# APPENDIX J
# QUALITY CONTROL SUMMARY REPORT

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# QUALITY CONTROL SUMMARY REPORT

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# ACRONYMS

| | |
|---|---|
| EDD | electronic data deliverable |
| IS | internal standard |
| LCS | laboratory control sample |
| LCSD | laboratory control sample duplicate |
| MRL | method reporting limit |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| PCB | polychlorinated biphenyl |
| PQL | project quantitation level |
| QAPP | Quality Assurance Project Plan |
| QC | quality control |
| QCSR | Quality Control Summary Report |
| RPD | relative percent difference |
| RVAAP | Ravenna Army Ammunition Plant |
| SDG | Sample Delivery Group |
| SVOC | semivolatile organic compound |
| VOC | volatile organic compound |
| %R | percent recovery |
| %RSD | percent relative standard deviation |

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# 1.0 INTRODUCTION

This Quality Control Summary Report (QCSR) covers the field and laboratory work performed during sampling events at the Ravenna Army Ammunition Plant (RAAP) Fuze and Booster Quarry Landfill/Ponds conducted from October through December 2003, and additional samples collected in June and July of 2004. Soil, sediment, surface water, and groundwater were sampled for volatile organic compounds (VOCs) including perchlorate, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), explosive compounds including nitrocellulose, metals, miscellaneous chemical species such as hexavalent chromium, and total organic carbon. In addition, several samples were collected for toxicity characteristic leaching procedure and analyzed for VOCs, SVOCs, pesticides, herbicides, and hazardous characteristics including flashpoint, pH, and reactivity. Samples referenced in Tables 5-1 through 5-4 of the *Work Plan and Sampling and Analysis Plan Addenda for the Phase I/Phase II Remedial Investigation of the Fuze Booster Quarry Landfill/Ponds at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2002) were collected by SpecPro Incorporated field personnel. GPL Laboratories, 202 Perry Parkway, Gaithersburg, MD 20877, performed all analytical work.

Data verification and review of field and laboratory results described in this QCSR were conducted under the guidance provided by the facility-wide *Quality Assurance Project Plan (QAPP) for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001), and the *Quality Assurance Project Plan Addendum for Phase I/Phase II Remedial Investigation of the Fuze Booster Quarry Landfill/Ponds* (USACE 2003). Where required, the U. S. Army Corps of Engineers' *Shell Document for Analytical Chemistry Requirement*s (USACE 1998) was used as a secondary reference. The topics covered include:

- the conformance of the participating laboratory to quality control (QC) procedures described in the referenced Quality Assurance Project Plans (QAPPs),
- an evaluation of the quality of the data, and
- all rejected data.

# 2.0 FIELD DATA VERIFICATION

Chain of custody records and sampling records were reviewed to ensure that the correct bottles and preservatives were utilized throughout sampling. Samples were preserved and held at the correct temperature from the time of collection through sample shipment, receipt in the laboratory, and until point of analysis. Appropriate field duplicates were collected on each matrix type and at the appropriate frequency to meet project requirements. Field QC samples were collected including trip blanks, field blanks, and equipment rinsate blanks. Unless addressed specifically in the summaries for each analytical method reviewed below, all field QC measures were within acceptance criteria and met project and method requirements.

# 3.0 LABORATORY DATA VERIFICATION

Twenty-six sample delivery groups (SDGs) were submitted to the laboratory. A complete data package consisting of analytical, calibration, and QC information for each method within an SDG was supplied by the laboratory. All data packages were reviewed for each method for adherence to QAPP requirements as stated above. Completeness, correctness, consistency, and compliance were evaluated for all samples, which include all sample duplicate analysis and conformance to project reporting limits. In addition, 15% of the data was validated. During the validation process, calibration, calibration verification, blank contamination, recoveries of laboratory control samples (LCS), and matrix spike/matrix spike duplicate (MS/MSD) were evaluated. For organic analyses, instrument tuning, internal standard (IS) performance, and surrogate recoveries were also evaluated. For metals, interference checks, dilution tests, and post-digestion recoveries were also evaluated.

## 3.1 GENERAL FINDINGS

Unless addressed specifically in the summaries for each analytical method reviewed below, preservation, sample custody logs, preparation, extraction and cleanup logs, analysis logs, sample identification, and holding times were within acceptance criteria and met method requirements. Calibration and QC parameters for all methods were found acceptable. All exceptions are discussed in the sections below.

High concentrations of metal analytes, hexavalent chromium, and mercury required occasional sample dilutions prior to analysis to maintain results within calibration range. Project quantitation levels (PQLs) were not adversely impacted by sample dilution.

Manual integration was performed for some analytes for VOCs, SVOCs, pesticides, and explosive compounds. The rationale provided in the case narratives based the need for manual integration on improper integration performed by the software. In most cases, the adjustments were made on low-concentration standards and QC samples where concentrations were near the limit of sensitivity. The laboratory submitted software-produced EICP chromatograms and corresponding manually integrated chromatograms. The adjustments were properly executed and consistent with the intent of the LCG guidance on manual integration.

## 3.2 PROJECT QUANTITATION LEVELS

In general, the laboratory was able to achieve the PQLs specified in the QAPP. VOC analysis was typically performed using a 5-mL purging volume to obtain reporting limits of approximately 5 μg/L for water. These levels met most LCG requirements; however, they did not achieve the PQL goals of the QAPP.

Method reporting limit (MRL) check standards were typically analyzed at the beginning of a sequence, but not consistently repeated either at the end of the sequence or every 12 hrs as required by the LCG for most analytical methods.

Prior to the beginning of the project, the laboratory was granted some PQL variances because of their inability to achieve QAPP-specified limits. In most cases, the laboratory reporting limits generally met LCG requirements. A comparison of the laboratory PQLs and the project-specific PQLs for performing baseline risk assessment for primary chemicals of potential concern at RVAAP is presented in Table 3-1. A comparison of the laboratory PQLs and the project-specific PQLs is presented in Appendix A.

**Table 3-1. Non-Conforming Primary Chemicals of Potential Concern at RVAAP**

| Element | Soil (mg/kg) | | Water (µg/L) | |
|---|---|---|---|---|
| | GPL MRL | Baseline RA DL Requirements | GPL MRL | Baseline RA DL Requirements |
| | mg/kg | | µg/L | |
| 2,4-DNT | NA | 0.9 | 0.26 | 0.1 |
| 2,6-DNT | NA | 0.9 | 0.26 | 0.1 |
| TNT | NA | 21 | NA | 3 |
| RDX | NA | 5.8 | NA | 0.8 |
| HMX | NA | 3900 | NA | 2,000 |
| Nitrocellulose | NA | Best available | NA | Best available |
| Nitroglycerine | NA | Best available | NA | Best available |
| Nitroguanidine | NA | 7,800 | NA | 4,000 |
| Aluminum | NA | Best available | NA | Best available |
| Arsenic | 2.0 | 0.4 | 20 | 0.1 |
| Barium | NA | 5,500 | NA | 2,000 |
| Cadmium | NA | 78 | 6.0 | 5.0 |
| Chromium | NA | 230 | NA | 100 |
| Lead | NA | 400 | NA | 15 |
| Mercury | NA | 23 | NA | 2.0 |
| Selenium | NA | 390 | NA | 50 |
| Silver | NA | 390 | NA | 200 |
| Zinc | NA | 24,000 | NA | 11,000 |
| 1,3,5-TNB | NA | 2,300 | NA | 1,000 |
| 1,3-DNB | NA | 7.8 | NA | 4.0 |
| Nitrobenzene | NA | 39 | NA | 20 |
| o-nitrotoluene | NA | 780 | NA | 400 |
| n-nitrotoluene | NA | 780 | NA | 400 |
| p-nitrotoluene | NA | 780 | NA | 400 |
| Manganese | NA | 3,600 | NA | 2,000 |
| PCBs | NA | 0.3 | 1.1 | 0.04 |

DL = Detection limit.
GPL = GPL Laboratories, Inc.
MRL = Method reporting limit.
NA = GPL MRL met QAPP requirements.
RA = Remedial action.
RVAAP = Ravenna Army Ammunition Plant.

Overall, the laboratory met PQL requirements. The exceptions noted above are discussed under the respective method evaluations.

## 3.3 FIELD DUPLICATES

Field duplicate samples were collected for each matrix under investigation and analyzed for all target analytes. Relative percent differences (RPDs) were calculated where applicable and the results are presented for each method. The RPDs are not applicable where one of the analytical results was nondetect or is estimated below the level of quantitation. This event is indicated by an asterisk (*) in the table. Where the RPD exceeded QAPP-acceptance criteria, 30% for waters or 50% for soils and sediments, the word “Fail” qualifies the listed RPD. Positive results in the primary and field duplicate have been qualified estimated (J). This estimated value implies that more variability than acceptable may occur in subsequent re-sampling events.

### 3.4 SPLIT SAMPLES

Field samples were divided between GPL and another laboratory to evaluate analytical quality. No evaluation of inter-laboratory precision was made because analytical data from the second laboratory was not provided.

## 4.0 VOLATILE ORGANIC COMPOUNDS

Nine samples were submitted as field duplicates for volatile analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Most RPD values have been qualified with an (*) representing undetectable or estimated below the quantitation limit in the other aliquot. All RPD values calculated for volatile organics meet the QAPP criteria.

| FBQMW-167 | | | |
|---|---|---|---|
| **Chemical** | **-0308-GW** | **-0407-GW** | **RPD** |
| 1,1,1-Trichloroethane | 5.80 | 5.00 U | 14.8 * |
| 1,1-Dichloroethene | 4.20 J | 5.00 U | 17.4 * |
| Acetone | 5.60 JB | 4.80 JB | 15.4 * |
| Methylene Chloride | 6.60 JB | 6.10 JB | 7.87 * |

| FBQSD-130- | | | |
|---|---|---|---|
| **Chemical** | **-0255-SD** | **-0389-SD** | **RPD** |
| Acetone | 16.00 JB | 17.00 JB | 6.1 * |
| Methylene Chloride | 18.00 JB | 16.00 JB | 11.7 * |

| FBQSD-133 | | | |
|---|---|---|---|
| **Chemical** | **-0258-SD** | **-0394-SD** | **RPD** |
| 2-Butanone | 17.00 U | 15.00 J | 12.5 * |
| Acetone | 8.50 JB | 40.00 B | 129 * |
| Methylene Chloride | 11.00 JB | 14.00 JB | 24 * |
| Toluene | 7.30 J | 79.00 | 166 * |

| FBQSD-138 | | | |
|---|---|---|---|
| **Chemical** | **-0263-SD** | **-0393-SD** | **RPD** |
| Acetone | 9.60 JB | 17.0 U | 55.6 * |
| Methylene Chloride | 11.00 JB | 17.00 JB | 42.8 * |

| FBQSD-140 | | | |
|---|---|---|---|
| **Chemical** | **-0265-SD** | **-0395-SD** | **RPD** |
| 2-Butanone | 13.00 JB | 9.80 JB | 28.1 * |
| Acetone | 36.00 | 32.00 | 11.8 |
| Methylene Chloride | 18.00 JB | 14.00 U | 25.0 * |

| FBQSO-086 | | | |
|---|---|---|---|
| **Chemical** | **-0172-SO** | **-0406-SO** | **RPD** |
| 2-Butanone | 5.40 J | 12.00 U | 75.9 * |
| Acetone | 12.00 JB | 10.00 JB | 18.2 * |
| Carbon Disulfide | 3.10 J | 6.10 U | 65.2 * |
| Methylene Chloride | 9.20 JB | 16.00 JB | 54.0 * |

| FBQSS-084 | | | |
|---|---|---|---|
| **Chemical** | **-0167-SO** | **-0404-SO** | **RPD** |
| Acetone | 10.00 JB | 7.30 JB | 31.2 * |
| Methylene Chloride | 6.50 JB | 11.00 JB | 51.4 * |
| Toluene | 3.90 J | 5.8 U | 39.2 * |

| FBQSW-134 | | | |
|---|---|---|---|
| **Chemical** | **-0300-SW** | **-0391-SW** | **RPD** |
| 2-Butanone | 3.40 J | 2.50 J | 30.5 * |
| Acetone | 14.00 B | 14.00 B | 0 * |
| Carbon Disulfide | 1.70 J | 5.0 U | 98.5 * |
| Methylene Chloride | 6.20 JB | 6.70 JB | 7.7 * |
| Toluene | 16.00 | 17.00 | 6.1 |

| FBQSW-135 | | | |
|---|---|---|---|
| **Chemical** | **-0301-SW** | **-0392-SW** | **RPD** |
| Acetone | 7.10 JB | 4.90 JB | 36.6 * |
| Methylene Chloride | 7.60 JB | 5.70 JB | 28.6 * |
| Toluene | 3.60 J | 3.90 J | 8.0 * |

In the review of laboratory QC criteria, calibrations were generally acceptable and followed method requirements. Instrument tuning met requirements. Where the percent relative standard deviation (%RSD) failed to meet the required 15% limit for an analyte, undetectable levels of these compounds were rejected (R) and positive results were qualified estimated (J). Table 4-1, Rejected Results for Volatile Compounds, lists specific sample numbers and analytes that were rejected.

Calibration verification was performed using a second source standard. When compounds had %RSD values that were greater than 20%, further evaluation of the data was performed. When positive bias existed in the %RSD, associated samples with undetectable levels of the compounds were not qualified. However, a positive bias associated with a positive result was qualified estimated (J). When a negative bias was present in the %RSD, positive values were qualified estimated (J) and nondetected values were estimated at the reporting limit (UJ). No %RSD values were seen in excess of 40%.

**Table 4-1. Rejected Results for Volatile Organic Compounds**

| SDG | Sample IDs | Compound | % RSD | Type | Date |
|---|---|---|---|---|---|
| 311136 | FBQ-MW-168-0310-GW | Bromomethane | 17 | ICAL | 11/10/03 |
| | FBQ-MW-172-0318-GW | Methylene Chloride | 23.6 | | |
| | FBQ-MW-172-0408-GW | Acetone | 32.7 | | |
| | FBQ-MW-175-0324-GW | 2-Butanone | 16 | | |
| | Trip Blank | *trans*-1,3-Dichloropropene | 21.8 | | |
| 311076 | FBQ-MW-171-0316-GW | 2-Hexanone | 15.4 | | |
| | FBQ-MW-170-0314-GW | Bromoform | 20.8 | | |
| | Trip Blank | 1,2-Dibromo-3-chloropropane | 21.8 | | |
| | FBQ-SO-079-0158-SO | 1,2,4-Trichlorobenzene | 23.6 | | |
| | FBQ-SS-079-0157-SO | Freon-113 | 19.8 | | |
| | FBQ-SS-098-0195-SO | Cyclohexane | 19.7 | | |
| 311113 | FBQ-MW-167-0308-GW | Methyl Acetate | 21.2 | | |
| | FBQ-MW-167-0407-GW | | | | |
| | FBQ-MW-169-0312-GW | | | | |
| | FBQ-MW-174-0322-GW | | | | |
| | FBQ-SO-086-0172-SO | | | | |
| | FBQ-SO-086-0406-SO | | | | |
| | Trip Blank | | | | |
| 310082 | FBQ-SS-019-0037-SO | Chloromethane | 17 | ICAL | 10/7/03 |
| | FBQ-SS-019-0038-SO | Bromomethane | 17.2 | | |
| | FBQ-SS-060-0119-SO | Methylene Chloride | 15.2 | | |
| | FBQ-SS-060-0120-SO | | | | |
| | FBQ-SS-017-0033-SO | | | | |
| | FBQ-SS-045-0089-SO | | | | |
| | FBQTB-0379 | | | | |
| | FBQ-SS-017-0033-SO-RE | Methylene Chloride | 17.2 | ICAL | 10/21/03 |
| | FBQ-SS-045-0089-SO-RE | Acetone | 27.7 | | |
| | | 2-Hexanone | 23.3 | | |
| 311095 | FBQ-SS-083-0165-SO | 1,1-Dichloroethene | 23.6 | ICAL | 11/10/03 |
| | FBQ-SS-083-0166-SO | Acetone | 32.7 | | |
| | FBQ-SS-084-0404-SO | *trans*-1,3-Dichloropropene | 21.8 | | |
| | FBQ-SS-084-0167-SO | Bromoform | 20.8 | | |
| | FBQ-TB-0405 | Methyl Acetate | 21.2 | | |

%RSD = Percent relative standard deviation.
SDG = Sample Delivery Group.

Surrogate recovery exceeded acceptable limits of 50 to 150% for the analysis of several samples in various SDGs. In most cases, samples were reanalyzed within the holding time with similar results. Since all recoveries were between 10 and 50%, positive values for all volatiles in these samples have been qualified estimated (J) and all nondetect values have been qualified estimated at the reporting limit (UJ). Samples affected by low surrogate recovery include: FBQSS-019-0037-SO, FBQSS-019-0038-SO, FBQSS-017-0033-SO, FBQSS-045-0089-SO, FBQ-SO-098-0195-SO, FBQ-SO-079-0158-SO, FBQ-SO-079-0157-SO, FBQ-SO-086-0172-SO, and FBQ-SO-086-0406-SO.

IS area counts were acceptable for all samples evaluated during validation.

Method blanks were contaminated above one-half the MRL with acetone, methylene chloride, and/or 2-butanone. Trip blanks contained acetone and methylene chloride also. Equipment rinse blanks also contained carbon disulfide in addition to methylene chloride and acetone. Sample results have been

qualified “B” for common laboratory contaminants less than ten times the amount in the blank and less than five times the amount in the blank for other contaminants according to the LCG criterion.

LCS recoveries were generally acceptable. Elevated LCS/LCS duplicate (LCSD) recoveries were seen in several SDGs. Positive values for toluene were qualified estimated (J) in SDG 311095; in all other cases, elevated LCS/LCSD percent recoveries were associated with undetectable compounds in the associated samples. Low recovery of methyl acetate was reported in SDG 311136. All samples in this analytical batch had undetectable levels of this compound, and have been previously qualified (R) due to calibration issues.

MS/MSD analysis was performed at an appropriate frequency by the laboratory. In general, MS/MSD percent recoveries for samples associated with this project were acceptable. When batch QC was utilized by the laboratory, more compounds were reported out of control for MS/MSD criteria. Project samples were not qualified based on batch QC samples not collected from this project. For soil and sediment samples, MS/MSD recoveries for chloromethane, methylene chloride, carbon disulfide, 4-methyl-2-pentanone, and 2-hexanone were slightly out of control limits. For aqueous samples, MS/MSD recoveries for acetone and methyl acetate were slightly outside of control limits. There was no significant impact on data usability.

## 5.0 SEMIVOLATILE ORGANIC COMPOUNDS

Nine samples were submitted as field duplicates for semivolatile analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Three field duplicates had undetectable levels of all SVOC compounds in both aliquots. Most RPD values have been qualified with an (*) representing undetectable or estimated below the quantitation limit in the other aliquot. All RPD values calculated for semivolatile organics meet the QAPP criteria.

| **FBQMW-167** | | | |
|---|---|---|---|
| **Chemical** | **-0308-GW** | **-0407-GW** | **RPD** |
| bis(2-Ethylhexyl) phthalate | 2.30 JB | 2.60 J | 12.2 * |
| Caprolactam | 46.00 | 36.00 | 24.4 |

| **FBQSD-130** | | | |
|---|---|---|---|
| **Chemical** | **-0255-SD** | **-0389-SD** | **RPD** |
| Benzo(*a*)pyrene | 100.00 J | 82.00 J | 19.8 * |
| Benzo(*b*)fluoranthene | 160.00 J | 120.00 J | 28.6 * |
| bis(2-Ethylhexyl) phthalate | 880.00 U | 93.00 J | 162 * |
| Chrysene | 110.00 J | 89.00 J | 21.1 * |
| Fluoranthene | 170.00 J | 160.00 J | 6.06 * |
| Pyrene | 200.00 J | 800.00 U | 120 * |

| **FBQSD-133** | | | |
|---|---|---|---|
| **Chemical** | **-0258-SD** | **-0394-SD** | **RPD** |
| 4-Methylphenol | 510.00 J | 440.00 J | 14.7 * |
| bis(2-Ethylhexyl) phthalate | 110.00 JB | 72.00 JB | 41.7 * |

| FBQSD-138 | | | |
|---|---|---|---|
| **Chemical** | **-0263-SD** | **-0393-SD** | **RPD** |
| Benzo(*a*)anthracene | 74.00 J | 560.00 U | 153 * |
| Benzo(*a*)pyrene | 72.00 J | 60.00 J | 18.2 * |
| Benzo(*b*)fluoranthene | 120.00 J | 96.00 J | 22.2 * |
| Chrysene | 81.00 J | 67.00 J | 18.9 * |
| Fluoranthene | 180.00 J | 140.00 J | 25.0 * |
| Phenanthrene | 97.00 J | 95.00 J | 2.1 * |
| Pyrene | 130.00 J | 560.00 U | 124 * |

| FBQSW-134 | | | |
|---|---|---|---|
| **Chemical** | **-0300-SW** | **-0391-SW** | **RPD** |
| 4-Methylphenol | 170.00 | 22.00 J | 154 * |
| bis(2-Ethylhexyl) phthalate | 2.80 JB | 2.50 JB | 11.3 * |
| Phenol | 120.00 | 110.00 | 8.7 |

| FBQSW-135 | | | |
|---|---|---|---|
| **Chemical** | **-0301-SW** | **-0392-SW** | **RPD** |
| bis(2-Ethylhexyl) phthalate | 1.40 J | 2.00JB | 35.3 * |

Calibration and calibration verifications were generally acceptable and followed method requirements. Instrument tuning and IS performance met requirements except where noted below.

In the review of laboratory QC criteria, calibrations and calibration verifications were generally acceptable and followed method requirements. Instrument tuning and IS performance met requirements. Where the %RSD failed to meet the required 15% limit for an analyte, undetectable levels of these compounds were rejected (R) and positive results were qualified estimated (J). Table 5-1, Rejected Results for semivolatile Compounds, lists specific sample numbers and analytes that were rejected.

The laboratory has recently started running a low level MRL standard at least at the beginning of each analytical sequence. Recovery is expected between 70 and 130%. For recoveries between 50 and 70%, all positive values have been qualified (J) and all nondetected compounds (UJ). Rejected data for semivolatile compounds are listed in Table 5-1 where %RSD was less than 50%. Continuing calibration verification was also used to qualify data with %RSD values greater than 20%. Compounds with a negative bias were qualified (J) to positive values and (R) to undetected compounds.

ISs were acceptable for all samples validated.

Method blanks were contaminated above one-half the MRL with bis(2-ethyl hexyl)phthalate. Sample results have been qualified (B) for this common laboratory contaminant less than ten times the amount in the blank according to the LCG criterion.

**Table 5-1. Rejected Results for Semivolatile Organic Compounds**

| SDG | Sample IDs | Compound | % RSD | Type | Date |
|---|---|---|---|---|---|
| 311136 | FBQ-MW-168-0310-GW | Benzadehyde | 74.5 | ICAL | 12/22/03 |
| | FBQ-MW-172-0318-GW | Phenol | 16.3 | | |
| | FBQ-MW-172-0408-GW | n-Nitroso-di-n-propylamine | 15.7 | | |
| | FBQ-MW-175-0324-GW | Naphthalene | 16.9 | | |
| | FBQ-MW-175-0324-GW-DL | 4-Chloroaniline | 18.4 | | |
| 311113 | FBQ-MW-167-0308-GW | Hexachlorocyclopentadiene | 19.6 | | |
| | FBQ-MW-167-0407-GW | 1,1-Biphenyl | 15.9 | | |
| | FBQ-MW-169-0312-GW | Acenaphthene | 23.1 | | |
| | FBQ-MW-174-0322-GW | 2,4-Dinitrophenol | 18.6 | | |
| | FBQ-SO-086-0172-SO | Dibenzofuran | 15.2 | | |
| | FBQ-SO-086-0406-SO | Fluorene | 16 | | |
| | Trip Blank | 4,6-Dinitro-2-methylphenol | 15.8 | | |
| | | n-Nitrosodiphenylamine | 19.4 | | |
| | | Atrazine | 76.8 | | |
| | | Phenanthrene | 22.5 | | |
| | | Anthracene | 23.5 | | |
| | | Carbazole | 23.6 | | |
| | | di-n-Butylphthalate | 25 | | |
| | | Fluoranthene | 21.8 | | |
| | | Pyrene | 19.2 | | |
| | | 3,3-Dichlorobenzidine | 34.4 | | |
| 3100082 | FBQ-SS-019-0038-SO | Benzadehyde | 67.7 | ICAL | 10/17/03 |
| | FBQ-SS-060-0119-SO | 2,4-Dinitrophenol | 26.8 | | |
| | FBQ-SS-060-0120-SO | 4,6-Dinitro-2-methylphenol | 15.6 | | |
| | FBQ-SS-017-0033-SO | 3,3-Dichlorobenzidine | 15.4 | | |
| | FBQ-SS-045-0089-SO | | | | |
| | | Hexachlorocyclopentadiene | 31.7 | MRL | |
| | | 4-Nitrophenol | 32.2 | | |
| | | n-Nitrosodimethylamine | 48.2 | | |
| | | di-n-Octylphthalate | -30.8 | | |
| | | Caprolactam | -37.2 | CCV | |
| | | 3-Nitroaniline | -24.5 | | |
| | | 2,4-Dinitrotoluene | -20.5 | | |
| | | 4-Nitroaniline | -31.5 | | |
| | | di-n-Butylphthalate | -24.0 | | |
| 311076 | FBQ-MW-171-0316-GW | Benzaldehyde | 57.6 | ICAL | 12/3/03 |
| | FBQ-MW-170-0314-GW | Acenaphthylene | 18.5 | | |
| | | 2,4-dinitrophenol | 20.5 | | |
| | | Atrazine | 42 | | |
| | | Phenanthrene | 18.9 | | |
| | | Carbazole | 17.7 | | |
| | | di-n-Butylphthalate | 18.3 | | |
| | | Fluoranthene | 18.6 | | |
| | | 3,3-Dichlorobenzidine | 23.3 | | |
| | | 4-Chloroaniline | -26.1 | CCV | |
| | | 4-Nitroaniline | -34.7 | | |
| | | 4-Nitrophenol | 0% | | |
| | | Pentachlorophenol | 6% | | |

**Table 5-1. Rejected Results for Semivolatile Organic Compounds (continued)**

| SDG | Sample IDs | Compound | % RSD | Type | Date |
|---|---|---|---|---|---|
| 311095 | FBQ-SS-083-0165-SO<br>FBQ-SS-083-0166-SO<br>FBQ-SS-084-0404-SO<br>FBQ-SS-084-0167-SO<br>FBQ-SO-079-0158-SO<br>FBQ-SO-079-0157-SO<br>FBQ-SS-098-0195-SO | Benzadehyde<br>Bis(2-chloroethyl)ether<br>Acenaphthylene<br>2,4-Dinitrophenol<br><br><br><br>Hexachlorobutadiene<br>din-n-Octylphthalate | 72.5<br>21.8<br>16.7<br>19.3<br><br><br><br>-23.3<br>-24.4 | ICAL<br><br><br><br><br><br><br>CCV<br> | 12/23/03 |
| 311103 | FBQ-SS-TCLP | Pyridine<br>Hexachlorobutadiene | 22.2<br>17 | ICAL | 12/1/03 |

%RSD = Percent relative standard deviation.
SDG = Sample Delivery Group.

Low LCS/LCSD percent recoveries were reported in SDG 311076 for 2-chlorophenol, 4-nitrophenol, pentachlorophenol, and phenol. Results for 4-nitrophenol and pentachlorophenol have been rejected (R) due to recovery less than 30%. All other compounds with low LCS percent recoveries have been qualified estimated (J/UJ). Low LCS recovery was reported in SDG 311095 for 2-chlorophenol, 4-nitrophenol, 4-chloro-3-methylphenol, pentachlorophenol, phenol, and n-nitrosodi-n-propylamine. All values of these compounds have been qualified estimated (J/UJ) due to these slight exceedances.

MS/MSD recoveries were within acceptance criteria.

# 6.0 PESTICIDES/POLYCHLORINATED BIPHENYLS

Nine samples were submitted as field duplicates for pesticide and PCB analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Six field duplicates had undetectable levels of all pesticide/PCB compounds in both aliquots. Most RPD values have been qualified with an (*) representing undetectable or estimated below the quantitation limit in the other aliquot. All RPD values calculated for pesticides and PCBs met the QAPP criteria.

| FBQSD-133 | | | |
|---|---|---|---|
| **Chemical** | **-0394-SD** | **-0258-SD** | **RPD** |
| Methoxychlor | 1.10 J | 2.80 U | 87.2 * |

| FBQSD-138 | | | |
|---|---|---|---|
| **Chemical** | **-0393-SD** | **-0263-SD** | **RPD** |
| Methoxychlor | 0.94 J | 2.5 U | 90.7 * |

| FBQSD-140 | | | |
|---|---|---|---|
| **Chemical** | **-0265-SD** | **-0395-SD** | **RPD** |
| 4,4-DDE | 0.79 J | 0.57 J | 32.3 * |

Calibration and calibration verifications were acceptable and followed method requirements.

Low LCS percent recovery (%R) was reported for delta-BHC in SDGs 311136, 311076, and 311113. The laboratory attributed this problem to a standard problem. However, because of the recovery less than 30%, all sample data in this analytical batch have been rejected (R) for delta-BHC in these associated SDGs. Table 6-1, Rejected Results for Pesticide/PCB Compounds, lists specific sample numbers and analytes that were rejected.

**Table 6-1. Rejected Results for Pesticide/PCB Compounds**

| SDG | Sample Number | Analyte | Analysis |
|---|---|---|---|
| 311136 | FBQ-MW-168-0310-GW<br>FBQ-MW-172-0318-GW<br>FBQ-MW-172-0408-GW<br>FBQ-MW-175-0324-GW | Delta-BHC | LCS |
| 311076 | FBQ-MW-171-0316-GW<br>FBQ-MW-170-0314-GW | Delta-BHC | LCS |
| 311113 | FBQ-MW-167-0308-GW<br>FBQ-MW-167-0407-GW<br>FBQ-MW-169-0312-GW<br>FBQ-MW-174-0322-GW | Delta-BHC | LCS |

PCB = Polychlorinated biphenyl.
SDG = Sample Delivery Group.

The method blank in SDG 311095 had low level contamination of 4,4-DDT; aldrin; dieldrin; endrin; endrin ketone; gamma-BHC; and heptachlor. The laboratory isolated this contamination to syringe contamination. Only one sample showed low level contamination of similar compounds at levels within five times the value found in the blank. These compounds have been qualified found in blank (B) in this sample.

MS/MSD recoveries were acceptable. Surrogate recoveries were generally acceptable.

With the exceptions noted above, the data are considered to be technically sound and usable.

# 7.0 EXPLOSIVES AND PROPELLANTS SW8330

Twenty-six samples were submitted as field duplicates for explosive analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Twenty-one field duplicates had undetectable levels of all explosive compounds in both aliquots. Most RPD values have been qualified with an (*) representing undetectable or estimated below the quantitation limit in the other aliquot. All RPD values calculated for explosives met the QAPP criteria.

| FBQSS-049 | | | |
|---|---|---|---|
| **Chemical** | **-0097-SO** | **-0378-SO** | **RPD** |
| 2,4,6-Trinitrotoluene | 82.00 J | 120.00 | 37.6 * |
| 2-Amino-4,6-Dinitrotoluene | 140.00 | 190.00 | 30.3 |
| 4-Amino-2,6-Dinitrotoluene | 110.00 | 140.00 | 24 |

| FBQSS-075 | | | |
|---|---|---|---|
| **Chemical** | **-0149-SO** | **-0403-SO** | **RPD** |
| Tetryl | 170.00 J | 200.00 U | 16.2 * |

| FBQSD-133 | | | |
|---|---|---|---|
| **Chemical** | **-0394-SD** | **-0258-SD** | **RPD** |
| m-Nitrotoluene | 81.00 J | 200.00 U | 84.7 * |

| FBQSD-138 | | | |
|---|---|---|---|
| **Chemical** | **-0263-SD** | **-0393-SD** | **RPD** |
| m-Nitrotoluene | 78.00 J | 200.00 U | 85.6 * |

| FBQSW-134 | | | |
|---|---|---|---|
| **Chemical** | **-0300-SW** | **-0391-SW** | **RPD** |
| 2-Amino-4,6-Dinitrotoluene | 0.68 J | 0.53 J | 24.8 * |
| 4-Amino-2,6-Dinitrotoluene | 20.00 J | 18.00 J | 10.5 * |

Calibration and calibration verifications were acceptable and followed method requirements. Associated calibration and method blanks were free of contamination.

Most LCS results met acceptable percent recoveries. In SDG 311082, low LCS %R was reported for tetryl. All samples had undetectable levels of tetryl and have been qualified rejected (R) due to recovery less than 30%. Also in SDG 311076, LCS/LCSD percent recoveries were outside of laboratory QC limits in the water analysis for 1,3,5-trinitrobenzene and tetryl. All associated samples had undetectable levels of these compounds, and results for these compounds were rejected (R) due to percent recoveries less than 30%. In the same SDG, LCS/LCSD percent recoveries were outside of laboratory QC limits in the soil analysis for 1,3,5-trinitrobenzene and tetryl and were rejected (R) due to percent recoveries less than 30%.

No surrogate results were reported for nitroguanidine. The laboratory stated that nitroguanidine was directly injected and there is typically no surrogate added when the direct injection method is used.

MS/MSD and LCS recoveries met the QAPP requirements.

With the exceptions noted above, the data are considered to be technically sound and usable.

## 8.0 METALS AND MERCURY

Twenty-six samples were submitted as field duplicates for metals analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Most RPD values have been qualified with an (*) representing undetectable or estimated below quantitation limit in the other aliquot. Most compounds where high RPD values have been calculated between duplicates are with sample concentrations within five times the standard reporting limit. No data were qualified with this low level variability. Most RPD values calculated for metals met the QAPP criteria.

Calibration and calibration verification performance were within acceptance criteria. Interference checks, dilution tests, and post-digestion recoveries were within acceptance criteria except where noted.

The preparation blank frequently contained calcium, chromium, copper, sodium, and occasionally other target analytes above the MRL. The initial calibration blank was free of contamination, while continuing calibration blanks contained aluminum, iron, lead, sodium, thallium, magnesium, and occasionally other target analytes. Results for these analytes should be qualified (B) where positive values are less than five times the blank value in accordance with the LCG.

LCS recoveries of all analytes were within the specified control limits.

MS/MSD recoveries frequently were outside of control limits for antimony, arsenic, copper, magnesium, and potassium. However, post-digestion spike recoveries were with acceptance limits.

With the exceptions noted above, the data are considered to be technically sound and usable.

# 9.0 GENERAL CHEMISTRY (IAAP NITROCELLULOSE, CYANIDE, SULFIDE, FLASHPOINT, TOTAL ORGANIC CARBON, AND HEXAVALENT CHROMIUM)

Calibrations for general chemistry methods were acceptable. Sulfide is a titrimetric method and data for the standardization of the titrant were provided. Subsequent continuing calibration verification standards confirmed that the analyses remained in control. Associated calibration and method blanks were free of contamination.

LCS recoveries for analytes were within the specified control limits. MS/MSD recoveries were within acceptance criteria.

Several sample dilutions were required due to the limited range of the analytical method performed for hexavalent chromium. Dilutions were required to bring hexavalent chromium levels to within the linear range of the instrument. Reported values accurately reflected target analyte concentrations in project samples.

The data are considered to be technically sound and usable.

# 10.0 QUALITY CONTROL PARAMETERS

## 10.1 ACCURACY

Accuracy is defined as the agreement of a measurement with an accepted reference or true value and was measured by the %R of each analyte in the LCSs analyzed with each sample batch. Any rejection of analytical results based on non-conformant LCS recoveries is discussed under each method in previous sections of this report. The overall level of accuracy is considered to be acceptable.

## 10.2 PRECISION

Precision is defined as the agreement between a set of replicate measurements without consideration or knowledge of the true value. Precision was evaluated based on MS/MSD and field duplicate results where available. Any rejection of analytical results based on non-conformant MS/MSD RPDs are discussed under each method in previous sections of this report. Field duplicate samples were also analyzed and RPDs were calculated where applicable. The overall level of precision is considered to be acceptable.

## 10.3 COMPLETENESS

Completeness is the quantitative measure of the amount of data obtained from a measurement process compared with the amount expected to be obtained under the conditions of measurement. Unusable analytical data are those results reported by the laboratory but rejected during the data validation process. Completeness for all analytical fractions is outlined below. Table 10-1 summarizes the overall rejected results for all methods. Soil VOCs had higher than 10% rejections. The overall percentage of acceptable results was 96.8%, meeting the project completeness goal of 90%.

**Table 10-1. Summary of Rejected Results for All Methods**

| Media | Analysis Group | Rejected Results | Total Results | Percent Rejected |
|---|---|---|---|---|
| Sediment | Metals | 0 | 1,012 | 0% |
| | Volatile Organics | 0 | 2,156 | 0% |
| | Semivolatile Organics | 0 | 2,860 | 0% |
| | Pesticides/PCBs | 0 | 1,276 | 0% |
| | Explosives | 0 | 748 | 0% |
| | General Chemistry | 0 | 99 | 0% |
| | Subtotal | 0 | 8,151 | 0% |
| Soil | Metals | 8 | 3,933 | 0.20% |
| | Volatile Organics | 279 | 1,066 | 26.2% |
| | Semivolatile Organics | 114 | 1,495 | 7.62% |
| | Pesticides/PCBs | 0 | 645 | 0% |
| | Explosives | 44 | 2,606 | 1.69% |
| | General Chemistry | 0 | 22 | 0% |
| | Subtotal | 445 | 9,767 | 4.56% |
| Surface Water, Groundwater, and Quality Control | Metals | 0 | 805 | 0% |
| | Volatile Organics | 157 | 2,548 | 6.16% |
| | Semivolatile Organics | 203 | 2,275 | 8.92% |
| | Pesticides/PCBs | 10 | 1,015 | 0.98% |
| | Explosives | 4 | 595 | 0.67% |
| | General Chemistry | 0 | 46 | 0% |
| | Subtotal | 374 | 7,284 | 5.13% |
| **Project Totals** | | **818** | **25,202** | **3.24%** |

PCB = Polychlorinated biphenyl.

## 10.4 REPRESENTATIVENESS

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness was evaluated by comparing the results of the field duplicate pairs and conducting sampling in accordance with the work plan, QAPP, and relevant standard operating procedures. Results for all analytes satisfied the field duplicate evaluation criteria and all sampling/analysis protocols were followed.

### 10.5 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared to another. Comparability for this project could not be evaluated because of the absence of any previous data.

### 10.6 REJECTED DATA

Rejected data eliminate the actual result or data points for these compounds in the affected samples. Therefore, the data cannot be used to definitively state that these compounds are not present in these samples. If these compounds were suspected to be present in the samples, or were considered a critical contaminant of concern, re-sampling and re-analysis may be necessary to validate the concentration reported to the standards required by the data quality guidelines.

## 11.0 ELECTRONIC DATA DELIVERABLES

The electronic data deliverables (EDDs) were reviewed for completeness and the following observations were made. Overall the EDDs were acceptable with the following exceptions.

- Calibration data are not included in the EDDs. However, all the data packages are presented in electronic format (PDF) as well as hard copies. Calibration and QC data are available in both CD-ROM and hard copy formats.

- The VOC and SVOC LCS analyzed with SDG 208002 contained only a short analyte list reported in the EDD, well under the target analyte list as required by the QAPP Addendum. However, the results for the whole target analyte list were reported in the hardcopy data package and CD-ROM.

- Inconsistent reporting of compound names has been corrected to reflect consistent reporting requirements in the EDD.

## 12.0 REFERENCES

This report was written by Valerie Mariola.

USACE (U. S. Army Corps of Engineers) 1998. *Shell Document for Analytical Chemistry Requirements.*

USACE 2001. *Quality Assurance Project Plan (QAPP) for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio,* March.

USACE 2002. *Work Plan and Sampling and Analysis Plan Addenda for the Phase I/Phase II RI at the Fuze and Booster Quarry Landfill/Ponds at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (SAP Addendum).

USACE 2003. *Quality Assurance Project Plan Addendum for Phase I/Phase II Remedial Investigation of the Fuze Booster Quarry Landfill/Ponds*, October.

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# ATTACHMENT A
# PROJECT QUANTITATION LIMIT GOALS AND ACHIEVED METHOD REPORTING LIMITS

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**Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits**

| Parameters/Methods | Water | | Soil/Sediment | |
|---|---|---|---|---|
| | Project Quantitation Goal (µg/L) | Achieved Method Detection Level (µg/L) | Project Quantitation Goal (µg/kg) | Achieved Method Detection Level (µg/kg) |
| ***VOCs SW 846-8260B*** | | | | |
| 1,1,1-Trichloroethane | 1 | 5.0 | 5 | 5 |
| 1,1,2,2-Tetrachloroethane | 1 | 5.0 | 5 | 5 |
| 1,1,2-Trichloroethane | 1 | 5.0 | 5 | 5 |
| 1,1-Dichloroethane | 1 | 5.0 | 5 | 5 |
| 1,1-Dichloroethene | 1 | 5.0 | 5 | 5 |
| 1,2-Dibromomethane | 1 | 5.0 | 5 | 5 |
| 1,2-Dichloroethane | 1 | 5.0 | 5 | 5 |
| 1,2-Dichloroethene (total) | 1 | 5.0 | 5 | 5 |
| 1,2-Dichloropropane | 1 | 5.0 | 5 | 5 |
| 2-Butanone | 10 | 10 | 20 | 10 |
| 2-Hexanone | 10 | 10 | 20 | 10 |
| 4-Methyl-2-pentanone | 10 | 10 | 20 | 10 |
| Acetone | 10 | 10 | 20 | 10 |
| Benzene | 1 | 5.0 | 5 | 5 |
| Bromochloromethane | 1 | 5.0 | 5 | 5 |
| Bromodichloromethane | 1 | 5.0 | 5 | 5 |
| Bromoform | 1 | 5.0 | 5 | 5 |
| Bromomethane | 1 | 5.0 | 5 | 10 |
| Carbon Disulfide | 1 | 5.0 | 5 | 5 |
| Carbon Tetrachloride | 1 | 5.0 | 5 | 5 |
| Chlorobenzene | 1 | 5.0 | 5 | 5 |
| Chloroethane | 1 | 5.0 | 5 | 10 |
| Chloroform | 1 | 5.0 | 5 | 5 |
| Chloromethane | 1 | 5.0 | 5 | 10 |
| *cis*-1,3-Dichloropropene | 1 | 5.0 | 5 | 5 |
| Dibromochloromethane | 1 | 5.0 | 5 | 5 |
| Ethylbenzene | 1 | 5.0 | 5 | 5 |
| Methylene Chloride | 1 | 5.0 | 5 | 10 |
| Styrene | 1 | 5.0 | 5 | 5 |
| Tetrachloroethene | 1 | 5.0 | 5 | 5 |
| Toluene | 1 | 5.0 | 5 | 5 |
| *trans*-1,3-Dichloropropene | 1 | 5.0 | 5 | 5 |
| ***VOCs SW 846-8260B*** | | | | |
| Trichloroethene | 1 | 5.0 | 5 | 5 |
| Vinyl Chloride | 1 | 5.0 | 5 | 10 |
| Xylenes (total) | 2 | 15 | 10 | 15 |
| ***SVOCs SW 846-8270C*** | | | | |
| 1,2,4-Trichlorobenzene | 10 | 11 | 330 | 330 |
| 1,2-Dichlorobenzene | 10 | 11 | 330 | 330 |
| 1,3-Dichlorobenzene | 10 | 11 | 330 | 330 |
| 1,4-Dichlorobenzene | 10 | 11 | 330 | 330 |
| 2,4,5-Trichlorophenol | 25 | 22 | 330 | 330 |
| 2,4,6-Trichlorophenol | 10 | 11 | 330 | 330 |
| 2,4-Dichlorophenol | 10 | 11 | 330 | 330 |
| 2,4-Dimethylphenol | 10 | 11 | 330 | 330 |

**Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits (continued)**

| Parameters/Methods | Water | | Soil/Sediment | |
|---|---|---|---|---|
| | Project Quantitation Goal (µg/L) | Achieved Method Detection Level (µg/L) | Project Quantitation Goal (µg/kg) | Achieved Method Detection Level (µg/kg) |
| 2,4-Dinitrophenol | 25 | 22 | 800 | 660 |
| 2,4-Dinitrotoluene | 10 | 11 | 330 | 330 |
| 2,6-Dinitrotoluene | 10 | 11 | 330 | 330 |
| 2-Chloronaphthalene | 10 | 11 | 330 | 330 |
| 2-Chlorophenol | 10 | 11 | 330 | 330 |
| 2-Methylnaphthalene | 10 | 11 | 330 | 330 |
| 2-Methylphenol | 10 | 11 | 330 | 330 |
| 2-Nitroaniline | 25 | 11 | 800 | 330 |
| 2-Nitrophenol | 10 | 11 | 330 | 330 |
| 3,3'-Dichlorobenzidine | 25 | 22 | 330 | 660 |
| 3-Nitroaniline | 25 | 11 | 800 | 330 |
| 4,6-Dinitro-2-methylphenol | 25 | 22 | 800 | 660 |
| 4-Bromophenylphenylether | 10 | 11 | 330 | 330 |
| 4-Chloro-3-methylphenol | 10 | 11 | 330 | 330 |
| 4-Chloroaniline | 10 | 11 | 330 | 330 |
| 4-Chlorophenyl-phenyl ether | 10 | 11 | 330 | 330 |
| 3 & 4-Methylphenol | 10 | 11 | 330 | 660 |
| 4-Nitroaniline | 25 | 11 | 800 | 330 |
| 4-Nitrophenol | 25 | 22 | 800 | 660 |
| Acenaphthene | 10 | 11 | 50 | 330 |
| ***SVOCs SW 846-8270C*** | | | | |
| Acenaphthylene | 10 | 11 | 50 | 330 |
| Anthracene | 10 | 11 | 50 | 330 |
| Benzo(*a*)anthracene | 10 | 11 | 50 | 330 |
| Benzo(*a*)pyrene | 10 | 11 | 50 | 330 |
| Benzo(*b*)fluoranthene | 10 | 11 | 50 | 330 |
| Benzo(*ghi*)perylene | 10 | 11 | 50 | 330 |
| Benzo(*k*)fluoranthene | 10 | 11 | 50 | 330 |
| Benzoic Acid | 25 | 22 | 800 | 660 |
| Benzyl alcohol | 10 | 11 | 330 | 330 |
| 2,2'-oxybis(1-Chloropropane) | 10 | 11 | 330 | 330 |
| bis(2-Chloroethoxy) methane | 10 | 11 | 330 | 330 |
| bis(2-Chloroethyl) ether | 10 | 11 | 330 | 330 |
| bis(2-Ethylhexyl)phthalate | 10 | 11 | 330 | 330 |
| Butylbenzylphthalate | 10 | 11 | 330 | 330 |
| Carbazole | 10 | 11 | 50 | 330 |
| Chrysene | 10 | 11 | 50 | 330 |
| Di-n-butylphthalate | 10 | 11 | 330 | 330 |
| Di-n-octylphthalate | 10 | 11 | 330 | 330 |
| Dibenzo(*a,h*)anthracene | 10 | 11 | 50 | 330 |
| Dibenzofuran | 10 | 11 | 330 | 330 |
| Diethylphthalate | 10 | 11 | 330 | 330 |
| Dimethylphthalate | 10 | 11 | 330 | 330 |
| Fluoranthene | 10 | 11 | 50 | 330 |
| Fluorene | 10 | 11 | 50 | 330 |

**Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits (continued)**

| Parameters/Methods | Water | | Soil/Sediment | |
|---|---|---|---|---|
| | Project Quantitation Goal (µg/L) | Achieved Method Detection Level (µg/L) | Project Quantitation Goal (µg/kg) | Achieved Method Detection Level (µg/kg) |
| Hexachlorobenzene | 10 | 11 | 330 | 330 |
| Hexachlorobutadiene | 10 | 11 | 330 | 330 |
| Hexachloroethane | 10 | 11 | 330 | 330 |
| Hexacholorocyclopentadiene | 10 | 11 | 330 | 330 |
| Indeno(1,2,3-*cd*)pyrene | 10 | 11 | 50 | 330 |
| Isophorone | 10 | 11 | 330 | 330 |
| N-Nitroso-di-n-dipropylamine | 10 | 11 | 330 | 330 |
| N-Nitrosodiphenylamine | 10 | 11 | 330 | 330 |
| ***SVOCs SW 846-8270C*** | | | | |
| Naphthalene | 10 | 11 | 50 | 330 |
| Nitrobenzene | 10 | 11 | 330 | 330 |
| Pentachlorophenol | 25 | 22 | 330 | 660 |
| Phenanthrene | 10 | 11 | 50 | 330 |
| Phenol | 10 | 11 | 330 | 330 |
| Pyrene | 10 | 11 | 50 | 330 |
| ***Pesticides SW 846-8081*** | | | | |
| 4,4-DDD | 0.05 | 0.05 | 1.7 | 1.7 |
| 4,4-DDE | 0.05 | 0.05 | 1.7 | 1.7 |
| 4,4-DDT | 0.05 | 0.05 | 1.7 | 1.7 |
| Aldrin | 0.05 | 0.05 | 1.7 | 1.7 |
| alpha-BHC | 0.05 | 0.05 | 1.7 | 1.7 |
| alpha-Chlordane | 0.05 | 0.05 | 1.7 | 1.7 |
| beta-BHC | 0.05 | 0.05 | 1.7 | 1.7 |
| Chlordane | 0.05 | 1.0 | 1.7 | 33 |
| delta-BHC | 0.05 | 0.05 | 1.7 | 1.7 |
| Dieldrin | 0.05 | 0.05 | 1.7 | 1.7 |
| Endosulfan I | 0.05 | 0.05 | 1.7 | 1.7 |
| Endosulfan II | 0.05 | 0.05 | 1.7 | 1.7 |
| Endosulfan Sulfate | 0.05 | 0.05 | 1.7 | 1.7 |
| Endrin | 0.05 | 0.05 | 1.7 | 1.7 |
| Endrin aldehyde | 0.05 | 0.05 | 1.7 | 1.7 |
| Endrin Ketone | 0.05 | 0.05 | 1.7 | 1.7 |
| gamma-BHC (Lindane) | 0.05 | 0.05 | 1.7 | 1.7 |
| gamma-Chlordane | 0.05 | 0.05 | 1.7 | 1.7 |
| Heptachlor | 0.05 | 0.05 | 1.7 | 1.7 |
| Heptachlor Epoxide | 0.05 | 0.05 | 1.7 | 1.7 |
| Methoxychlor | 0.1 | 0.05 | 1.7 | 1.7 |
| Toxaphene | 2.0 | 1.0 | 170 | 33 |
| ***PCB SW 846-8082*** | | | | |
| Arochlor-1016 | 0.5 | 1.0 | 33 | 33 |
| Arochlor-1221 | 0.5 | 1.0 | 33 | 33 |
| ***PCB SW 846-8082*** | | | | |
| Aroclor-1232 | 0.5 | 1.0 | 33 | 33 |
| Aroclor-1242 | 0.5 | 1.0 | 33 | 33 |
| Aroclor-1248 | 0.5 | 1.0 | 33 | 33 |
| Aroclor-1254 | 0.5 | 1.0 | 33 | 33 |

**Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits (continued)**

| Parameters/Methods | Water | | Soil/Sediment | |
|---|---|---|---|---|
| | Project Quantitation Goal (µg/L) | Achieved Method Detection Level (µg/L) | Project Quantitation Goal (µg/kg) | Achieved Method Detection Level (µg/kg) |
| Aroclor-1260 | 0.5 | 1.0 | 33 | 33 |
| ***Explosive Compounds SW 846-8330*** | | | | |
| HMX (Octahydro-1,3,5,7-Tetranitro-1,3,5,7-tetrazocine) | 0.5 | 0.52 | 1.0 | 0.2 |
| RDX (cyclonite) Hexahydro-1,3,5-trinitro-1,3,5-triazine | 0.5 | 0.52 | 1.0 | 0.2 |
| 1,3,5-Trinitrobenzene | 0.2 | 0.26 | 0.25 | 0.1 |
| 1,3-Dinitrobenzene | 0.2 | 0.26 | 0.25 | 0.1 |
| Tetryl | 0.2 | 0.52 | 1.0 | 0.2 |
| Nitrobenzene | 0.2 | 0.26 | 0.25 | 0.1 |
| 2,4,6-Trinitrotoluene | 0.2 | 0.26 | 0.25 | 0.1 |
| 2,4-Dinitrotoluene | 0.1 | 0.26 | 0.25 | 0.1 |
| 2,6-Dinitrotoluene | 0.1 | 0.26 | 0.25 | 0.1 |
| 2-Amino-4,6-dinitrotoluene | 0.2 | 0.26 | 0.25 | 0.1 |
| 4-Amino-2,6-dinitrotoluene | 0.2 | 0.26 | 0.25 | 0.1 |
| o-Nitrotoluene | 0.2 | 0.52 | 0.25 | 0.2 |
| m-Nitrotoluene | 0.2 | 0.52 | 0.25 | 0.2 |
| p-Nitrotoluene | 0.2 | 0.52 | 0.25 | 0.2 |
| ***Additional Explosive Compounds*** | | | | |
| Nitroglycerin | 3.0 | 26 | 3 | 10 |
| Nitroquanidine | 20 | 10 | 0.25 | 0.13 |
| Nitrocellulose | 500 | 700 | 5 | 39 |
| ***Metals SW 846-6010B/6020 or 7000*** | | | | |
| Aluminum | 100 | 200 | 10 | 20 |
| Antimony | 5 | 20 | .05 | 2.0 |
| Arsenic | 5 | 20 | 0.5 | 2.0 |
| Barium | 10 | 5.0 | 1 | 0.5 |
| Beryllium | 1 | 2.0 | 0.1 | 0.2 |
| ***Metals SW 846-6010B/6020*** | | | | |
| Cadmium | 1 | 6.0 | 0.1 | 0.6 |
| Calcium | 100 | 1000 | 10 | 100 |
| Chromium | 5 | 5.0 | 0.5 | 0.5 |
| Cobalt | 5 | 5.0 | 0.5 | 0.5 |
| Copper | 5 | 10 | 0.5 | 1.0 |
| Iron | 100 | 150 | 10 | 15 |
| Lead | 3 | 10 | 0.3 | 1.0 |
| Magnesium | 100 | 250 | 10 | 25 |
| Manganese | 10 | 5.0 | 1 | 0.5 |
| Mercury (CVAA) SW846-7470A/7471A | 0.2 | 0.2 | 0.1 | 0.03 |
| Nickel | 10 | 10 | 1 | 1.0 |
| Potassium | 200 | 250 | 20 | 25 |
| Selenium | 5 | 20 | 0.5 | 2.0 |
| Silver | 5 | 3.0 | 0.5 | 0.3 |

**Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits (continued)**

| Parameters/Methods | Water | | Soil/Sediment | |
|---|---|---|---|---|
| | Project Quantitation Goal (µg/L) | Achieved Method Detection Level (µg/L) | Project Quantitation Goal (µg/kg) | Achieved Method Detection Level (µg/kg) |
| Sodium | 200 | 2500 | 20 | 250 |
| Thallium | 2 | 30 | 0.2 | 3.0 |
| Vanadium | 10 | 10 | 1 | 1.0 |
| Zinc | 10 | 20 | 1 | 2.0 |
| ***General Chemistry*** | | | | |
| Nitrate/Nitrite Nitrogen E353.2 | 0.1 | 0.02 | NL | NA |
| Sulfide E376.2 | 1.0 | 2.5 | NL | 80 |
| Total Cyanide SW846 9014T | 0.01 | 0.005 | 0.5 | 0.25 |
| Hexavalent Chromium SW846 7196A | NL | 0.05 | NL | 0.4 |
| Total Organic Carbon SW846 9060A | 1.0 | 1.0 | 10.0 | 100 |

PCB = Polychlorinated biphenyl.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.
NL = Project quantitation level not listed for this analyte in the Facility-wide Quality Assurance Project Plan.
NA = No analysis for this compound.

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