iron	0	21	44	4
Lead	2	31	0	11
Magnesium	*	55	*	17
Manganese	4	52	8	29
Mercury	*	*	*	*
Nickel	*	*	*	*
Potassium	*	*	*	*
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	*	*	*	*
Zinc	12	21	18	7
Cyanide	*	*	*	*
Volatile Organic Compounds				
all compounds	na	*	*	*
Semivolatile Organic Compounds				
all compounds	na	*	*	*
Explosive Compounds				
all compounds	*	*	*	*
except Nitrocellulose	*	35	*	*
Hexavalent Chromium				
	na	na	na	na
Pesticide/PCB Compounds				
all compounds	na	*	*	*

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL11333/LL11281 Surface Soil RPD	LL10903/LL11126 Surface Soil RPD	LL10905/LL11127 Surface Soil RPD	LL11337/LL11292 Surface Soil RPD
Metals				
Aluminum	23	3	2	1
Antimony	*	*	*	*
Arsenic	20	20	7	25
Barium	*	*	*	*
Beryllium	*	*	*	*
Cadmium	*	*	*	*
Calcium	UNAC	*	*	10
Chromium	33	1	0	15
Cobalt	*	*	*	*
Copper	1	21	*	*
Iron	18	15	13	1
Lead	1	28	7	53
Magnesium	*	*	*	*
Manganese	11	58	10	6
Mercury	*	*	*	*
Nickel	*	*	*	*
Potassium	*	*	*	*
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	*	*	5	*
Zinc	15	1	4	14
Cyanide	na	*	*	na
Volatile Organic Compounds				
all compounds	na	na	na	na
Semivolatile Organic Compounds				
all compounds	na	na	na	na
Explosive Compounds				
all compounds	*	*	na	*
Hexavalent Chromium				
	na	na	na	na
Pesticide/PCB Compounds				
all compounds	na	na	na	na

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL11199/LL11109 Surface Soil RPD	LL10782/LL11116 Surface Soil RPD	LL10777/LL11122 Surface Soil RPD	LL11314/LL11129 Surface Soil RPD
Metals				
Aluminum	127	21	4	10
Antimony	*	*	*	*
Arsenic	122	11	7	6
Barium	*	*	*	*
Beryllium	*	*	*	*
Cadmium	*	*	*	*
Calcium	96	*	*	10
Chromium	131	23	7	6
Cobalt	*	*	*	*
Copper	131	10	*	3
Iron	123	49	4	2
Lead	112	4	3	36
Magnesium	128	17	*	*
Manganese	114	9	7	11
Mercury	*	*	*	*
Nickel	*	16	*	*
Potassium	*	*	*	*
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	*	*	*	*
Zinc	142	24	18	10
Cyanide	*	na	*	na
Volatile Organic Compounds				
all compounds	na	na	na	na
Semivolatile Organic Compounds				
all compounds	na	na	na	na
Explosive Compounds				
all compounds	*	*	*	*
Hexavalent Chromium	na	*	*	na
Pesticide/PCB Compounds				
all compounds	na	na	na	na

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL10740/LL11118 Surface Soil RPD	LL10724/LL11117 Surface Soil RPD	LL10908/LL11125 Surface Soil RPD	LL11249/LL11280 Surface Soil RPD
Metals				
Aluminum	30	0	4	9
Antimony	*	*	*	*
Arsenic	10	7	2	10
Barium	47	16	*	*
Beryllium	*	*	*	*
Cadmium	*	*	*	*
Calcium	*	UNAC	33	UNAC
Chromium	20	4	6	1
Cobalt	UNAC	UNAC	*	*
Copper	0	2	4	*
Iron	10	2	3	18
Lead	44	2	9	32
Magnesium	9	9	2	*
Manganese	153	1	14	18
Mercury	*	*	*	*
Nickel	10	3	7	*
Potassium	*	*	*	38
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	38	*	*	9
Zinc	14	1	2	28
Cyanide	na	na	*	na
Volatile Organic Compounds				
all compounds	na	na	na	na
Semivolatile Organic Compounds				
all compounds	na	na	na	na
Explosive Compounds				
all compounds	*	*	*	*
except 2,4,6-TNT	UNAC	*	*	*
RDX	46	*	*	*
Nitrocellulose	140	*	*	*
Hexavalent Chromium	*	*	*	na
Pesticide/PCB Compounds				
all compounds	na	na	na	na

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL11258/LL11128 Surface Soil RPD	LL11237/LL11278 Surface Soil RPD	LL10818/LL11113 Subsurface Soil RPD	LL11245/LL11133 Subsurface Soil RPD
Metals				
Aluminum	11	0	13	2
Antimony	*	*	*	*
Arsenic	1	15	31	15
Barium	*	*	14	*
Beryllium	*	*	*	*
Cadmium	*	*	*	*
Calcium	*	*	*	*
Chromium	3	4	8	4
Cobalt	51	*	*	*
Copper	*	2	*	13
Iron	4	5	9	12
Lead	12	19	19	12
Magnesium	*	*	9	9
Manganese	33	21	32	5
Mercury	*	*	*	*
Nickel	*	*	*	*
Potassium	*	*	*	*
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	4	*	*	*
Zinc	5	3	5	21
Cyanide	na	na	na	*
Volatile Organic Compounds				
all compounds	na	na	na	na
Semivolatile Organic Compounds				
all compounds	na	na	na	na
Explosive Compounds				
all compounds	*	*	*	*
except 2,4,6-TNT	*	*	*	20
Nitrocellulose	*	*	*	89
Hexavalent Chromium	na	na	*	na
Pesticide/PCB Compounds				
all compounds	na	na	na	na

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL11233/LL11279 Subsurface Soil RPD	LL11052/LL11134 Sediment RPD	LL11040/LL11139 Sediment RPD	LL11274/LL11136 Sediment RPD
Metals				
Aluminum	8	32	34	3
Antimony	*	UNAC	7	*
Arsenic	36	27	49	15
Barium	*	*	*	*
Beryllium	*	*	*	*
Cadmium	*	*	*	*
Calcium	*	*	37	1
Chromium	8	22	37	1
Cobalt	*	*	*	*
Copper	14	28	89	1
Iron	26	35	84	11
Lead	12	15	12	0
Magnesium	12	24	*	1
Manganese	28	2	24	10
Mercury	*	*	*	*
Nickel	*	*	103	7
Potassium	*	*	*	*
Selenium	*	*	*	*
Silver	*	*	*	*
Sodium	*	*	*	*
Thallium	*	*	*	*
Vanadium	7	*	*	*
Zinc	15	4	17	2
Cyanide	*	na	na	na
Volatile Organic Compounds				
all compounds	na	na	na	na
Semivolatile Organic Compounds				
all compounds	na	na	na	na
Explosive Compounds				
all compounds	*	*	*	*
except 2,4,6-TNT	9	*	*	*
Hexavalent Chromium	na	na	*	*
Pesticide/PCB Compounds				
all compounds	na	na	na	na

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL11050/LL11135 Sediment RPD	LL11103/LL11137 Sediment RPD
Metals		
Aluminum	12	80
Antimony	*	*
Arsenic	26	94
Barium	*	*
Beryllium	*	*
Cadmium	*	*
Calcium	25	49
Chromium	19	77
Cobalt	*	*
Copper	10	*
Iron	28	85
Lead	24	90
Magnesium	*	78
Manganese	3	83
Mercury	*	*
Nickel	*	83
Potassium	*	*
Selenium	*	*
Silver	*	*
Sodium	*	*
Thallium	*	*
Vanadium	*	*
Zinc	13	91
Cyanide	*	*
Volatile Organic Compounds		
all compounds	*	*
Semivolatile Organic Compounds		
all compounds	*	*
Explosive Compounds		
all compounds	*	*
except		
Hexavalent Chromium	na	na
Pesticide/PCB Compounds		
all compounds	*	*

Table G-4. Field Duplicate Comparison, RVAAP Load Line 1 Phase II RI 2000 (continued)

Analysis	LL11082/LL11145 Groundwater RPD	LL11097/LL11142 Surface Water RPD	LL11071/LL11140 Surface Water RPD
Metals			
Aluminum	*	*	*
Antimony	*	*	*
Arsenic	*	*	*
Barium	*	*	*
Beryllium	*	*	*
Cadmium	*	*	*
Calcium	1	2	*
Chromium	*	*	8
Cobalt	*	*	*
Copper	*	*	*
Iron	*	*	*
Lead	*	*	*
Magnesium	*	*	*
Manganese	*	*	*
Mercury	*	*	*
Nickel	*	*	*
Potassium	*	*	*
Selenium	*	*	*
Silver	*	*	*
Sodium	*	*	*
Thallium	*	*	*
Vanadium	*	*	*
Zinc	*	*	*
Cyanide	na	na	na
Volatile Organic Compounds			
all compounds	*	*	*
Semivolatile Organic Compounds			
all compounds	*	*	*
Explosive Compounds			
all compounds	*	*	*
except			
Hexavalent Chromium	na	na	na
Pesticide/PCB Compounds			
all compounds	8	*	*

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

PCB = polychlorinated biphenyl.

RPD = relative percent difference.

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

Field duplicate explosive comparisons were also considered good. Of 612 RPD observations for surface soils, subsurface soils, and sediments, one nitrocellulose RPD was at 89 and one was at 140. This resulted in more than 99 percent of the observations being <50 or having acceptable absolute differences. All VOC, SVOC, pesticide, and PCB duplicate observations were within 5 times the respective reporting levels and presented acceptable comparisons, with the exception of one PCB comparison, which provided an acceptable RPD of 25. All cyanide and hexavalent chromium comparisons were within 5 times the respective reporting levels and presented acceptable comparisons, with the exception of one hexachromium comparison that was unacceptable. Total organic carbon duplicate RPDs for sediment samples (25, 4, 55 and 14) are considered good.

Results for the few surface water duplicates and one groundwater duplicate collected were predominantly within 5× the respective reporting levels, and all comparisons are considered acceptable.

4.9 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 QAPjP. These levels were achieved or exceeded throughout the analytical process, with the exception of thallium in water. Actual laboratory method detection levels achieved during this investigation are presented in Table G-5 with original practical 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. However, there were larger elevations of reporting levels in several soil and sediment PCB, pesticide, and semivolatiles results due to high levels of the PCB, Aroclor 1254. This caused solid sample reporting levels for other analytes to be elevated by factors of 10-50 times, as a result of required dilutions. High levels of 2,4,6-trinitrotoluene also caused explosive and semivolatile analyses to be diluted and reporting levels to be elevated in soils. Water determinations consistently met project reporting level goals. 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 validation to determine their potential impact on individual data points, if any. Validation action levels are set at 5× the reporting level for all analytes, except those designated as common laboratory contaminants (methylene chloride, acetone, toluene, 2-butanone, and phthalate compounds), with action levels set at 10× the reporting levels. During data validation, 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 the 5× or 10× action level, the data are not qualified, and they are considered a positive value. They will receive a validation reason code of “F01, F08.”
- When the analyte sample concentration is determined to be below the 5× or 10× action level but above the reporting level, the data are considered to be 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.”

**Table G-5. Project Quantitation Limit Goals and Achieved Method Detection Levels
for Ravenna Load Line 1 Phase II RI 2000 Investigation**

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
Volatile Organic Compounds (VOCs) SW 846-8260B	(µg/L)	(µg/L)	(µg/kg)	(µg/kg)
Chloromethane	10	1.1	10	0.73
Bromomethane	10	0.92	10	1.2
Vinyl chloride	10	0.58	10	0.66
Chloroethane	10	0.67	10	0.92
Methylene chloride	5	0.4	5	1.4
Acetone	10	5.9	10	1.8
Carbon disulfide	5	0.4	5	1.1
1,1-Dichloroethene	5	0.53	5	0.67
1,1-Dichloroethane	5	0.62	5	0.63
1,2-Dichloroethene (total)	5	0.87	5	0.96
Chloroform	5	0.51	5	0.71
1,2-Dichloroethane	5	0.43	5	0.57
2-Butanone	10	9.7	10	4.8
1,1,1-Trichloroethane	5	0.63	5	0.71
Carbon tetrachloride	5	0.41	5	0.62
Bromodichloromethane	5	0.39	5	0.65
1,2-Dichloropropane	5	0.32	5	0.65
cis-1,3-Dichloropropene	5	0.35	5	0.61
Trichloroethene	5	0.54	5	0.7
Dibromochloromethane	5	0.36	5	0.57
1,1,2-Trichloroethane	5	0.41	5	0.54
Benzene	5	0.45	5	0.63
trans-1,3-Dichloropropene	5	0.64	5	0.59
Tribromomethane	5	0.35	5	0.50
4-Methyl-2-pentanone	10	5.5	10	3.3

**Table G-5. Project Quantitation Limit Goals and Achieved Method Detection Levels
for Ravenna Load Line 1 Phase II RI 2000 Investigation (continued)**

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
2-Hexanone	10	8.6	10	1.2
Tetrachloroethene	5	1.3	5	0.74
Toluene	5	0.45	5	0.75
1,1,2,2-Tetrachloroethane	5	0.57	5	0.7
Chlorobenzene	5	0.43	5	0.72
Ethylbenzene	5	0.41	5	0.84
Styrene	5	0.43	5	0.65
Xylenes (total)	5	1.4	5	0.2
Semivolatile Organic Compounds (SVOCs) SW 846-8270C				
	(µg/L)	(µg/L)	(µg/kg)	(µg/kg)
Phenol	10	1.3	330	35
bis(2-Chloroethyl) ether	10	2.1	330	33
2-Chlorophenol	10	1.6	330	28
1,3-Dichlorobenzene	10	1	330	32
1,4-Dichlorobenzene	10	0.9	330	36
1,2-Dichlorobenzene	10	0.9	330	29
2-Methylphenol	10	1.1	330	37
2,2'-oxybis(1-Chloropropane)	10	1.3	330	93
4-Methylphenol	10	1.7	330	27
N-nitroso-di-n-dipropylamine	10	1	330	31
Hexachloroethane	10	2.3	330	40
Nitrobenzene	10	2.6	330	32
Isophorone	10	2.7	330	32
2-Nitrophenol	10	1	330	44
2,4-Dimethylphenol	10	1.1	330	57
bis(2-chloroethoxy) methane	10	2.6	330	21
2,4-Dichlorophenol	10	1	330	45

Table G-5. Project Quantitation Limit Goals and Achieved Method Detection Levels for Ravenna Load Line 1 Phase II RI 2000 Investigation (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
1,2,4-Trichlorobenzene	10	2.5	330	38
Naphthalene	10	0.7	330	35
4-Chloroaniline	10	2.8	330	33
Hexachlorobutadiene	10	1.2	330	31
4-chloro-3-methylphenol	10	1.2	330	31
2-Methylnaphthalene	10	0.9	330	33
Hexachlorocyclopentadiene	10	3.4	330	150
2,4,6-Trichlorophenol	10	1.3	330	57
2,4,5-Trichlorophenol	25	1.1	800	69
2-Chloronaphthalene	10	2.5	330	32
2-Nitroaniline	25	1.4	800	33
Dimethylphthalate	10	3.7	330	36
Acenaphthylene	10	2.7	330	35
2,6-Dinitrotoluene	10	2.8	330	30
3-Nitroaniline	25	2	800	33
Acenaphthene	10	2.7	330	35
2,4-Dinitrophenol	25	13	800	150
4-Nitrophenol	25	4.8	800	350
Dibenzofuran	10	2.8	330	36
2,4-Dinitrotoluene	10	0.8	330	41
Diethylphthalate	10	3.2	330	38
4-Chlorophenyl-phenyl ether	10	1.3	330	36
Fluorene	10	2.9	330	29
4-Nitroaniline	25	1.2	800	47
4,6-Dinitro-2-methylphenol	25	7.5	800	180
N-nitrosodiphenylamine	10	0.9	330	37
4-bromophenyl-phenylether	10	1	300	35
Hexachlorobenzene	10	1.8	330	41

Table G-5. Project Quantitation Limit Goals and Achieved Method Detection Levels for Ravenna LL1 Phase II RI 2000 Investigation (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
Pentachlorophenol	25	0.6	800	34
Phenanthrene	10	2.4	330	43
Anthracene	10	0.9	330	37
Carbazole	10	1.1	330	42
Di-n-butylphthalate	10	1.1	330	59
Fluoranthene	10	0.9	330	38
Pyrene	10	1.4	330	57
Butylbenzylphthalate	10	1.9	330	44
3,3'-Dichlorobenzidine	10	1.1	330	140
Benzo(a)anthracene	10	2.8	330	35
Chrysene	10	0.9	330	50
bis(2-Ethylhexyl)phthalate	10	2.1	330	65
Di-n-octylphthalate	10	2	330	50
Benzo(b)fluoranthene	10	2.6	330	35
Benzo(k)fluoranthene	10	1.2	330	41
Benzo(a)pyrene	10	3	330	33
Indeno(1,2,3-cd)pyrene	10	1.2	330	42
Dibenzo(a,h)anthracene	10	1.2	330	38
Benzo(g,h,i)perylene	10	3.3	330	45
PCBs				
SW 846-8082	(µg/L)	(µg/L)	(µg/kg)	(µg/kg)
Arochlor-1016	1.0	0.02	33	5.3
Arochlor-1221	2.0	0.09	67	19
Arochlor-1232	1.0	0.16	33	11
Arochlor-1242	1.0	0.3	33	18
Arochlor-1248	1.0	0.22	33	4.6
Arochlor-1254	1.0	0.10	33	20
Arochlor-1260	1.0	0.07	33	7.4

**Table G-5. Project Quantitation Limit Goals and Achieved Method Detection Levels
for Ravenna LL1 Phase II RI 2000 Investigation (continued)**

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
Explosive Compounds				
SW 846-8330	(µg/L)	(µg/L)	(mg/kg)	(mg/kg)
HMX Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	20	0.09	2	0.18
RDX (cyclonite) Hexahydro-1,3,5-trinitro-1,3,5-triazine	20	0.09	2	0.17
1,3,5-Trinitrobenzene	2	0.09	1	0.09
1,3-Dinitrobenzene	3	0.04	1	0.03
Tetryl	50	0.06	5	0.38
Nitrobenzene	10	0.06	1	0.05
2,4,6-Trinitrotoluene	3	0.05	1	0.05
2,4-Dinitrotoluene	0.1	0.05	1	0.05
2,6-Dinitrotoluene	0.1	0.09	1	0.09
4-Amino-2,6-dinitrotoluene	0.1	0.09	1	0.09
4-Amino-2,6-dinitrotoluene	0.1	0.09	1	0.09
o-Nitrotoluene	10	0.14	1	0.14
m-Nitrotoluene	10	0.14	1	0.14
p-Nitrotoluene	10	0.10	1	0.09
Additional Explosive Compounds:				
Nitroglycerin	10	0.3	1	0.12
Nitroguanidine	10	0.96	1	0.023
Nitrocellulose	10	0.36	1	0.28
Metals (Target Analyte List)				
SW 846-6010B/6020 or 7000	(µg/L)	(µg/L)	(mg/kg)	(mg/kg)
Aluminum	200	28	20	1.1
Antimony	5	2.2	0.5	0.49
Arsenic	5	4.1	0.5	0.3
Barium	200	3	20	0.13
Beryllium	4	0.54	0.5	0.046

**Table G-5. Project Quantitation Limit Goals and Achieved Method Detection Levels
for Ravenna LL1 Phase II RI 2000 Investigation (continued)**

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal	Achieved Method Detection Level	Project Quantitation Goal	Achieved Method Detection Level
Cadmium	5	0.28	0.5	0.04
Calcium	5000	250	500	37
Chromium	10	1.4	1	0.38
Cobalt	50	1.3	15	0.15
Copper	25	4.2	2.5	0.27
Iron	100	88	10	6.6
Lead	3	2.5	0.3	0.249
Magnesium	5000	30	500	12
Manganese	15	0.9	1.5	0.15
Mercury (CVAA) SW 846-7470A/7471A	0.2	0.13	0.1	0.008
Nickel	40	2.2	4	0.27
Potassium	5000	41	500	5.1
Selenium	5	4.5	0.5	0.319
Silver	10	1.5	1	0.152
Sodium	5000	630	500	50
Thallium	2	5	0.5	0.5
Vanadium	50	0.82	5	0.13
Zinc	20	12	2	1.2

- When the analyte sample concentration is determined to be below the 5× or 10× action level and below the reporting level, the data are considered to be 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 was rejected as a result of method blank contamination; however, various analytes are 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, one rinsate sample, and a site potable water source.

There was only a minor concentration of the VOC acetone detected in one project trip blank. The concentration observed for acetone was 16 µg/L compared to the reporting level of 10 µg/L. It is therefore determined that VOC analyses have not been affected through the transportation and storage process and that the procedures and precautions employed were effective in preserving the integrity of the sample analysis.

Field source water blank LL11152 (09/20/2000) and equipment rinsate LL11150 (09/20/2000) exhibited few analyte levels above project reporting levels. Those detected included minor levels of acetone and carbon disulfide in the equipment rinsate. The site source water blank exhibited normal levels of calcium, magnesium, potassium, and sodium, with minor concentrations of bromodichloromethane and chloroform. There is no indication that the source water or the equipment rinsate impacted associated sample levels.

4.10 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 directly to the laboratory by courier, were received in good condition, and at appropriate temperature. A few organic analyses were conducted outside the holding time because samples were re-extracted and reanalyzed due to low surrogate recoveries. These data were qualified accordingly as outside of the holding time per EPA validation protocols. These instances occurred when initial extraction results required the laboratory to repeat semivolatile extractions for a sample 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 that were 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 they are not believed to have detracted from achieving the overall project data quality objectives.

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-6 presents the standardized parameter groups, analyzed analytical methods, sample containers, preservation techniques, and associated holding times.

4.11 COMPLETENESS

Usable data are defined as those data that pass individual scrutiny during the verification 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.

Objectives for the RVAAP Load Line 1 Phase II RI Investigation Work Plan have been achieved. The project produced valid results for more 99 percent of the sample analyses performed and successfully collected all the samples planned.

Table G-6. 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	1 - 2 oz glass jar with Teflon [®] - lined cap (no headspace)	20 g	Cool, 4 degrees C	14 d
Semivolatile Organic Compounds 3540/8270C	1 - 8 oz glass jar with Teflon [®] - lined cap	60 g	Cool, 4 degrees C	14 d (extraction) 40 d (analysis)
Pesticide Compounds 3540/8081A	Include in SVOC container	60 g	Cool, 4 degrees C	14 d (extraction) 40 d (analysis)
PCBs 3540/8082	Include in SVOC container	60 g	Cool, 4 degrees C	14 d (extraction) 40 d (analysis)
Explosive Compounds 8330	1 - 4 oz glass jar with Teflon [®] - lined cap	60 g	Cool, 4 degrees C	14 d (extraction) 40 d (analysis)
Propellant Compounds 8330, 353.2, and UV-HPLC	1 - 4 oz glass jar with Teflon [®] - lined cap	60 g	Cool, 4 degrees C	14 d (extraction) 40 d (analysis)
Metals 6010B and 7471	1 - 4 oz glass jar with Teflon [®] - lined cap	50 g	Cool, 4 degrees C	180 d; Hg @ 28 d
Cyanide 9012A	Include in metals container	25 g	Cool, 4 degrees C	14 d
Hexavalent Chromium 7196A	Include in metals container	25 g	Cool, 4 degrees C	24 hr

Table G-6 (cont.). Container Requirements for Water Samples at Ravenna Army Ammunition Plant, Ravenna, Ohio

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

PCB = polychlorinated biphenyl.

TDS = total dissolved solids.

TSS = total suspended solids.

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5.0 DATA QUALITY ASSESSMENT SUMMARY

The overall quality of RVAAP Load Line 1 Phase II RI information meets or exceeds the established project objectives. Through proper implementation of the project data verification, reviews, and assessment process, project information has been determined to be acceptable for use, as qualified.

Data, as presented, have been qualified as usable, estimated “J,” 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 all 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.

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ATTACHMENT

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 hours.
- 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 percent.
- C03 Initial calibration sequence was not followed as required.
- C04 Continuing calibration RRF was < 0.05 .
- C05 Continuing calibration %D was > 25 percent.
- 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 percent.
- C13 Combined breakdown of endrin/DDT was > 30 percent.
- C14 Professional judgment was used to qualify the data.

Initial/Continuing Calibration – Inorganics

- D01 ICV or CCV was 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 percent.
- 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 percent.
- G08 Radiological chemical recovery was >150 percent.

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 percent.
- 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 percent.

- H08 Radiological MS/MSD recovery was >160 percent.
- 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 percent.
- 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× the CRDL.
- J03 Duplicate sample results were <5× 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 percent recovery was obtained during either check.
- L02 Recoveries during either check were >120 percent.
- 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-hour GC/MS window.
- M07 Professional judgment was used to qualify the data.
- M08 The %D between the two pesticide/PCB column checks was >25 percent.

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 was 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× 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 percent.
- P04 No action was taken on the LCS data.
- P05 LCS was not analyzed at required frequency.
- P06 Radiological LCS recovery was <50 percent for aqueous samples; <40 percent for solid samples.
- P07 Radiological LCS recovery was >150 percent for aqueous samples; >160 percent for solid samples.
- P08 Professional judgment was used to qualify the data.

Field Duplicate

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

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