DATA VALIDATION REPORT

# Former Sylvania Electric Products Incorporated Facility Cantiague Rock Road Hicksville, New York

GTE Operations Support Incorporated

December 1999

O'BRIEN & GERE ENGINEERS, INC.

5816.009.001.182

# Data Validation Report

# Former Sylvania Electric Products Incorporated Facility Cantiague Rock Road Hicksville, New York

Swiatoslav W. Kaczmar, Ph.D., C.I.H.
Vice President, Environmental Toxicology
and Industrial Hygiene

December 1999

O'BRIEN & GERE ENGINEERS, INC.

O'Brien & Gere Engineers, Inc.
5000 Brittonfield Parkway
Syracuse, New York 13221

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## Executive summary

This report addresses data quality for soil and ground water samples collected at the former Sylvania Electric Products Incorporated facility in Hicksville, New York. Sample collection activities were conducted by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) from 7/7/99 to 7/16/99, from 7/19/99 to 7/23/99, and from 8/9/99 to 8/12/99.

The environmental samples collected for this investigation were submitted to O'Brien & Gere Laboratories, Inc. of Syracuse, New York for analysis of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, mercury, and cyanide using United States Environmental Protection Agency (USEPA) Methods with New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP) Exhibit E Protocol; and for radiochemistry analyses including gamma spectrometry, gross alpha/gross beta, thorium 228, 230, and 232, and uranium 234, 235, and 238 using Los Alamos National Laboratory (LANL), and United States Department of Energy (USDOE) Methods. The analytical data generated for this investigation were evaluated by O'Brien & Gere using the quality assurance/quality control (QA/QC) criteria established in NYSDEC ASP, USEPA, LANL and USDOE Methods as guidance. Excursions from the QA/QC criteria were qualified based on guidance provided in the USEPA *Region II Contract Laboratory Program (CLP) Organics Data Review*, SOP No. HW-6, Revision #11, the *USEPA Region II Evaluation of Metals Data for the Contract Laboratory Program (CLP)*, the USDOE *Guidance For Radiochemical Data Validation*, RD4, and the Science Applications International Corporation (SAIC) *Laboratory Data Validation Guidelines For Evaluating Radionuclide Analyzes*, 143-ARCS-92.01, Revision 05.

Overall, 100 percent of the metals data and approximately 98.9 percent of the VOC data; 99.6 percent of the SVOC data; and 100 percent of the PCB, metal, cyanide, mercury, and radiochemistry data were determined to be usable for qualitative and quantitative purposes.

# 1. Introduction

## 1.1. Sample identification

This report addresses the results of a data quality evaluation for soil and ground water samples collected at the former Sylvania Electric Products Incorporated facility in Hicksville, New York. Sample collection activities were conducted by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) from 7/7/99 to 7/16/99, from 7/19/99 to 7/23/99, and from 8/9/99 to 8/12/99. The quantity and types of samples that were submitted for data validation are presented in Table 1-1 below.

**Table 1-1.** ***Sample cross reference list***

| | | Sample Identification | | |
|---|---|---|---|---|
| **Package Identification** | **Date Collected** | **Client ID** | **Laboratory ID** | **Analysis Requested** |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-03 (12-18") | M6195 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-03 (18-24") | M6196 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04A (2-3") | M6197 | Gross alpha, Gross beta, Gamma Spectrometry, Thorium, Uranium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04A (3-4") | M6198 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04A (4-5") | M6199 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04A (5-6") | M6200 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04A (6-15") | M6201 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04B (0-6") | M6202 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |

Table 1-1. *Sample cross reference list*

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04B (6-12") | M6203 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04C (0-6") | M6204 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-04C (6-12") | M6205 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-05 (12-24") | M6206 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/7/99 | SB-05 (96-120") | M6207 | Gross alpha, Gross beta, Gamma Spectrometry, VOCs, SVOCs, Pesticides/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-06 (0-24") | M6391 | Gross alpha, Gross beta, Gamma Spectrometry, VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-06 (136-160") | M6392 | Pesticide/PCBs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-07 (156-180") | M6393 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-08 (168-192") | M6394 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-09 (72-96") | M6395 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-09 (46-48") | M6396 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-09B (12-14") | M6397 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-09 (0-6") | M6398 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-09 (6-12") | M6399 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-09 (12-14") | M6400 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/8/99 | SB-09 (24-36") | M6401 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-11 (72-96") | M6543 | Pesticide/PCBs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-12 (120-144") | M6544 | Gross alpha, Gross beta, Gamma Spectrometry, VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-13 (0-24") | M6545 | VOCs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-13 (120-144") | M6546 | Gross alpha, Gross beta, Gamma Spectrometry, VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-10B (48-72") | M6547 | Gross alpha, Gross beta, Gamma Spectrometry, VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-14 (96-132") | M6548 | Gross alpha, Gross beta, Gamma Spectrometry, VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09 (0-12") | M6553 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09 (12-24") | M6554 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09 (24-36") | M6555 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09 (36-48") | M6556 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09C (48-60") | M6557 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09C (60-72") | M6558 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09E (0-12") | M6559 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids, Thorium, Uranium |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09E (12-24") | M6560 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09E (24-36") | M6561 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09E (36-48") | M6562 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09E (48-60") | M6563 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09E (60-72") | M6564 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09D (48-60") | M6565 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09D (60-72") | M6566 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09D (0-6") | M6567 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09D (6-12") | M6568 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09D (12-18") | M6569 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09D (18-24") | M6570 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09D (24-30") | M6571 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/9/99 | SB-09D (30-36") | M6572 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (3-12") | M6905 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (12-24") | M6906 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (24-36") | M6907 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (48-66") | M6908 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (66-84") | M6909 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (144-159") | M6910 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (159-174") | M6898 | Gross alpha, Gross beta, Gamma Spectrometry, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (96-108") | M6911 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-15 (108-120") | M6912 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-16 (0-12") | M6913 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-16 (12-30") | M6914 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-16 (30-42") | M6915 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-16 (48-60") | M6916 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-16 (60-72") | M6917 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-16 (72-96") | M6918 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-16 (108-132") | M6919 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-16 (168-192") | M6899 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-17A (18-36") | M6920 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-17A (36-46") | M6921 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-17A (30-36") | M6922 | VOCs, Percent Solids |

Table 1-1. *Sample cross reference list*

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-17A (48-54") | M6923 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-17A (54-60") | M6924 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-17B (0-24") | M6925 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-17B (24-48") | M6926 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-17B (144-196") | M6927 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-18 (48-96") | M6900 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/10/99 | SB-19 (48-96") | M6901 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-21 (74-81") | M6928 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-22 (48-96") | M6929 | Thorium, Uranium, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-20 (72-90") | M6902 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-23B (108-120") | | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-23B (160-177") | M6903 | VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-24 (48-60") | M6904 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-24 (66-84") | M6930 | Gross alpha, Gross beta, Gamma Spectrometry, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-24 (120-132") | M6931 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |

Table 1-1. *Sample cross reference list*

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-25 (0-18") | M6932 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/11/99 | SB-25 (18-30") | M6933 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | BK-1 (0-3") | M6950 | Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | BK-2 (0-3") | M6951 | Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | BK-2 (84-96") | M6952 | Gross alpha, Gross beta, Gamma Spectrometry, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | BK-1 (68-88") | M6953 | Gross alpha, Gross beta, Gamma Spectrometry, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-27 (28-42") | M6954 | Gross alpha, Gross beta, Gamma Spectrometry, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-32 (15-33") | M6955 | Gross alpha, Gross beta, Gamma Spectrometry, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-35 (120-144") | M6956 | SVOCs ,Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-28 (32-46") | M6957 | Gross alpha, Gross beta, Gamma Spectrometry, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-29 (30-42") | M6958 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-30A (8-27") | M6959 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-30B (20-33") | M6960 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-31 (24-30") | M6961 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-33 (24-36") | M6962 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-34 (18-30") | M6963 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-36 (0-24") | M6964 | Gross alpha, Gross beta, Gamma Spectrometry, Uranium, Thorium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/12/99 | SB-36 (48-60") | M6965 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-37 (0-12") | M7068 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-37 (12-24") | M7069 | Gross alpha, Gross beta, Gamma Spectrometry, Thorium, Uranium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-37 (96-126") | M7070 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-38 (0-18") | M7071 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-38 (48-60") | M7072 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-40 (48-60") | M7073 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-40 (0-24") | M7074 | Gross alpha, Gross beta, Gamma Spectrometry, Thorium, Uranium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-41 (12-18") | M7075 | Gross alpha, Gross beta, Gamma Spectrometry, Thorium, Uranium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-41 (78-90") | M7076 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-41 (108-120") | M7077 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-37 (48-60") | M7078 | VOCs, Percent Solids |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-37 (168-192") | M7079 | Uranium, Thorium, VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-40 (80-90") | M7080 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-41 (100-108") | M7081 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-42 (96-117") | M7082 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-43 (66-84") | M7083 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/13/99 | SB-44 (48-72") | M7084 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/14/99 | SB-45 (72-78") | M7210 | Gross alpha, Gross beta, Gamma Spectrometry, Thorium, Uranium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/14/99 | SB-23B (108-120") | M7211 | Gross alpha, Gross beta, Gamma Spectrometry, Thorium, Uranium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/14/99 | SB-45 (202-212") | M7212 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/14/99 | SB-45 (212-222") | M7213 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/14/99 | SB-47 (116-136") | M7214 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/14/99 | SB-48 (96-114") | M7215 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/14/99 | SB-49 (144-156") | M7216 | Uranium, Thorium, VOCs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/14/99 | SB-50 (144-156") | M7217 | VOCs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/15/99 | SB-51 (72-84") | M7485 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/15/99 | SB-53 (12-24") | M7486 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |

Table 1-1. *Sample cross reference list*

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/15/99 | SB-54 (96-120") | M7489 | VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/15/99 | SB-49B (18-20") | M7490 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/15/99 | SB-55 (72-96") | M7491 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/15/99 | SB-56 (72-96") | M7492 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/15/99 | SB-57 (72-96") | M7493 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/16/99 | SB-62 (6-12") | M7487 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/16/99 | SB-62 (12-18") | M7488 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/16/99 | SB-59 (120-144") | M7494 | Uranium, Thorium, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-64 (18-24") | M7608 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-64 (48-60") | M7609 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-68 (54-66") | M7610 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-68 (18-30") | M7611 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-63 (14-16") | M7612 | VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-65 (125-135") | M7614 (MS, MSD) | SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | BLD DUP [SB-65 (125-135")] | M7613 | VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-64 (96-108") | M7618 | VOCs, Mercury, Cyanide, Percent Solids |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-67 (72-88") | M7619 | VOCs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-69 (168-180") | M7615 | SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-66 (144-156") | M7616 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-68 (84-94") | M7617 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/19/99 | SB-64 (96-108") | M7618 | SVOCs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-71 (18-30") | M7664 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-72 (72-78") | M7665 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-71 (66-72") | M7666 | Gross alpha, Gross beta, Gamma Spectrometry, Uranium, Thorium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | BLD DUP [SB-71 (66-72")] | M7667 | Gross alpha, Gross beta, Gamma Spectrometry, Uranium, Thorium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-76 (48-64") | M7668 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-77 (126-132") | M7669 | Gross alpha, Gross beta, Gamma Spectrometry, Uranium, Thorium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-72 (48-60") | M7670 | SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-71 (144-160") | M7671 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-73 (168-192") | M7672 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-74 (168-192") | M7673 | VOCs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-75 (168-180") | M7674 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |

Table 1-1. *Sample cross reference list*

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-76 (168-192) | M7675 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/20/99 | SB-77 (156-180") | M7676 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-78 (126-138") | M7815 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-79 (72-74") | M7816 | Gross alpha, Gross beta, Gamma Spectrometry, Uranium, Thorium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-82 (24-30") | M7817 | Gross alpha, Gross beta, Gamma Spectrometry, Uranium, Thorium, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-78 (68-89") | M7818 | VOCs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-78 (175-189") | M7819 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-79 (144-156") | M7820 | VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-80 (24-44") | M7821 | VOCs, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-80 (180-192") | M7822 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-81 (174-186") | M7823 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-82 (180-192") | M7824 | Uranium,Tthorium, VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-83 (72-96") | M7825 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-84 (72-96") | M7826 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/21/99 | SB-85 (72-91") | M7827 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| July 7, 1999 - July 23, 1999 | 7/22/99 | SB-85B (156-168") | M7884 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/22/99 | SB-86 (168-180") | M7885 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/22/99 | SB-87 (156-180") | M7886 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/22/99 | BLD DUP [SB-87 (156-180")] | M7887 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/22/99 | SB-88 (168-192") | M7888 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/22/99 | SB-89 (168-192") | M7889 (MS, MSD) | Uranium, Thorium, VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/22/99 | SB-90 (144-168") | M7890 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/22/99 | SB-91 (174-192") | M7891 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/23/99 | SB-92 (168-192") | M8030 (MS, MSD) | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/23/99 | SB-93 (168-192") | M8031 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/23/99 | SB-94 (72-96") | M8032 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/23/99 | SB-95 (72-90") | M8033 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/23/99 | BLD DUP [SB-95 (72-90")] | M8034 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/23/99 | SB-96 (72-84") | M8035 | VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| July 7, 1999 - July 23, 1999 | 7/23/99 | SB-97 (168-192") | M8036 | VOCs, SVOCs, Pesticide/PCBs, Mercury, Cyanide, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/9/99 | SB-98 (6-12") | M9312 | Gross alpha, Gross beta, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/9/99 | SB-98 (12-24") | M9313 | Gross alpha, Gross beta, Percent Solids |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| August 8, 9, 10, 11, and 12, 1999 | 8/9/99 | SB-98 (24-30") | M9314 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/9/99 | TW-1/FF | M9315/M9318 | Gross alpha, Gross beta, Uranium, Thorium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/9/99 | TRIP BLANK | M9317 | VOCs |
| August 8, 9, 10, 11, and 12, 1999 | 8/9/99 | TW-2/FF | M9316/M9319 | Gross alpha, Gross beta, Gamma Spectrometry, Uranium, Thorium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | TW-3/FF | M9342/M9346 | Gross alpha, Gross beta, Uranium, Thorium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | TW-4/FF | M9343/M9347 | Gross alpha, Gross beta, Uranium, Thorium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | TW-5/FF | M9344/M9348 | Gross alpha, Gross beta, Gamma Spectrometry, Uranium, Thorium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | TRIP BLANK | M9345 | VOCs |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | SB-99 (72-78") | M9336 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | SB-100 (68-90") | M9337 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | SB-101 (40-46") | M9338 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | SB-102 (60-66") | M9339 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | SB-103 (118-130") | M9340 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/10/99 | SB-104 (72-84") | M9341 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |

**Table 1-1.** ***Sample cross reference list***

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-106 (60-72") | M9414 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-107 (84-96") | M9415 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-108 (84-96") | M9418 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-109 (84-96") | M9421 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-105 (30-40") | M9422 | Gross alpha, Gross beta, Gamma Spectrometry, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-105 (54-60") | M9423 | Gross alpha, Gross beta, Gamma Spectrometry, VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-105 (70-76") | M9424 | Gross alpha, Gross beta, Gamma Spectrometry, VOCs, SVOCs, Mercury, Cyanide, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-108 (40-60") | M9417 (MS, MSD) | VOCs, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-106 (48-60") | M9419 | VOCs, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | SB-109 (48-60") | M9420 | VOCs, Percent Solids |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | HG-W-24D | M9425 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | HG-W-24 | M9426 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | HG-W-25/FF | M9427/M9430 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | MW-1 | M9428 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/11/99 | TRIP BLANK | M9429 | VOCs |

Table 1-1. *Sample cross reference list*

| Package Identification | Date Collected | Sample Identification: Client ID | Sample Identification: Laboratory ID | Analysis Requested |
|---|---|---|---|---|
| August 8, 9, 10, 11, and 12, 1999 | 8/12/99 | EQUIP BLANK | M9558 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/12/99 | MW-2 | M9559 (MS, MSD) | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/12/99 | MW-5 | M9560 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/12/99 | BLD DUP [MW-5] | M9563 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/12/99 | MW-3 | M9561 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/12/99 | MW-4 | M9562 | Gross alpha, Gross beta, Thorium, Uranium, VOCs, SVOCs, Mercury, Cyanide |
| August 8, 9, 10, 11, and 12, 1999 | 8/12/99 | TRIP BLANK | M9559 | VOCs |

Note:
VOCs indicates volatile organic compounds;
SVOCs indicate semivolatile organic compounds;
PCBs indicates polychlorinated biphenyls;
MS indicates matrix spike analysis;
MSD indicates matrix spike duplicate analysis.
FF indicates field filtered sample.

## 1.2. General considerations

Validation is a process of determining the suitability of a measurement system for providing useful analytical data. Although the term is frequently used in discussing methodologies, it applies to all aspects of the system and especially to samples, their measurement, and the actual data output. Accordingly, this

report outlines deviations from the applicable QC criteria outlined in the following documents:

- APHA, AWWA, WPCF. 1992. *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, Washington, D.C.
- Los Alamos National Laboratory (LANL). 1995. *Health and Environmental Chemistry: Analytical Techniques, Data Management, and Quality Assurance*, LA-10300-M, Vol.II, Los Alamos, New Mexico.
- New York State Department of Conservation (NYSDEC). 1995. *Analytical Services Protocol (ASP)*, October 1995 Revisions. Albany, NY.
- O'Brien & Gere Engineers, Inc. 1999. *Former Sylvania Electric Products Incorporated Facility Cantiague Rock Road, Hicksville, New York*, Syracuse, New York.
- United States Department of Energy (USDOE). 1990. *Environmental Measurements Laboratory (EML) Procedures Manual*, 27th Edition, Volume 1, New York, New York.
- United States Environmental Protection Agency (USEPA). 1980. *Prescribed Procedures for the Measurement of Radioactivity in Drinking Water*, EPA-600/4-80-032. Washington D.C.

Excursions from the QA/QC criteria were qualified based on guidance provided in the following documents:

- Science Applications International Corporation (SAIC). 1992. *Laboratory Data Validation Guidelines For Evaluating Radionuclide Analyzes*, 143-ARCS-92.01, Revision 05, Oak Ridge, Tennessee.
- USDOE. 1995. *Guidance For Radiochemical Data Validation*, RD4, Gaithersburg, Maryland.
- USEPA. 1992b. *USEPA Region II Evaluation of Metals Data for the CLP 3/90*. New York, NY.
- USEPA. 1996. *USEPA Region II CLP Organics Data Review, SOP No. HW-6, Revision #11*. New York, NY.

## 1.3. Analytical methods

The environmental samples collected for this investigation were submitted to O'Brien & Gere Laboratories, Inc. of Syracuse, New York for analysis of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, mercury, and cyanide using United States Environmental Protection Agency (USEPA) Methods with New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP) Exhibit E Protocol; and for gamma spectrometry; gross alpha/gross beta; thorium 228, 230, and 232; and uranium 234, 235, and 238 using Los Alamos National Laboratory (LANL), and United States Department of Energy (USDOE) Methods. The methods utilized in this investigation are presented in Table 1-2.

**Table 1-2.** ***Analytical method references***

| Parameter | Method | Reference |
|---|---|---|
| VOCs | 8260B | 1 |
| SVOCs | 8270C | 1 |
| PCBs | 8082 | 1 |
| metals | 6010B | 1 |
| mercury | 7470A/7471A | 1 |
| cyanide | 9010B/9014 | 1 |
| percent solids | Method 2540-G | 2 |
| gamma spectrometry | LANL ER-130, 901.1 modified | 3, 5 |
| Thorium 228, 230, 232 | EML TH-01 modified | 4 |
| Uranium 234, 235, 238 | EML U-02 modified | 4 |
| gross alpha/gross beta | 900 0 | 5 |

Note:
1 - NYSDEC. 1995. *Analytical Services Protocol (ASP) Methods*, October 1995 Revisions. Albany, NY.
2 - APHA, AWWA, WPCF. 1992. *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, Washington, D.C.
3 - Los Alamos National Laboratory (LANL). 1995. Health and Environmental Chemistry: Analytical Techniques, Data Management, and Quality Assurance, LA-10300-M, Vol.II, Los Alamos, New Mexico.
4 - United States Department of Energy (USDOE). 1990. *Environmental Measurements Laboratory (EML) Procedures Manual*, 27th Edition, Volume 1, New York, New York.
5 - United States Environmental Protection Agency (USEPA). 1980. *Prescribed Procedures for the Measurement of Radioactivity in Drinking Water*, EPA-600/4-80-032. Washington D.C.

The following chapters of this document address distinct aspects of the validation process. Chapter 2 lists the data QA/QC protocols used to validate the sample data. Specific QA/QC deviations and qualifications performed on the sample data are discussed in Chapter 3. Finally, data completeness and usability are discussed in Chapter 4.

# 2. Data validation protocols

## 2.1. Sample analysis parameters

The validation of analyses for this project utilized guidance presented in the QAPP (O'Brien & Gere 1990), the analytical methodology, and the data validation guidelines referenced in Chapter 1 herein.

The following QA/QC parameters were evaluated for the VOC and SVOC analyses:

- Holding times, sample preservation, and percent solids,
- GC/MS tuning criteria,
- Initial and continuing calibration,
- Blank analysis,
- Surrogate recovery,
- Matrix spike/matrix spike duplicate (MS/MSD) analysis,
- Field duplicate analysis,
- Laboratory control sample (LCS) and matrix spike blank analysis,
- Internal standards performance,
- Analyte identification, quantitation, and reported detection limits,
- System performance, and
- Documentation completeness.

The following QA/QC parameters were evaluated for the PCB analyses:

- Holding times, sample preservation, and percent solids,
- Analytical sequence,
- Initial and continuing calibration,
- Blank analysis,
- Surrogate recovery,
- MS/MSD analysis,
- Field duplicate analysis,
- LCS and matrix spike blank analysis,
- Analyte identification, quantitation, and reported detection limits,

- System performance, and
- Documentation completeness.

The following QA/QC parameters were evaluated for the metal, mercury, and cyanide analyses (where applicable):

- Holding times, sample preservation, and percent solids,
- Contract required detection limit (CRDL) standard analysis criteria,
- Initial and continuing calibration,
- Blank analysis,
- Inductively coupled plasma (ICP) interference check sample analysis,
- MS/MSD analysis,
- Field duplicate analysis,
- LCS and matrix spike blank analysis,
- Laboratory duplicate analysis,
- ICP serial dilution analysis,
- Furnace atomic absorption analysis,
- Verification of instrument parameters,
- Instrument detection limits,
- Linear ranges,
- Analyte quantitation, and reported detection limits, and
- Documentation completeness.

The following QA/QC parameters were evaluated for the radiochemistry (gamma spectrometry, gross alpha/gross beta, thorium, uranium) analyses (where applicable):

- Holding times and sample preservation,
- Calibration
- Blank analysis
- Sample specific chemical (tracer) recovery
- LCS
- MS analysis
- Duplicate analysis
- Field duplicate analysis
- Radionuclide quantitation and detection evaluation
- Chemical separation specificity (alpha spectroscopy)
- Target radionuclide list identification (gamma spectroscopy)
- Tentatively identification (gamma spectroscopy)
- System performance
- Documentation completeness

## 2.2. Data validation qualifiers

The following guidelines are used regarding the assignment of qualifiers and the use of qualified data:

- The data quality evaluation results in only one qualifier for each analyte; in a case when several qualifiers are applicable to the same analyte, the cumulative effect of the various QA/QC excursions is employed in assigning the final data qualifier.

- QA/QC excursions which do not result in the qualification of an analyte, or which result in additional qualification if the analyte was previously qualified, are not discussed.

- The use of approximated analytical data for quantitative uses is consistent with the guidance presented in the *USEPA Risk Assessment Guidance for Superfund* (USEPA 1992a).

The following qualifiers have been used in this data validation.

"R" Indicates that the reporting limit or sample result has been determined to be unusable due to a major deficiency in the data generation process. The data should not be used for any qualitative or quantitative purposes. For radiochemistry, the result is not usable for the intended purpose.

"U" Indicates that the analyte was analyzed for, but was not detected. The sample quantitation limit is presented. This qualifier is also used to signify that the detection limit of an analyte was raised due to blank contamination. For radiochemistry data, this qualifier indicates that the result is so uncertain that is it not appropriate to make numerical decision based on its value.

"J" Indicates that the result should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process. This qualifier is also applied when the analyte concentration was greater than the method detection limit (MDL) but less than the reporting limit (RL). For radiochemistry, an unusually uncertain result is assigned a J qualifier.

"JI" Indicates that the result should be considered approximate due to the presence of peak interferences in the gamma spectrometry data.

"BU" For radiochemistry, this qualifier is applied when blank results are statistically evaluated and when the associated sample result is qualified as a result of the blank evaluation.

# 3. Data quality evaluation

## 3.1. Summary

This chapter summarizes the QA/QC parameters, validation criteria, and qualifications performed on the sample data when the QA/QC parameters specified in Chapter 2 did not meet criteria. Samples that required qualification are described in the following sections, and are identified by the description documented on the sample chain-of-custody records.

## 3.2. Document completeness

The cooler temperature for the samples received 7/23/99 was not recorded by the laboratory. The sample custodian indicated that, although not documented, the cooler temperature was within the required temperature of 4°C±2°C.

Samples collected 7/10/99 and 7/11/99 were received by the laboratory on 7/13/99 since the samples were kept in the field until 7/12/99. While in the field, the samples were kept in a secured area and in a cooler that contained ice. This was documented in the case file in a memo dated 11/1/99.

Approximately twenty transcription errors between the raw data and the sample results were detected in the gamma spectrometry data. The errors were corrected during the data validation process.

## 3.3. VOC analyses

### 3.3.1. Criteria

The QA/QC parameters presented in Section 2.1 for VOAs were applied to environmental samples listed in Table 1-1. The following QA/QC parameters were found to meet validation criteria:

- Sample preservation, and percent solids,
- GC/MS tuning criteria,
- Analyte identification and quantitation,
- System performance.

Deviations from QA/QC criteria presented in Section 2.1 are summarized below.

### 3.3.2. Holding times

Sample SB-24(66-84") was collected 7/11/99 and received by the laboratory on 7/13/99. The additional analysis of sample SB-24(66-84") for VOCs was requested by the Project Manager on 7/30/99. The analysis was performed as requested outside of the 14 days from collection technical holding time. The holding time excursion is summarized in the following table:

**Table 3-1.** ***Holding time excursions for VOC analyses***

| Sample ID | Date collected | Date Analyzed | Analytes Affected | Action |
|---|---|---|---|---|
| SB-24(66-84") | 7/11/99 | 8/3/99, 8/4/99 | VOCs | UJ,J |

### 3.3.3. Blank analysis

A trip blank was not collected with the soil samples collected 7/99 for VOC analysis. As a result, contamination during shipment was not evaluated for the soil samples.

Target analytes were detected in blanks analyzed for VOCs in this investigation. Samples which contained the common laboratory contaminant methylene chloride at less than ten times the associated blank concentration were qualified as undetected due to the blank contamination, as required by the USEPA Region II data validation guidelines. The blank excursions are summarized in the following table:

**Table 3-2.** ***Blank excursions for VOC analyses***

| Blank ID | Analyte | Detected Concentration | Affected Sample Results | Action |
|---|---|---|---|---|
| PB071599S1/S3 | methylene chloride | 1 1 µg/Kg | SB10B(48-72") | 5U |
| Trip Blank (8/11/99) | methylene chloride | 0 2 µg/L | SB105(70-76") | 37U |
| Equipment Blank | methylene chloride | 0.1 µg/L | MW-3 | 4U |
| Trip Blank (8/12/99) | methylene chloride | 0 1 µg/L | MW-3 | 4U |

Note· PB indicates method (preparation) blank

### 3.3.4. Surrogate recovery

The surrogate recoveries for several samples were outside of the method control limits. As a result, the target analytes in the samples were qualified as approximate (UJ,J). The following table presents the target analytes qualified as a result of surrogate excursions:

**Table 3-3.** ***Surrogate excursions for VOC analyses***

| Sample ID | Surrogate | Excursion | Affected analytes | Action |
|---|---|---|---|---|
| SB-54(96-120") | p-bromofluorobenzene | 51%R | VOCs with the exception of tetrachloroethene | UJ,J |
| BLDDUP [SB-65(125-135")DL | 1,2-dichloroethane-d4<br>toluene-d8 | 66%R<br>83%R | tetrachloroethene | J |
| SB-67(72-88")DL | toluene-d8 | 79%R | tetrachloroethene | J |

Note· %R indicates percent recovery.
DL indicates dilution analysis was performed

### 3.3.5. MS/MSD analysis

The criterion for the analysis of trichloroethene in one MS/MSD sample was exceeded. As a result of the MS/MSD excursion, the target analyte in the sample associated with the MS/MSD was qualified as approximate (J). The following table presents the target analyte qualified as a result of the MS/MSD excursion:

Table 3-4. *MS/MSD excursion for VOC analyses*

| MS/MSD ID | Analyte | Excursion | Affected Sample | Action |
|---|---|---|---|---|
| SB-17A(30-36") | trichloroethene | 438RPD | SB-17A(30-36") | J |

Note:
RPD indicates relative percent difference

### 3.3.6. Initial calibration

The percent relative standard deviation (%RSD) for methylene chloride and the relative response factor (RRF) in initial calibrations analyzed for this investigation were exceeded. As a result of the initial calibration excursion, samples associated with the %RSD excursion were qualified as approximate (UJ) and the samples associated with the RRF excursion were rejected (R). The following table presents the calibration excursions:

**Table 3-5.** ***Initial calibration excursions for VOC analyses***

| Initial Calibration ID | Analyte | Excursion | Affected Samples | Action |
|---|---|---|---|---|
| 7/22/99 | methylene chloride | 38.4 %RSD | SB-63(140-16")<br>SB-73(168-192")<br>SB-74(168-192")<br>SB-75(168-180")<br>SB-76(168-192")<br>SB-77(156-180")<br>SB-78(68-89")<br>SB-78(175-189")<br>SB-85(72-91")<br>SB-81(174-186")<br>SB-82(180-192")<br>SB-83(72-96")<br>SB-84(72-96")<br>SB-80(180-192")<br>SB-79(144-156")<br>SB-80(24-44")<br>SB-85B(156-168")<br>SB-86(168-180")<br>SB-87(168-180")<br>SB-88(168-192")<br>SB-89(168-192")<br>BLDDUP[SB-87(156-180")<br>SB-91(174-192")<br>SB-90(144-168")<br>SB-71(144-160")<br>SB-92(168-192")<br>SB-93(168-192")<br>SB-94(72-96")<br>SB-95(72-90")<br>BLDDUP[SB-95(72-90")]<br>SB-96(72-84")<br>SB-97(168-192") | UJ |

Table 3-5. *Initial calibration excursions for VOC analyses*

| Initial Calibration ID | Analyte | Excursion | Affected Samples | Action |
|---|---|---|---|---|
| 7/13/99 | acetone | 0.034 RF | SB-17A(30-36")<br>SB-24(48-60")<br>SB-47(116-136")<br>SB-49(144-156")<br>BLDDUP[SB65(125-135")]<br>SB-64(96-108")<br>SB-67(72-88")<br>SB-24(66-84")<br>TW-1<br>TW-2<br>TW-3<br>TW-4<br>TW-5<br>HG-W-24D<br>HG-W-24<br>HG-W-25<br>MW-1<br>MW-2<br>MW-5<br>MW-3<br>MW-4<br>BLDDUP[MW-5] | R |
| 7/13/99 | acetone | 0 034 RF | Drum Composite | J |

Note: %RSD indicates percent relative standard deviation.
RRF indicates relative response factor.

### 3.3.7. Continuing calibration

The percent difference (%D) and RRF for target analytes in continuing calibrations analyzed for this investigation exceeded the criteria. As a result of the continuing calibration excursions, the results for samples associated with the %D excursion were qualified as approximate (UJ,J) and the samples associated with the RRF excursion were rejected (R). The following table presents the calibration excursions:

Table 3-6. *Continuing calibration excursions for VOC analyses*

| Continuing calibration ID | Analyte | Excursion | Affected Sample | Action |
|---|---|---|---|---|
| 7/12/99 (J4831) | 2-butanone | 33.1 %D | SB-05(96-120")<br>SB-06(0-24")<br>SB-12(120-144")<br>SB-13(120-144") | UJ |
| 7/15/99 (J4904) | acetone<br>2-butanone<br>2-hexanone | 30.8 %D<br>41.5 %D<br>31.7 %D | SB-10B(48–72")<br>SB-14(96-132") | UJ |
| 7/16/99 (J4945) | 2-butanone | 29.6 %D | SB-18(48-96")<br>SB-20(72-90")<br>SB-23B(160-177")<br>SB-37(168-192")<br>SB-44(48-72") | UJ |
| 7/20/99 (J4998) | acetone<br>bromomethane<br>2-butanone<br>4-methyl-2-pentanone<br>2-hexanone | 54 %D<br>36.8 %D<br>69.7 %D<br>35.1 %D<br>58.7 %D | SB-48(96-114")<br>SB-50(144-156")<br>SB-54(96-120")<br>SB-49B(18-20") | UJ,J |
| 7/26/99 (J5090) | methylene chloride | 27.7 %D | SB-73(168-192")<br>SB-74(168-192")<br>SB-75(168-180")<br>SB-76(168-192")<br>SB-77(156-180")<br>SB-78(68-89")<br>SB-78(175-189")<br>SB-85(72-91") | UJ |
| 7/19/99 (J4961) | bromomethane | 29.8 %D | SB-13(0-24")<br>SB-37(48-60")<br>SB-45(212-222") | UJ |
| 7/26/99 (J5111) | 1,1,2,2-tetrachloroethane | 26.9 %D | SB-81(174-186")<br>SB-82(180-192")<br>SB-83(72-96")<br>SB-84(72-96") | UJ |
| 7/29/99 (J5195) | 2-butanone | 25.4 %D | SB-91(174-192")<br>SB-90(144-168")<br>SB-71(144-160") | UJ,J |
| 8/3/99 (M5245) | acetone<br>2-butanone | 25.6 %D<br>29 4 %D | SB-97(168-192") | UJ |
| 7/22/99 (G5251) | 2-butanone | 0 048 RRF | SB-49(144-156") | R |
| 8/3/99 (G5345) | bromomethane | 30.3 %D | SB-24(66-84") | UJ |

Table 3-6. *Continuing calibration excursions for VOC analyses*

| Continuing calibration ID | Analyte | Excursion | Affected Sample | Action |
|---|---|---|---|---|
| 8/23/99 (G5638) | 2-butanone | 0.046 RRF | MW-4<br>BLDDUP[MW-5]<br>MW-3<br>Drum Composite | R |

Note: %D indicates percent difference.

### 3.3.8. LCS analysis

The recoveries for several target analytes LCSs analyzed for this investigation were outside of the laboratory control limits. The reanalysis of the LCSs resulted in similar recovery excursions. As a result of the LCS excursions, the target analytes in the samples associated with the LCS were qualified as approximate (UJ,J). The following table presents the target analytes qualified as a result of the LCS excursions:

Table 3-7. *LCS or matrix spike blank excursions for VOC analyses*

| LCS ID | Analyte | Excursion | Affected Samples | Action |
|---|---|---|---|---|
| L071299S1 | 1,1-dichloroethene<br>trans-1,2-dichloroethene<br>ethylbenzene<br>xylene (total) | 85 %R<br>81 %R<br>81 %R<br>84 %R | SB05(96-120")<br>SB13(120-144") | UJ |
| L071599S3 | 1,1-dichloroethene<br>trans-1,2-dichloroethene | 88 %R<br>85 %R | SB-10B(48-72")<br>SB-14(96-132") | UJ |
| L072099S1 | 1,1-dichloroethene<br>trans-1,2-dichloroethene<br>1,1,1-trichloroethane<br>benzene<br>trichloroethene<br>toluene<br>chlorobenzene<br>ethylbenzene<br>xylene (total)<br>vinyl chloride<br>chloroethane | 82 %R<br>78 %R<br>87 %R<br>88 %R<br>87 %R<br>84 %R<br>85 %R<br>81 %R<br>78 %R<br>48 %R<br>65 %R | SB-48(96-114")<br>SB-50(144-156")<br>SB-54(96-120")<br>SB-49B(18-20") | UJ,J |

**Table 3-7. *LCS or matrix spike blank excursions for VOC analyses***

| LCS ID | Analyte | Excursion | Affected Samples | Action |
|---|---|---|---|---|
| L072699S3 | 1,1-dichloroethene | 87 %R | SB-73(168-192") | UJ |
| | trans-1,2-dichloroethene | 85 %R | SB-74(168-192") | |
| | benzene | 88 %R | SB-75(168-180") | |
| | toluene | 90 %R | SB-76(168-192") | |
| | | | SB-77(156-180") | |
| | | | SB-78(68-89") | |
| | | | SB-78(175-189") | |
| | | | SB-85(72-91") | |
| L072699S4 | 1,1-dichloroethene | 88 %R | SB-81(174-186") | UJ |
| | trans-1,2-dichloroethene | 86 %R | SB-82(180-192") | |
| | trichloroethene | 89 %R | SB-83(72-96") | |
| | toluene | 89 %R | SB-84(72-96") | |
| L072799S1 | 1,1-dichloroethene | 88 %R | SB-80(180-192") | UJ |
| | methylene chloride | 76 %R | SB-79(144-156") | |
| | trans-1,2-dichloroethene | 85 %R | | |
| | benzene | 89 %R | | |
| | toluene | 89 %R | | |
| L072899S4 | methylene chloride | 78 %R | SB-86(168-180") | UJ |
| | | | SB-80(24-44") | |
| | | | SB-85B(156-168") | |
| | | | SB-87(156-180") | |
| | | | SB-88(168-192") | |
| | | | SB-89(168-192") | |
| | | | BLDDUP[SB-87(156-180")] | |
| L072999S1 | methylene chloride | 75 %R | SB-91(174-192") | |
| | trans-1,2-dichloroethene | 81 %R | SB-90(144-168") | |
| | | | SB-71(144-160") | |

Note:
L indicates LCS.
%R indicates percent recovery

### 3.3.9. Internal standards performance

The recoveries for several internal standards in samples analyzed for VOCs were lower than the control limits. Repeated analyses confirmed the internal standard excursions. In accordance with NYSDEC Region II data validation guidelines, the results for target analytes associated with internal standard area recoveries greater than 25% but less than the lower control limit were qualified as approximate, and the results for target analytes associated with internal standard area recoveries less than 25% were rejected. The internal standard areas excursions are summarized in the following table:

Table 3-8. *Internal standard area excursions for VOC analyses*

| Sample ID | Internal standard | Affected Analytes | Action |
|---|---|---|---|
| SB-06(0-24") | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |
| SB-12(120-144") | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |
| SB-13(120-144") | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |
| SB-13(0-24")RE | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |
| SB-54(96-120") | 1,4-dichlorobenzene-d4 | See affected analyte listed below | R |
| SB-79(144-156") | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |
| SB-90(144-168")RE | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |
| BLDDUP[SB-95(72-90") | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |
| SB-96(72-84") | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |
| SB-97(168-192") | 1,4-dichlorobenzene-d4 | See affected analyte listed below | UJ |

Note.
The analyte affected by internal standard 1,4-dichlorobenzene-d4 includes the following: 1,1,2,2- tetrachloroethane

### 3.3.10. Field duplicate analysis

The sample associated with the field duplicate collected 7/19/99 was not analyzed for VOCs; therefore, the field duplicate precision for this sample set could not be performed.

### 3.3.11. Analyte reported detection limits

Dilutions were performed during the analysis of several samples due to high concentrations of target analytes. For some samples, both the concentration from the diluted analysis (for those target analytes that exceeded calibration range) and the detection limits from the lowest dilution analysis were combined in the sample report. The analytes which were analyzed using dilutions are summarized in the following table:

**Table 3-9.** ***Analytes reported from diluted VOC analyses***

| Sample ID | Reason for dilution |
|---|---|
| SB-24(48-60") combined | High concentration of target analytes |
| SB-17A(30-36") medium | High concentration of target analytes |
| SB-24(66-84") combined, medium | High concentration of target analytes |
| SB-47(116-136") medium | High concentration of target analytes |
| SB-54(96-120") combined, medium | High concentration of target analytes |
| SB-49(144-156") medium | High concentration of target analytes |
| BLDDUP[SB65(125-135)] combined, medium | High concentration of target analytes |
| SB-64(98-108") medium | High concentration of target analytes |
| SB-67(72-88") combined, medium | High concentration of target analytes |
| SB-79(144-156") combined | High concentration of target analytes |
| SB-80(24-44") | High concentration of target analytes |
| TW-1 combined | High concentration of target analytes |
| TW-2 combined | High concentration of target analytes |
| TW-3 combined | High concentration of target analytes |
| TW-4 | High concentration of target analytes |
| TW-5 | High concentration of target analytes |
| SB-106(48-60") combined | High concentration of target analytes |
| SB-105(54-60") combined, medium | High concentration of target analytes |
| SB-105(70-76") combined, medium | High concentration of target analytes |
| MW-1 | High concentration of target analytes |
| MW-2 | High concentration of target analytes |
| MW-5 | High concentration of target analytes |
| MW-3 | High concentration of target analytes |
| MW-4 | High concentration of target analytes |
| BLDDUP[MW-5] | High concentration of target analytes |
| Drum composite | High concentration of target analytes |

Note:
Combined indicates that the results from two dilutions were combined together and reported for that sample.
Medium level indicates that the medium level soil analysis was performed on the sample

## 3.4. SVOC analyses

### 3.4.1. Criteria

The QA/QC parameters presented in Section 2.1 for SVOCs were applied to environmental samples listed in Table 1-1. The following QA/QC parameters were found to meet validation criteria:

- Holding times, sample preservation,
- GC/MS tuning criteria,
- Initial calibration,
- Surrogate recovery,
- MS/MSD analysis,
- Field duplicate analysis,
- Analyte identification and quantitation,
- System performance.

Deviations from QA/QC criteria presented in Section 2.1 are summarized below.

### 3.4.2. Continuing calibration

The percent difference for continuing calibrations analyzed for this investigation was outside the control limits. As a result of the continuing calibration excursions, the results for these analytes in associated samples were qualified as approximate (UJ,J). The following table presents the continuing calibration excursions:

**Table 3-10.** ***Continuing calibration excursions for SVOC analyses***

| Continuing calibration ID | Analyte | Excursion | Affected Sample Results | Action |
|---|---|---|---|---|
| 7/19/99 (F1445) | dibenz(a,h)anthracene<br>benzo(g,h,i)perylene | 26.0 %D<br>30 6 %D | SB-05(96-120") | UJ |
| 7/21/99 (F1484) | hexachlorocyclopentadiene | 36 4 %D | SB-21(74-81")<br>SB-35 (120-144")<br>SB-28(32-46")<br>SB-37(168-192")<br>SB-10B(48-72")<br>SB-24(66-84")<br>SB-18(48-96") | UJ |

**Table 3-10. *Continuing calibration excursions for SVOC analyses***

| Continuing calibration ID | Analyte | Excursion | Affected Sample Results | Action |
|---|---|---|---|---|
| 7/23/99 (F1522) | hexachlorocyclopentadiene | 64.7 %D | SB-40(80-90")<br>SB-41(100-108")<br>SB-42(96-117")<br>SB-43(66-84")<br>SB-44(48-72")<br>SB-45(212-222")<br>SB-47(116-136")<br>SB-48(96-114")<br>SB-22(48-96")<br>SB-19(48-96") | UJ |
| 7/26/99 (F1541) | hexachlorocyclopentadiene<br>pyrene<br>3,3'-dichlorobenzidine<br>di-n-octyl phthalate | 60.6 %D<br>26.9 %D<br>34.7 %D<br>34.6 %D | SB-55(72-96")<br>SB-56(72-96")<br>SB-57(72-96")<br>SB-59(120-144")<br>SB-49B(18-20")<br>SB-32(15-33") | UJ |
| 7/27/99 (F1561) | hexachlorocyclopentadiene<br>3,3'-dichlorobenzidine<br>di-n-octyl phthalate | 67.9 %D<br>32.7 %D<br>25 1 %D | SB-54(96-120") | UJ |
| 7/28/99 (F1579) | hexachlorocyclopentadiene | 48 5 %D | SB-63(14-16") | UJ |
| 7/29/99 (F1599) | pentachlorophenol | 25.4 %D | SB-69(168-180")<br>SB-65(125-135")<br>BLDDUP[SB-65(125-135")]<br>SB-66(144-156")<br>SB-68(84-94")<br>SB-71(144-160")<br>SB-73(168-192")<br>SB-75(168-180")<br>SB-76(168-192")<br>SB-77(156-180")<br>SB-72(48-60")<br>SB-64(96-108") | UJ |
| 7/30/99 (F1613) | benzo(g,h,i)perylene | 30 3 %D | SB-78(175-189") | UJ |
| 8/2/99 (F1632) | 2,2'-oxybis(1-chloropropane)<br>benzo(g,h,i)perylene | 25.3 %D<br>30.3 %D | SB-80(180-192")<br>SB-81(174-186")<br>SB-83(72-96") | UJ |
| 8/3/99 (F1651) | 2,2'-oxybis(1-chloropropane)<br>pentachlorophenol | 25.5 %D<br>33.6 %D | SB-79(144-156")<br>SB-82(180-192")<br>SB-84(72-96")<br>SB-85(72-91")<br>SB-85B(156-168")<br>SB-86(168-180")<br>SB-87(156-180")<br>BLDDUP[SB-87(156-180")]<br>SB-06(0-24") | UJ |

Table 3-10. *Continuing calibration excursions for SVOC analyses*

| Continuing calibration ID | Analyte | Excursion | Affected Sample Results | Action |
|---|---|---|---|---|
| 8/4/99 (F1666) | 2,2'-oxybis(1-chloropropane)<br>pyrene | 30.3 %D<br>34.8 %D | SB-90(144-168")<br>SB-96(72-84")<br>SB-97(168-192")<br>SB-92(168-192") | UJ,J |
| 8/5/99 (F1686) | 2,2'-oxybis(1-chloropropane) | 35 2 %D | SB-88(168-192")<br>SB-89(168-192")<br>SB-91(174-192")<br>SB-93(168-192")<br>SB-94(72-96")<br>SB-95(72-90")<br>BLDDUP[SB-95(72-90")]<br>SB-07(156-180") | UJ |
| 8/20/99 (F1810) | 4-nitrophenol<br>4-nitroaniline<br>hexachlorocyclopentadiene | 33.6 %D<br>31.1 %D<br>27.5 %D | TW-3<br>TW-4<br>TW-5<br>HG-W-24D<br>HG-W-35<br>MW-1<br>MW-2<br>MW-5<br>MW-3<br>MW-4 | UJ |
| 8/23/99 (F1831) | hexachlorocyclopentadiene<br>4-nitrophenol<br>4-nitroaniline | 47.8 %D<br>26.1 %D<br>27 1 %D | BLDDUP[MW-5] | UJ |
| 8/27/99 (F1869) | hexachlorocyclopentadiene | 34 3 %D | SB-105(54-60") | UJ |
| 8/31/99 (F1909) | hexachlorocyclopentadiene | 33 7 %D | SB-105(70-76") | UJ |

Note:
%D indicates percent difference.
RF indicates response factor

### 3.4.3. Blank analysis

One target analyte was detected in one preparation blank analyzed for SVOCs in this investigation. The sample which contained the common laboratory contaminant phthalate at less than ten times the associated blank concentration was qualified as undetected due to the blank contamination, as required by the USEPA Region II data validation guidelines. The blank excursion is summarized in the following table:

**Table 3-11.** ***Blank excursions for SVOC analyses***

| Blank ID | Analyte | Detected Concentration | Affected Sample Results | Action |
|---|---|---|---|---|
| PB081799S1 | bis(2-ethyl hexyl) phthalate | 51 µg/Kg | SB-105(70-76") | 350U |

Note:
PB indicates method (preparation) blank

### 3.4.4. LCS analysis

The recoveries for analytes in the LCSs analyzed for this investigation were outside of the laboratory control limits. As a result of these excursions the results were qualified as approximate (UJ,J). The following table presents the target analytes qualified as a result of the LCS excursions:

**Table 3-12.** ***LCS excursions for SVOC analyses***

| LCS ID | Analyte | Excursion | Affected Sample | Action |
|---|---|---|---|---|
| L070999S1 | 2,4-dinitrophenol | 25 %R | SB-05(96-120") | UJ |
| L071499S2 | indeno(1,2,3-cd)pyrene | 58 %R | SB-07(156-180")<br>SB-08(168-192")<br>SB-12(120-144")<br>SB-13(120-144")<br>SB-10B(48-72")<br>SB-14(96-132")<br>SB-15(159-174")<br>SB-16(168-192")<br>SB-18(48-96")<br>SB-20(72-90")<br>SB-23B(160-177")<br>SB-24(66-84")<br>BK-1(68-88")<br>SB-27(28-42")<br>SB-32(15-33") | UJ |

Table 3-12. *LCS excursions for SVOC analyses*

| LCS ID | Analyte | Excursion | Affected Sample | Action |
|---|---|---|---|---|
| L071699S1 | 2,4-dinitrophenol | 27 %R | SB-19(48-96")<br>SB-21(74-81")<br>SB-22(48-96")<br>SB-35(120-144")<br>SB-28(32-46")<br>SB-37(168-192")<br>SB40(80-90")<br>SB-41(100-108")<br>SB-42(96-117")<br>SB-43(66-84")<br>SB-44(48-72")<br>SB-45(212-222")<br>SB-47(116-136")<br>SB-48(96-114") | UJ |
| L072099S1 | di-n-octyl phthalate<br>hexachlorocyclopentadiene | 149 %R<br>37 %R | SB-49B(18-20")<br>SB-55(72-96")<br>SB-56(72-96")<br>SB-57(72-96")<br>SB-59(120-144") | UJ |
| L072399S1 | hexachlorocyclopentadiene<br>indeno(1,2,3-cd) pyrene<br>dibenz(a,h)anthracene<br>benzo(g,h,i)perylene | 36 %R<br>52 %R<br>56 %R<br>44 %R | SB-63(14-16")<br>BLDDUP[SB-65(125-135")]<br>SB-65(125-135")<br>SB-69(168-180")<br>SB-66(144-156")<br>SB-68(84-94")<br>SB-64(96-108")<br>SB-72(48-60")<br>SB-71(144-160")<br>SB-73(168-192")<br>SB-75(168-180")<br>SB-76(168-192")<br>SB-77(156-180") | UJ,J |
| L072399S1 | di-n-octyl phthalate | 157 %R | SB-63(14-16") | UJ |
| L072699S2 | 2,4-dinitrophenol | 18 %R | SB-78(175-189")<br>SB-79(144-156")<br>SB-80(180-192")<br>SB-81(174-186")<br>SB-82(180-192")<br>SB-83(72-96")<br>SB-84(72-96")<br>SB-85(72-91") | UJ |
| L072799S3 | pyrene | 139 %R | SB-90(144-168") | J |

**Table 3-12.** ***LCS excursions for SVOC analyses***

| LCS ID | Analyte | Excursion | Affected Sample | Action |
|---|---|---|---|---|
| L072899S1 | 2,4-dinitrophenol | 21 %R | SB-85B(156-168")<br>SB-86(168-180")<br>SB-87(156-180")<br>BLDDUP[SB-87(156-180")] | UJ |

Note:
%R indicates percent recovery

### 3.4.5. Internal standards performance

The recoveries for internal standards in samples analyzed for SVOCs were lower than the lower control limit. Repeated analyses confirmed the internal standard excursions. In accordance with NYSDEC Region II data validation guidelines, the results for target analytes associated with internal standard area recoveries greater than 25% but less than the lower control limit were qualified as approximate, and the results for target analytes associated with internal standard area recoveries less than 25% were rejected. The internal standard areas excursions are summarized in the following table:

**Table 3-13.** ***Internal standard area excursions for SVOC analyses***

| Sample ID | Internal standard | Analyte | Action |
|---|---|---|---|
| SB-24(66-84") | phenanthrene-d10<br>chrysene-d12<br>perylene-d12 | For affected analytes see below | UJ,J, *R (7) |
| SB-18(48-96") | perylene-d12 | For affected analytes see below | UJ |
| SB-06(0-24")RE | chrysene-d12<br>perylene-d12 | For affected analytes see below | UJ,J |
| SB-24(48-60")RE | chrysene-d12<br>perylene-d12 | For affected analytes see below | UJ,J, *R (2) |
| SB-47(116-136") | phenanthrene-d10<br>chrysene-d12<br>perylene-d12 | For affected analytes see below | UJ,J, *R (7) |
| SB-22(48-96") | perylene-d12 | For affected analytes see below | UJ |
| SB-19(48-96") | phenanthrene-d10<br>perylene-d12 | For affected analytes see below | UJ |
| SB-54(96-120")RE | 1,4-dichlorobenzene-d4<br>chrysene-d12<br>perylene-d12 | For affected analytes see below | UJ,J, *R (3) |
| SB-72(48-60") | perylene-d12 | For affected analytes see below | UJ |

**Table 3-13.** ***Internal standard area excursions for SVOC analyses***

| Sample ID | Internal standard | Analyte | Action |
|---|---|---|---|
| SB-64(96-108") | chrysene-d12<br>perylene-d12 | For affected analytes see below | UJ,J |

Note:
RE indicates reanalysis of the sample.

* R(x) indicates that x number of analytes were rejected since the internal standard area was less than 25% of the control limit.

The analytes affected by internal standard 1,4-dichlorobenzene-d4 include the following: bis(2-chloroethyl)ether, phenol, 2-chlorophenol, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, 2,2'-oxybis(1-chloropropane), 2-methylphenol, hexachloroethane, n-nitroso-di-n-propylamine, 4-methylphenol.

The analytes affected by internal standard phenanthrene-d10 include the following: 4,6-dinitro-2-methylphenol, n-nitrosodiphenylamine, 4-bromophenyl phenyl ether, hexachlorobenzene, pentachlorophenol, phenanthrene, anthracene, di-n-butyl phthalate, carbazole, fluoranthene.

The analytes affected by internal standard chrysene-d12 include the following: pyrene, butyl benzyl phthalate, 3,3'-dichlorobenzidine, benzo(a)anthracene, chrysene, bis(2-ethylhexyl)phthalate.

The analytes affected by internal standard perylene-d12 include the following: di-n-octyl phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene.

### 3.4.6. Analytical reported detection limits

Dilutions were performed during the analysis of several samples due to high concentrations of target analytes. The analytes which were analyzed using dilutions are summarized in the following table:

**Table 3-14.** ***Analytes reported from diluted SVOC analyses***

| Sample ID | Reason for dilution |
|---|---|
| SB-24(66-84") | High concentration of target analytes |
| SB-64(96-108") | High concentration of target analytes |
| SB-90(144-168") | High concentration of target analytes |
| SB-18(48-96") | High concentration of target analytes |
| SB-105(54-60") | High concentration of target analytes |

The results for benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene in sample SB-54(96-120") which were reported by the laboratory as detected concentrations were corrected to the detection limit values due to a laboratory transcription error.

## 3.5. PCB analyses

### 3.5.1. Criteria

The QA/QC parameters presented in Section 2.1 for were applied to environmental samples listed in Table 1-1.

The following QA/QC parameters were found to meet validation criteria:

- Holding times, sample preservation, and percent solids,
- Analytical sequence,
- Initial and continuing calibration,
- Blank analysis,
- Surrogate recovery,
- MS/MSD analysis,
- Field duplicate analysis,
- LCS and matrix spike blank analysis,
- Analyte quantitation,
- System performance.

Deviations from QA/QC criteria presented in Section 2.1 are summarized below.

### 3.5.2. Analyte identification

The %D values calculated for the positive results for both chromatographic columns (RTX-5, DB608) used in sample analyses were greater than 25%. As a result, in accordance with the Region II data validation guidelines the results for samples with a %D less than 100% were qualified as approximate (J). The analyte identification excursions are summarized in the following table:

Table 3-15. *Analyte identification excursions for PCB analyses*

| Sample ID | Analyte | Excursion | Action |
|---|---|---|---|
| SB-06(130-160") | Aroclor 1254 | 50%D | J |
| SB-10B(48-72") | Aroclor 1254 | 50%D | J |
| SB-63(14-16") | Aroclor 1254 | 75%D | J |
| BLDDUP[SB-65(125-135")] | Aroclor 1254 | 33%D | J |
| SB-65(125-135") | Aroclor 1254 | 35%D | J |
| SB-97(168-192") | Aroclor 1254 | 40%D | J |

Note:
%D indicates percent difference

### 3.5.3. Analyte reported detection limits

Dilutions were performed during the analysis of several samples due to high concentration of target analytes. The analytes which were analyzed using dilutions are summarized in the following table:

Table 3-16. *Analytes reported from diluted Pesticide/PCB analyses*

| Sample ID | Reason for dilution |
|---|---|
| SB-11(72-96"}<br>SB-54(96-120")<br>SB-79(144-156") | High concentration of target analytes |

## 3.6. Metals, mercury and cyanide analyses

### 3.6.1. Criteria

The QA/QC parameters presented in Section 2.1 for metals (consisting of aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc), mercury,

and cyanide were applied to environmental samples listed in Table 1-1. The following QA/QC parameters were found to meet validation criteria:

- Holding times, sample preservation, and percent solids,
- CRDL standard analysis criteria,
- Initial and continuing calibration,
- ICP interference check sample analysis,
- Field duplicate analysis,
- LCS and matrix spike blank analysis,
- Furnace atomic absorption analysis,
- Verification of instrument parameters,
- Instrument detection limits,
- Linear ranges,
- Analyte quantitation, and reported detection limits, and
- Documentation completeness.

Deviations from QA/QC criteria presented in Section 2.1 are summarized below.

### 3.6.2. Blank analysis

Target analytes were detected in preparation blanks analyzed for metals in this investigation. The samples which contained the target analytes at less than five times the associated blank concentration were qualified as undetected due to the blank contamination, as required by the USEPA Region II data validation guidelines. The blank excursions are summarized in the following table:

**Table 3-17.** ***Blank excursions for metal analyses***

| Blank ID | Analyte | Detected Concentration | Affected Sample Results | Action (mg/L) |
|---|---|---|---|---|
| PB082399W2 | arsenic | 0.002 mg/L | TW-4FF | 0.0019U |
| | | | HG-W-24D | 0.002U |
| | | | HG-W-24 | 0.0028U |
| | | | HG-W-25 | 0.002U |
| | | | MW-1 | 0.002U |
| | | | MW-5 | 0.003U |
| | | | MW-3 | 0.005U |
| | | | MW-4 | 0 003U |
| PB082399W2 | barium | 0 0004 mg/L | TW-3FF | 0 001U |
| Equipment Blank | iron | 0.0199mg/L | TW-1FF | 0.008U |
| | | | TW-2FF | 0.027U |
| | | | TW-3FF | 0 017U |

Table 3-17. *Blank excursions for metal analyses*

| Blank ID | Analyte | Detected Concentration | Affected Sample Results | Action (mg/L) |
|---|---|---|---|---|
| Equipment Blank | zinc | 0.0099mg/L | TW-1FF | 0.014U |
| | | | TW-2FF | 0.01U |
| | | | TW-3FF | 0.009U |
| | | | TW-4FF | 0 014U |
| | | | TW-5FF | 0.012U |
| | | | HG-W-24D | 0.011U |
| | | | HG-W-24 | 0.025U |
| | | | MW-1 | 0.02U |
| | | | HG-W-25FF | 0.042U |
| | | | MW-2 | 0.013U |
| | | | MW-5 | 0.006U |
| | | | MW-3 | 0.011U |
| | | | BDLDUP[MW-5] | 0 006U |

Note:
PB indicates method (preparation) blank.

### 3.6.3. MS analysis

Analytes in MS samples analyzed for metals were outside of the method control limits. In accordance with USEPA Region II data validation guidelines, when the sample concentrations are less than four times the spike concentrations, target analytes with MS recoveries that are outside of control limits, but are greater than 10% but less than 126% are qualified as approximate (UJ,J), target analytes with MS recoveries that are greater than 126% but less than 200% that are positive detections are qualified as approximate (J). The MS excursions are summarized in the following table:

**Table 3-18. *MS excursions for metal analyses***

| Sample ID | Analyte | Excursion | Affected Sample Results | Action |
|---|---|---|---|---|
| SB-63(14-16") | aluminum | 181 %R | SB-24(66-84") | J |
| | | | SB-54(96-120") | |
| | | | SB-49B(18-20") | |
| | | | SB-55(72-96") | |
| | | | SB-56(72-96") | |
| | | | SB-57(72-96") | |
| | | | SB-59(120-144") | |
| | | | SB-63(14-16") | |
| | | | BLDDUP[SB-65(125-135")] | |
| | | | SB-65(125-135") | |
| | | | SB-69(168-180") | |
| | | | SB-66(144-156") | |
| | | | SB-68(84-94") | |
| | | | SB-64(96-108") | |
| | | | SB-72(48-60") | |
| | | | SB-71(144-160") | |
| | | | SB-73(168-192") | |
| | | | SB-75(168-182") | |
| | | | SB-76(168-192") | |
| | | | SB-77(156-180") | |
| SB-20(72-90") | manganese | 128 %R | SB-05(96-120") | J |
| | | | SB-06(0-24") | |
| | | | SB-07(156-180") | |
| | | | SB-08(168-192") | |
| | | | SB-12(120-144") | |
| | | | SB-13(120-144") | |
| | | | SB-10B(48-72") | |
| | | | SB-14(96-132") | |
| | | | SB-15(159-174") | |
| | | | SB-16(168-192") | |
| | | | SB-18(48-96") | |
| | | | SB-19(48-96") | |
| | | | SB-20(72-90") | |
| | | | SB-23B(160-177") | |
| | | | SB-24(48-60") | |
| | | | SB-21(74-81") | |
| | | | SB-22(48-96") | |

Table 3-18. ***MS excursions for metal analyses***

| Sample ID | Analyte | Excursion | Affected Sample Results | Action |
|---|---|---|---|---|
| SB-48(96-114") | manganese | 11%R | BK-1(0-3")<br>BK-2(0-3")<br>BK-2(84-96")<br>BK-1(68-88")<br>SB-27(28-42")<br>SB-32(15-33")<br>SB-35(120-144")<br>SB-28(32-46")<br>SB-37(168-192")<br>SB-40(80-90")<br>SB-41(100-108")<br>SB-42(96-117")<br>SB-43(66-84")<br>SB-44(48-72")<br>SB-45(212-222")<br>SB-47(116-136")<br>SB-48(96-114") | |

Note: %R indicates percent recovery.

### 3.6.4. Laboratory duplicate analysis

The RPD for analytes in laboratory duplicate samples were greater than the 10%D criterion. In accordance with the Region II data validation guidelines, the results for these analytes were qualified as approximate (J). The laboratory duplicate excursions are summarized in the following table:

**Table 3-19.** ***Laboratory duplicate excursions for metal analyses***

| Serial dilution ID | Analyte | Excursion | Affected samples | Action |
|---|---|---|---|---|
| SB-63(14-16") | aluminum | 22 RPD | SB-24(66-84") | J |
| | iron | 28 RPD | SB-54(96-120") | |
| | | | SB-49B(18-20") | |
| | | | SB-55(72-96") | |
| | | | SB-56(72-96") | |
| | | | SB-57(72-96") | |
| | | | SB-59(120-144") | |
| | | | SB-63(14-16") | |
| | | | BLDDUP[SB-65(125-135")] | |
| | | | SB-65(125-135") | |
| | | | SB-69(168-180") | |
| | | | SB-66(144-156") | |
| | | | SB-68(84-94") | |
| | | | SB-64(96-108") | |
| | | | SB-72(48-60") | |
| | | | SB-71(144-160") | |
| | | | SB-73(168-192") | |
| | | | SB-75(168-182") | |
| | | | SB-76(168-192") | |
| | | | SB-77(156-180") | |
| SB-92(168-192") | copper | 25 RPD | SB-92(168-192") | J |
| | | | SB-93(168-192") | |
| | | | SB-94(72-96") | |
| | | | SB-95(72-90") | |
| | | | BLDDUP[SB-95(72-90")] | |
| | | | SB-96(72-84") | |
| | | | SB-97(168-192") | |
| SB-20(72-90") | zinc | 25 RPD | SB-05(96-120") | J |
| | | | SB-06(0-24") | |
| | | | SB-07(156-180") | |
| | | | SB-08(168-192") | |
| | | | SB-12(120-144") | |
| | | | SB-13(120-144") | |
| | | | SB-10B(48-72") | |
| | | | SB-14(96-132") | |
| | | | SB-15(159-174") | |
| | | | SB-16(168-192") | |
| | | | SB-18(48-96") | |
| | | | SB-19(48-96") | |
| | | | SB-20(72-90") | |
| | | | SB-23B(160-177") | |
| | | | SB-24(48-60") | |
| | | | SB-21(74-81") | |
| | | | SB-22(48-96") | |

Table 3-19. ***Laboratory duplicate excursions for metal analyses***

| Serial dilution ID | Analyte | Excursion | Affected samples | Action |
|---|---|---|---|---|
| SB-48(96-114") | iron<br>lead<br>manganese | 21 RPD<br>78 RPD<br>39 RPD | BK-1(0-3")<br>BK-2(0-3")<br>BK-2(84-96")<br>BK-1(68-88")<br>SB-27(28-42")<br>SB-32(15-33")<br>SB-35(120-144")<br>SB-28(32-46")<br>SB-37(168-192")<br>SB-40(80-90")<br>SB-41(100-108")<br>SB-42(96-117")<br>SB-43(66-84")<br>SB-44(48-72")<br>SB-45(212-222")<br>SB-47(116-136")<br>SB-48(96-114") | J |
| SB-92(168-192") | copper | 25 RPD | SB-105(54-60")<br>SB-105(70-76") | J |

Note:
%D indicates percent difference

### 3.6.5. ICP serial dilution analysis

The serial dilution recoveries for analytes in samples were greater than the 10%D criterion. In accordance with the Region II data validation guidelines, the results for these analytes were qualified as approximate (J). The ICP serial dilution excursions are summarized in the following table:

**Table 3-20.** ***ICP serial dilution excursions for metal analyses***

| Serial dilution ID | Analyte | Excursion | Affected samples | Action |
|---|---|---|---|---|
| SB-63(14-16") | barium<br>calcium | 45 %D<br>15 %D | SB-24(66-84")<br>SB-54(96-120")<br>SB-49B(18-20")<br>SB-55(72-96")<br>SB-56(72-96")<br>SB-57(72-96")<br>SB-59(120-144")<br>SB-63(14-16")<br>BLDDUP[SB-65(125-135")]<br>SB-65(125-135")<br>SB-69(168-180")<br>SB-66(144-156")<br>SB-68(84-94")<br>SB-64(96-108")<br>SB-72(48-60")<br>SB-71(144-160")<br>SB-73(168-192")<br>SB-75(168-180")<br>SB-76(168-192")<br>SB-77(156-180") | J |
| SB-89(168-192") | barium<br>calcium | 45 %D<br>15 %D | SB-78(175-189")<br>SB-79(144-156")<br>SB-80(180-192")<br>SB-81(174-186")<br>SB-82(180-192")<br>SB-83(72-96")<br>SB-84(72-96")<br>SB-85(72-91")<br>SB-85B(156-168")<br>SB-86(168-180")<br>SB-87(156-180")<br>BLDDUP[SB87(156-180")]<br>SB-88(168-192")<br>SB-89(168-192")<br>SB-90(144-168") | J |
| SB-89(168-192") | barium | 45 %D | SB-91(174-192") | J |
| SB-92(168-192") | sodium | 10.9 %D | SB-92(168-192")<br>SB-105(54-60")<br>SB-105(70-76") | J |

Note:
%D indicates percent difference

## 3.7. Gross alpha/gross beta analyses

### 3.7.1. Criteria

The QA/QC parameters presented in Section 2.1 for radiochemistry were applied to the environmental samples listed in Table 1-1. The following QA/QC parameters were found to meet validation criteria:

- Holding times and sample preservation,
- Calibration
- Radionuclide quantitation and detection limits
- System performance
- Documentation completeness

### 3.7.2. Blank analysis

The blank results were evaluated using the following statistical approach: if the sample result minus the blank result is less than 2 times the quadratic sum of the sample and blank errors, apply the qualifier "BU" to the sample. The 2 factor can be interpreted in terms of a confidence limit that the true sample result is greater than the true blank result. Assuming a Gaussian distribution for the errors, the 2 factor corresponds to a 99% confidence limit that the true sample result is greater than the true blank result. The statistical evaluation of the blank results are summarized in the following table:

**Table 3-21.** ***Blank evaluation for gross alpha/ gross beta analyses***

| Blank ID | Radionuclide | Blank Concentration ± Uncertainty (pCi) | Affected Sample Results | Action |
|---|---|---|---|---|
| PB071399S1 | gross alpha | 6.9E-02 ± 6.3E-02 | SB-04C(0-6")<br>SB-04C(6-12")<br>SB-05(96-120") | BU |
| PB071499S1 | gross beta | 4 3E-01 ± 1 4E-01 | SB-09(46-48") | BU |
| PB071599S1 | gross alpha<br>gross beta | 9.3E0 ± 7.8 E-01<br>1 3E01 ± 7.2E-01 | SB-09D(6-12")<br>SB-09D(30-36") | BU |
| PB072099S1 | gross alpha | 3 3E-02 ± 5 1E-02 | BK-2(84-96")<br>BK-1(68-88")<br>SB-31(24-30")<br>SB-34(18-30") | BU |
| PB072899S1 | gross alpha | 1 4E-01 ± 8 2E-02 | SB-68(54-66") | BU |

**Table 3-21.** ***Blank evaluation for gross alpha/ gross beta analyses***

| Blank ID | Radionuclide | Blank Concentration ± Uncertainty (pCi) | Affected Sample Results | Action |
|---|---|---|---|---|
| PB081999S1 | gross alpha | 9.0E-03 ± 4.5E-02 | SB-100(68-90")<br>SB-101B(40-46") | BU |
| PB082399W1 | gross alpha | 6 4E-02 ± 6 5E-02 | TW-1FF | BU |
| PB082399W2 | gross alpha | 9.0E-03 ± 4.5E-02 | HG-W-24D<br>HG-W-24<br>HG-W-25<br>HG-W-25FF<br>MW-5<br>MW-3<br>MW-4<br>BLDDUP[MW-5] | BU |
| PB082399W2 | gross beta | 1.0E-01 ± 9.4E-02 | HG-W-24<br>HG-W-25<br>MW-1<br>HG-W-25FF<br>MW-3<br>MW-4 | BU |

Note:
pCi indicates picocurries.
Uncertainty indicates total propagated uncertainty which includes counting error and non–counting error.
PB indicates method (preparation) blank

### 3.7.3. LCS evaluation

The LCS results were evaluated using the following statistical approach: if the absolute value of the recovery value minus its expected value is greater than 2 times the quadratic sum of the percent errors of the recovery and the sample being qualified, apply the "J" qualifier to the sample. The percent error of the recovery is the quadratic sum of the percent errors of the spiked result and its expected value. The statistical evaluation of the LCS results are summarized in the following table:

**Table 3-22.** ***LCS evaluation for gross alpha / gross beta analyses***

| LCS ID | Radionuclide | Recovery/ Expected value* | Affected sample results | Action |
|---|---|---|---|---|
| L071399S1 | gross beta | 128.8/115 | SB-03(18-24")<br>SB-04A(6-15")<br>SB-04B(0-6")<br>SB-04B(6-12")<br>SB-04C(0-6")<br>SB-04C(6-12")<br>SB-05(12-24")<br>SB-05(96-120") | J |

Table 3-22. *LCS evaluation for gross alpha / gross beta analyses*

| LCS ID | Radionuclide | Recovery/ Expected value* | Affected sample results | Action |
|---|---|---|---|---|
| L071499S1 | gross beta | 129.5/115 4 | SB-06(0-24")<br>SB-09(72-96")<br>SB-12(120-144")<br>SB-10B(48-72")<br>SB-14(96-132") | J |
| L071599S1 | gross beta | 130.2/115 | SB-09(0-12")<br>SB-09(24-36")<br>SB-09(36-48")<br>SB-09C(48-60")<br>SB-09C(60-72")<br>SB-09E(0-12")<br>SB-09E(24-36")<br>SB-09E(36-48")<br>SB-09E(48-60")<br>SB-09E(60-72")<br>SB-09D(60-72")<br>SB-09D(0-6")<br>SB-09D(30-36") | J |
| L071699S1 | gross beta | 130.1/115 | SB-15(159-174")<br>SB-15(24-36")<br>SB-15(66-84")<br>SB-15(144-159")<br>SB-15(96-108")<br>SB-15(108-120")<br>SB-16(0-12")<br>SB-16(30-42")<br>SB-16(60-72")<br>SB-16(72-96")<br>SB-16(108-132") | J |
| L072099S1 | gross beta | 129.3/115.4 | SB-17B(0-24")<br>SB-25(18-30")<br>BK-2(84-96")<br>BK-1(68-88")<br>SB-27(28-42")<br>SB-32(15-33")<br>SB-28(32-46")<br>SB-29(30-42")<br>SB-30A(8-27")<br>SB-30B(20-33")<br>SB-31(24-30")<br>SB-33(24-36")<br>SB-34(18-30")<br>SB-36(48-60") | J |

Table 3-22. *LCS evaluation for gross alpha / gross beta analyses*

| LCS ID | Radionuclide | Recovery/ Expected value* | Affected sample results | Action |
|---|---|---|---|---|
| L072799S1 | gross beta | 126.9/115 | SB-38(48-60")<br>SB-40(48-60")<br>SB-41(108-120")<br>SB-51(72-84")<br>SB-53(12-24") | J |
| L072899S1 | gross beta | 129 2/115 | SB-68(54-66") | J |
| L081999S1 | gross beta | 128.2/115 | SB-98(6-12")<br>SB-98(24-30")<br>SB-99(72-78")<br>SB-100(68-90")<br>SB-101B(40-46")<br>SB-102(60-66")<br>SB-103(118-130")<br>SB-104(72-84")<br>SB-108(84-96") | J |
| L082399W1 | gross beta | 130.2/115 | TW-1<br>TW-1FF<br>TW-2FF<br>TW-3<br>TW-3FF<br>TW-4FF<br>TW-5FF | J |
| LO82399W2 | gross beta | 131/115 | HG-W-24D<br>HG-W-24<br>HG-W-25<br>MW-1<br>HG-W-25FF<br>MW-2<br>MW-5<br>MW-3<br>MW-4<br>BLDDUP[MW-5] | J |

Note:
* indicates unit is picocuries per gram for soils (S) and picocuries per liter for water (W)

### 3.7.4. Duplicate analysis

The duplicate results were evaluated using the following statistical approach: if the ratio of the absolute value of the difference between the duplicate results to the quadratic sum of the errors of the results, or relative error ratio (RER) is greater than 3, apply the qualifier "J" to the associated sample. In the case that there is a result for one of the samples and the other was 'not found' but no result is computed, use the not found's minimal detectable concentration

(MDC) for the result. The statistical evaluation of the duplicate results are summarized in the following table:

**Table 3-23.** ***Duplicate evaluation for gamma spectrometry analyses***

| Duplicate ID | Radionuclide | RER | Affected sample results | Action |
|---|---|---|---|---|
| SB-15(3-12") | gross alpha<br>gross beta | 3.7<br>8.9 | SB-15(159-174")<br>SB-15(3-12")<br>SB-15(12-24")<br>SB-15(24-36")<br>SB-15(48-66")<br>SB-15(66-84")<br>SB-15(144-159")<br>SB-15(96-108")<br>SB-15(108-120")<br>SB-16(60-72")<br>SB-16(72-96")<br>SB-16(108-132")<br>SB-16(0-12")<br>SB-16(12-30")<br>SB-16(30-42")<br>SB-16(48-60")<br>SB-17A(18-36")<br>SB-17A(36-46")<br>SB-17A(48-54")<br>SB-17A(54-60") | J |
| SB-37(0-12") | gross alpha | 3.9 | SB-37(0-12")<br>SB-37(12-24")<br>SB-37(96-126")<br>SB-38(0-18")<br>SB-38(48-60")<br>SB-40(48-60")<br>SB-40(0-24")<br>SB-41(12-18")<br>SB-41(78-90")<br>SB-41(108-120")<br>SB-45(72-78")<br>SB-23B(108-120")<br>SB-45(202-212")<br>SB-51(72-84")<br>SB-53(12-24")<br>SB-62(6-12")<br>SB-62(12-18") | J |

**Table 3-23.** ***Duplicate evaluation for gamma spectrometry analyses***

| Duplicate ID | Radionuclide | RER | Affected sample results | Action |
|---|---|---|---|---|
| TW-5FF | gross alpha | 5.7 | TW-1<br>TW-2<br>TW-1FF<br>TW-2FF<br>TW-3<br>TW-4<br>TW-5<br>TW-3FF<br>TW-4FF<br>TW-5FF | J |
| MW-2 | gross alpha<br>gross beta | 9.4<br>3.7 | HG-W-24D<br>HG-W-24<br>HG-W-25<br>MW-1<br>HG-W-25FF<br>MW-2<br>MW-5<br>MW-3<br>MW-4<br>BLDDUP[MW-5] | J |

Note:
RER indicates relative error ratio

### 3.7.5. Field duplicate analysis

The field duplicate results were evaluated using the following statistical approach: if the ratio of the absolute value of the difference between the duplicate results to the quadratic sum of the errors of the results, or relative error ratio (RER) is greater than 3, apply the qualifier "J" to the field duplicate and the associated sample. In the case that there is a result for one of the samples and the other was 'not found' but no result is computed, use the not found's minimal detectable concentration (MDC) for the result. The statistical evaluation of the field duplicate results is summarized in the following table:

**Table 3-24.** ***Field duplicate evaluation for gamma spectrometry analyses***

| Field Duplicate ID | Radionuclide | RER | Affected sample results | Action |
|---|---|---|---|---|
| SB-71(66-72") / BLDDUP[SB-71(66-72")] | gross alpha<br>gross beta | 4.97<br>7 98 | SB-71(66-72")<br>BLDDUP[SB-71(66-72")] | J |

Note:
RER indicates relative error ratio

## 3.8. Gamma spectrometry analyses

### 3.8.1. Criteria

The QA/QC parameters presented in Section 2.1 for radiochemistry were applied to the environmental samples listed in Table 1-1. The following QA/QC parameters were found to meet validation criteria:

- Holding times and sample preservation,
- Calibration
- LCS
- Radionuclide quantitation
- System performance
- Documentation completeness

### 3.8.2. Blank analysis

The blank results were evaluated using the following statistical approach: if the sample result minus the blank result is less than 2 times the quadratic sum of the sample and blank errors, apply the qualifier "BU" to the sample result. The 2 factor can be interpreted in terms of a confidence limit that the true sample result is greater than the true blank result. Assuming a Gaussian distribution for the errors, the 2 factor corresponds to a 99% confidence limit that the true sample result is greater than the true blank result. The statistical evaluation of the blank results are summarized in the following table:

Table 3-2. *Blank evaluation for gamma spectrometry analyses*

| Blank ID | Radionuclide | Blank Concentration ± Uncertainty (pCi) | Affected Sample Results | Action |
|---|---|---|---|---|
| PB071399S1 | radium 226 | 4.2E-01 ± 7.2E-01 | SB-03(12-18")<br>SB-04A(4-5")<br>SB-04A(6-15")<br>SB-04B(6-12") | BU |
| PB071399S1 | uranium 235 | 2 6E0 ± 4.4E0 | SB-03(12-18")<br>SB-04A(4-5")<br>SB-04A(6-15")<br>SB-04B(6-12")<br>SB-04C(6-12")<br>SB-05(12-24")<br>SB-05(96-120") | BU |

**Table 3-2.** ***Blank evaluation for gamma spectrometry analyses***

| Blank ID | Radionuclide | Blank Concentration ± Uncertainty (pCi) | Affected Sample Results | Action |
|---|---|---|---|---|
| PB071299S1 | lead 210 | 4 7E0 ± 7.9E01 | SB-04A(2-3")<br>SB-04A(3-4") | BU |
| PB071699S1 | potassium 40 | 5.8E01 ± 8.6E01 | SB-15(159-174")<br>SB-17A(36-46")<br>SB-17B(0-24")<br>SB-17B(24-48") | BU |
| PB072699S1 | lead 210 | 1.0E02 ± 4.9 E02 | SB-32(15-33")<br>SB-33(24-36")<br>SB-38(48-60") | BU |
| PB072699S1 | cesium 137 | 7 1E-01 ± 4 4E0 | SB-38(0-18") | BU |
| PB072799S1 | cesium 137 | 8.3E-01 ± 4.6E0 | SB-62(6-12")<br>SB-64(18-24") | BU |
| PB090999S3 | potassium 40 | 2 5E01 ± 5 6E01 | SB-105(54-60") | BU |
| PB0917PPW1 | potassium 40 | 5.9E01 ± 1.3E02 | TW-2FF<br>TW-5FF | BU |

Note:
pCi indicates picocuries.
Uncertainty indicates total propagated uncertainty which includes counting error and non-counting error.
PB indicates method (preparation) blank

### 3.8.3. Duplicate analysis

The duplicate results were evaluated using the following statistical approach: if the ratio of the absolute value of the difference between the duplicate results to the quadratic sum of the errors of the results, or relative error ratio (RER) is greater than 3, apply the qualifier "J" to the associated sample result. In the case that there is a result for one of the samples and the other was 'not found' but no result is computed, use the not found's minimal detectable concentration (MDC) for the result. The statistical evaluation of the duplicate results are summarized in the following table:

**Table 3-26.** ***Duplicate evaluation for gamma spectrometry analyses***

| Duplicate ID | Radionuclide | RER | Affected sample results | Action |
|---|---|---|---|---|
| SB-25(0-18") | lead 212 | 3 7 | SB-24(120-132")<br>SB-25(0-18")<br>SB-25(18-30") | J |

Note:
RER indicates relative error ratio

### 3.8.4. Field duplicate analysis

The field duplicate results were evaluated using the following statistical approach: if the ratio of the absolute value of the difference between the duplicate results to the quadratic sum of the errors of the results, or relative error ratio (RER) is greater than 3, apply the qualifier "J" to the field duplicate and the associated sample. In the case that there is a result for one of the samples and the other was 'not found' but no result is computed, use the not found's minimal detectable concentration (MDC) for the result. The statistical evaluation of the field duplicate results are summarized in the following table:

**Table 3-27.** ***Field duplicate evaluation for gamma spectrometry analyses***

| Field Duplicate ID | Radionuclide | RER | Affected sample results | Action |
|---|---|---|---|---|
| SB-71(66-72")/BLDDUP[SB-71(66-72")] | actinium 228 | 3.4 | SB-71(66-72")<br>BLDDUP[SB-71(66-72")] | J |
| SB-71(66-72")/BLDDUP[SB-71(66-72")] | bismuth 212<br>thallium 208 | 3.1<br>4 8 | SB-71(66-72") | J |
| SB-107(84-96")/BLDDUP[SB-107(84-96")] | thallium 208 | 3.8 | BLDDUP[SB-107(84-96")] | J |

Note:
RER indicates relative error ratio.

### 3.8.5. Target radionuclide list identification

The radiochemical data generated for this investigation was evaluated for gamma peak interferences. For this investigation, the gamma spectrometry data was corrected for uranium 235 and radium 226. Radionuclides detected by gamma spectrometry with three or less energy lines include potassium 40, lead 210, bismuth 211, lead 211, bismuth 212, radium 224, radium 226, protactinium 231, thorium 231, and thorium 234. In the case that gamma peaks that interfere with the quantitation of the radionuclide of interest with three energy lines or less are present, and correction was not performed for the interference, the result is qualified as "JI". Qualifiers applied to sample results as a result of gamma peak interference are summarized in the following table:

**Table 3-28. *Gamma spectrometry interference evaluation***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-09(6-12") | potassium 40<br>thorium 234<br>radium 224<br>protactinium 231 | JI |
| SB-12(120-144') | thorium 234 | JI |
| SB-04A(2-3") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-04A(3-4") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-04B(0-6") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-04C(0-6") | radium 224 | JI |
| SB-04E(0-12") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-09D(0-6") | thorium 234<br>radium 224 | JI |
| SB-09(0-6") | thorium 234<br>protactinium 231<br>bismuth 211 | JI |
| SB-09(0-12") | thorium 234<br>radium 224 | JI |
| SB-03(12-18") | thorium 234<br>protactnium 231 | JI |
| SB-03(18-24") | thorium 234<br>thorium 231<br>radium 224 | JI |
| SB-04A(4-5") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-04A(5-6") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |

Table 3-28. *Gamma spectrometry interference evaluation*

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-04A(6-15") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-04B(6-12") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-04C(6-12") | thorium 234 | JI |
| SB-05(12-24") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-05(96-120") | thorium 234<br>radium 224 | JI |
| SB-06(0-24") | thorium 234 | JI |
| SB-09(72-96") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211<br>lead 212 | JI |
| SB-09(46-48") | thorium 234<br>protactinium 231 | JI |
| SB-09(12-24") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-09(24-36") | thorium 234<br>protactinium 231 | JI |
| SB-13(120-144") | radium 224 | JI |
| SB-10B(48-72") | radium 224<br>protactinium 231 | JI |
| SB-14(96-132") | thorium 234<br>radium 224 | JI |
| SB-09(12-24") | thorium 234<br>protactinium 231 | JI |
| SB-09(24-36") | thorium 234<br>radium 224<br>bismuth 211 | JI |

**Table 3-28.** ***Gamma spectrometry interference evaluation***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-09(36-48") | thorium 234<br>bismuth 211 | JI |
| SB-09C(48-60") | thorium 234<br>radium 224 | JI |
| SB-09E(12-24") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-09E(24-36") | thorium 234<br>radium 224 | JI |
| SB-09E(36-48") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-09E(48-60") | thorium 234<br>radium 224 | JI |
| SB-09E(60-72") | thorium 234 | JI |
| SB-09D(48-60") | thorium 234<br>protactinium 231 | JI |
| SB-09D(60-72") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-09D(6-12") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-09D(12-18") | thorium 234 | JI |
| SB-09(18-24") | thorium 234<br>protactinium 231 | JI |
| SB-09D(24-30") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-09D(30-36") | thorium 234<br>radium 224 | JI |
| SB-15(159-174") | thorium 234<br>thorium 231<br>protactinium 231 | JI |
| SB-15(3-12") | thorium 234 | JI |

**Table 3-28.** ***Gamma spectrometry interference evaluation***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-15(12-24") | thorium 234<br>thorium 231<br>protactinium 231 | JI |
| SB-15(24-36") | thorium 234 | JI |
| SB-15(48-66") | thorium 234<br>radium 224<br>protactinium 231 | JI |
| SB-15(66-84") | thorium 234 | JI |
| SB-15(144-159") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231 | JI |
| SB-15(96-108") | thorium 234 | JI |
| SB-15(108-120") | thorium 234<br>radium 224 | JI |
| SB-16(0-12") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-16(12-30") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-16(30-42") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-16(48-60") | thorium 234<br>thorium 231<br>protactinium 231 | JI |
| SB-16(60-72") | thorium 234<br>thorium 231 | JI |
| SB-16(72-96") | thorium 234<br>bismuth 211 | JI |
| SB-16(108-132") | thorium 234 | JI |
| SB-17A(18-36") | thorium 234<br>radium 224<br>bismuth 211 | JI |

Table 3-28. *Gamma spectrometry interference evaluation*

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-17A(36-46") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-17A(48-54") | thorium 234<br>radium 224<br>protactinium 231 | JI |
| SB-17A(54-60") | thorium 234 | JI |
| SB-17B(0-24") | thorium 234<br>thorium 231 | JI |
| SB-17B(24-28") | thorium 234 | JI |
| SB-17B(144-196") | thorium 234<br>thorium 231<br>radium 224<br>bismuth 211 | JI |
| SB-24(66-84") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231 | JI |
| SB-24(120-132") | thorium 234 | JI |
| SB-25(0-18") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-25(18-30") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| BK-2(84-96") | thorium 234 | JI |
| BK-1(68-88") | radium 226 | JI |
| SB-27(28-42") | thorium 234<br>bismuth 211 | JI |
| SB-32(15-33") | thorium 234<br>radium 224 | JI |
| SB-28(32-46") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-29(30-42") | radium 224 | JI |
| SB-30A(8-27") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |

Table 3-28. *Gamma spectrometry interference evaluation*

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-30B(20-33") | thorium 234<br>radium 224 | JI |
| SB-31(24-30") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB33(24-36") | thorium 234<br>radium 224<br>protactinium 231 | JI |
| SB-34(18-30") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-36(0-24") | thorium 234<br>radium 224 | JI |
| SB-36(48-60") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-37(0-12") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-37(12-24") | thorium 234<br>thorium 231<br>radium 224<br>bismuth 211 | JI |
| SB-37(96-126") | thorium 234<br>bismuth 211 | JI |
| SB-38(0-18") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231 | JI |
| SB-38(48-60") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-40(48-60") | thorium 234<br>bismuth 211 | JI |
| SB-40(0-24") | thorium 234<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |

**Table 3-28.** ***Gamma spectrometry interference evaluation***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-41(12-18") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-41(78-90") | thorium 234 | JI |
| SB-41(108-120") | thorium 234<br>radium 224 | JI |
| SB-45(72-78") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231 | JI |
| SB-23B(108-120") | thorium 234<br>thorium 231 | JI |
| SB-45(202-212") | thorium 234 | JI |
| SB-51(72-84") | thorium 234<br>protactinium 231<br>bismuth 211 | JI |
| SB-53(12-24") | thorium 234<br>radium 224 | JI |
| SB-62(6-12") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-62(12-18") | thorium 234 | JI |
| SB-64(18-24") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| SB-64(48-60") | thorium 234 | JI |
| SB-68(54-66") | thorium 234 | JI |
| SB-68(18-30") | thorium 234<br>radium 224 | JI |
| SB-71(18-30") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-72(72-78") | thorium 234 | JI |

Table 3-28. *Gamma spectrometry interference evaluation*

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-71(66-72") | thorium 234<br>thorium 231<br>radium 224<br>protactinium 231<br>bismuth 211 | JI |
| BLDDUP[SB-71(66-72")] | thorium 234<br>thorium 231<br>protactinium 231 | JI |
| SB-76(48-64") | thorium 234<br>bismuth 211 | JI |
| SB-77(126-132") | thorium 234<br>radium 224<br>protactinium 231 | JI |
| SB-78(126-138") | thorium 234 | JI |
| SB-79(72-74") | thorium 234<br>thorium 231<br>protactinium 231 | JI |
| SB-82(24-30") | thorium 234<br>protactinium 231 | JI |
| SB-98(24-30") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| TW-2FF | thorium 234<br>radium 224 | JI |
| SB-99(72-78") | thorium 234<br>radium 224 | JI |
| SB-100(68-90") | thorium 234<br>bismuth 211 | JI |
| SB-101B(40-46") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-102(60-66") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-103(118-130") | thorium 234<br>radium 224<br>bismuth 211 | JI |
| SB-104(72-84") | thorium 234<br>radium 224 | JI |

**Table 3-28.** ***Gamma spectrometry interference evaluation***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-106(60-72") | thorium 234<br>thorium 231<br>protactinium 231<br>bismuth 211 | JI |
| SB-107(84-96") | thorium 234<br>radium 224 | JI |
| BLDDUP[SB-107(84-96")] | thorium 234 | JI |
| SB-108(84-96") | thorium 234 | JI |
| SB-109(84-96") | thorium 234<br>thorium 231<br>bismuth 211 | JI |
| SB-105(30-40") | thorium 234 | JI |
| SB-105(70-76") | thorium 234 | JI |
| SB-105(56-60") | thorium 234<br>thorium 231 | JI |

### 3.8.6. Detection evaluation

Evaluations of detection for each sample result were performed using the following statistical approach: if a sample result is less than its total propagated error, apply the qualifier "U" to the sample result. The laboratory applied the "J" qualifier for sample results that were less than the MDC. Qualifiers applied to sample results as a result of the detection evaluation are summarized in the following table:

**Table 3-29.** ***Detection evaluation for gamma spectrometry analyses***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-38(0-18") | protactinium 231<br>radium 223 | U |
| SB-38(48-60") | lead 214 | U |
| SB-40(48-60") | bismuth 211 | U |
| SB-40(0-24") | lead 214<br>protactinium 231<br>radium 226 | U |

Table 3-29. *Detection evaluation for gamma spectrometry analyses*

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-41(12-18") | bismuth 211<br>protactinium 231<br>radium 223<br>radium 226 | U |
| SB-41(78-90") | bismuth 211<br>radium 226 | U |
| SB-23B(108-120") | bismuth 211<br>protactinium 231 | U |
| SB-45(202-212") | bismuth 211 | U |
| SB-51(72-84") | bismuth 211 | U |
| SB-62(6-12") | bismuth 211<br>protactinium 231<br>radium 223 | U |
| SB-64(18-24") | bismuth 211<br>protactinium 231<br>radium 223 | U |
| SB-64(48-60") | bismuth 211 | U |
| BK-1(68-88") | lead 212 | U |
| SB-27(28-42") | bismuth 211 | U |
| SB-28(32-46") | bismuth 211<br>radium 224<br>thorium 234<br>uranium 235 | U |
| SB-29(30-42") | radium 224 | U |
| SB-30A(8-27") | bismuth 211<br>bismuth 212<br>protactinuium 231<br>thorium 234 | U |
| SB-31(24-36") | protactinium 231<br>uranium 235 | U |
| SB-33(24-36") | protactinium 231<br>uranium 235 | U |
| SB-34(18-30") | radium 224 | U |
| SB-36(0-24") | lead 212<br>radium 223 | U |

**Table 3-29. *Detection evaluation for gamma spectrometry analyses***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-36(48-60") | bismuth 211<br>radium 224 | U |
| SB-37(0-12") | bismuth 211<br>lead 214<br>radium 226 | U |
| SB-37(12-24") | bismuth 211<br>radium 223<br>radium 226 | U |
| SB-37(96-126") | bismuth 211 | U |
| SB-16(72-96") | bismuth 211<br>bismuth 212<br>thorium 234 | U |
| SB16(108-132") | bismuth 211<br>lead 210 | U |
| SB-17A(18-36") | bismuth 211<br>lead 214 | U |
| SB-17A(36-46") | bismuth 211<br>lead 214 | U |
| SB-17A(48-54") | bismuth 212<br>radium 224 | U |
| SB-17A(54-60") | bismuth 211 | U |
| SB-17B(0-24") | bismuth 214<br>radium 223<br>thorium 231 | U |
| SB-17B(24-28") | radium 226 | U |
| SB-17B(144-196") | bismuth 211<br>lead 214<br>radium 223 | U |
| SB-24(120-132") | bismuth 211 | U |
| SB-25(0-18") | lead 212 | U |
| SB-25(18-30") | bismuth 211<br>lead 214<br>radium 224 | U |
| BK-2(84-96") | bismuth 211 | U |
| SB15(159-174") | bismuth 211<br>protactinium 231<br>radium 223<br>uranium 235 | U |

Table 3-29. *Detection evaluation for gamma spectrometry analyses*

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-15(3-12") | bismuth 211 | U |
| SB-15(12-24") | bismuth 211<br>protactinium 231<br>radium 223<br>radium 226 | U |
| SB-15(24-36") | bismuth 211 | U |
| SB-15(48-66") | lead 212<br>protactinium 231 | U |
| SB-15(144-159") | protactinium 231<br>radium 223<br>radium 226 | U |
| SB-15(96-108") | bismuth 211 | U |
| SB-15(108-120") | lead 214 | U |
| SB-16(0-12") | bismuth 211<br>lead 210<br>lead 214 | U |
| SB-16(12-30") | bismuth 211 | U |
| SB-16(30-42") | bismuth 211<br>lead 214 | U |
| SB-16(48-60") | protactinium 231<br>radium 223<br>thorium 231 | U |
| SB-09(36-48") | actinium 228<br>lead 214<br>thallium 208<br>thorium 234 | U |
| SB-09C(48-60") | radium 224 | U |
| SB-09C(60-72") | bismuth 211<br>lead 212 | U |
| SB-09E(12-24") | actinium 228<br>bismuth 211<br>bismuth 212<br>protactinium 231<br>radium 224<br>thorium 231 | U |
| SB-09E(24-36") | bismuth 211 | U |

**Table 3-29.** ***Detection evaluation for gamma spectrometry analyses***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-09E(36-48") | bismuth 211<br>radium 224 | U |
| SB-09E(48-60") | thallium 208 | U |
| SB-09D(48-60") | bismuth 211 | U |
| SB-09D(60-72)* | bismuth 211<br>lead 214<br>protactinium 231 | U |
| SB-09D(6-12") | bismuth 211<br>lead 214<br>protactinium 231 | U |
| SB-09D(12-18") | bismuth 211 | U |
| SB-09D(24-30") | lead 214<br>protactinium 231 | U |
| SB-05(96-120") | lead 214<br>radium 224<br>thallium 208<br>thorium 234 | U |
| SB-06(0-24") | bismuth 211<br>lead 214<br>thorium 234 | U |
| SB-09(72-96") | bismuth 211<br>protactinium 231 | U |
| SB-09B(12-24") | bismuth 211<br>lead 214<br>protactinium 231<br>radium 223 | U |
| SB-09(12-24") | bismuth 211<br>protactinium 231 | U |
| SB-09(24-36") | radium 226 | U |
| SB-12(120-144") | bismuth 211 | U |
| SB-13(120-144") | lead 212<br>thorium 234 | U |
| SB-10B(48-72") | bismuth 212<br>lead 214<br>protactinium 231<br>radium 224<br>radium 226<br>uranium 235 | U |
| SB-14(96-132") | thorium 234 | U |

Table 3-29. *Detection evaluation for gamma spectrometry analyses*

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-09(12-24") | protactinium 231<br>radium 226 | U |
| SB-09(24-36") | bismuth 211 | U |
| SB-03(12-18") | bismuth 211<br>protactinium 231 | U |
| SB-03(18-24") | bismuth 212<br>radium 223<br>radium 224<br>thorium 231 | U |
| SB-04A(4-5") | bismuth 211<br>lead 210<br>potassium 40<br>radium 224<br>thallium 208 | U |
| SB-04A(5-6") | lead 210 | U |
| SB-04B(6-12") | bismuth 211<br>lead 212<br>lead 214<br>thallium 208<br>thorium 234 | U |
| SB-04C(6-12") | lead 214 | U |
| SB-05(12-24") | bismuth 211<br>lead 210 | U |
| SB-17A(54-60") | cesium 137 | U |
| SB-17B(0-24") | cesium 137 | U |
| SB-32(15-33") | cesium 137 | U |
| SB-09D(18-24") | cesium 137 | U |
| SB-17A(18-36") | cesium 137 | U |
| SB-37(12-24") | cesium 137 | U |
| SB-77(126-132") | cesium 137 | U |
| SB-04A(3-4") | radium 226 | U |
| SB-04B(0-6") | bismuth 211<br>radium 224<br>thorium 234<br>uranium 235 | U |
| SB-04C(0-6") | radium 224 | U |

**Table 3-29. *Detection evaluation for gamma spectrometry analyses***

| Sample ID | Radionuclide | Action |
|---|---|---|
| SB-09(0-6") | bismuth 211<br>protactinium 231 | U |
| SB-09(0-12") | radium 224 | U |
| SB-09E(0-12") | bismuth 211<br>radium 224 | U |
| SB-71(18-30") | bismuth 211 | U |
| SB-72(72-78") | bismuth 211<br>thorium 234 | U |
| SB-71(66-72") | bismuth 211<br>protactnium 231 | U |
| BLDDUP[SB-71(66-72")] | bismuth 211<br>protactnium 231<br>thorium 231 | U |
| SB-76(48-64") | bismuth 211<br>radium 226 | U |
| SB-77(126-132") | radium 224 | U |
| SB-79(72-74") | bismuth 211<br>protactinium 231 | U |
| SB-98(24-30") | bismuth 211<br>bismuth 212<br>radium 224 | U |
| TW-2FF | thorium 234 | U |
| SB-99(72-78") | radium 224 | U |
| SB-100(68-90") | bismuth 211<br>radium 226<br>thallium 208<br>uranium 235 | U |
| SB-101B(40-46") | bismuth 211<br>cesium 137<br>radium 224<br>thorium 234 | U |
| SB-102(60-66") | bismuth 211<br>lead 212 | U |
| SB-103(118-130") | bismuth 211<br>radium 224 | U |
| SB-104(72-84") | radium 224 | U |

Table 3-29. *Detection evaluation for gamma spectrometry analyses*

| Sample ID | Radionuclide | Action |
|---|---|---|
| TW-5 | potassium 40<br>radium 226<br>uranium 235 | U |
| SB-106(60-72") | bismuth 211<br>protactinium 231<br>thorium 231 | U |
| SB-107(84-96") | bismuth 211<br>radium 226 | U |
| SB-108(84-96") | radium 226 | U |
| SB-109(84-96") | bismuth 211<br>radium 223 | U |
| SB-105(30-40") | bismuth 211 | U |
| SB-105(54-60") | radium 224 | U |

## 3.9. Thorium 228, 230, 232 and uranium 234, 235, 238 analyses

### 3.9.1. Criteria

The QA/QC parameters presented in Section 2.1 for radiochemistry were applied to the environmental samples listed in Table 1-1. The following QA/QC parameters were found to meet validation criteria:

- Holding times and sample preservation,
- Calibration
- LCS
- MS analysis
- Duplicate analysis
- Field duplicate analysis
- Radionuclide quantitation and detection limits
- Chemical separation specificity
- System performance
- Documentation completeness

### 3.9.2. Blank analysis

The blank results were evaluated using the following statistical approach: if the sample result minus the blank result is less than 2 times the quadratic sum of the sample and blank errors, apply the qualifier "BU" to the associated sample result. The 2 factor can be interpreted in terms of a confidence limit that the true sample result is greater than the true blank result. Assuming a Gaussian distribution for the errors, the 2 factor corresponds to a 99% confidence limit that the true sample result is greater than the true blank result. The statistical evaluation of the blank results are summarized in the following table:

**Table 3-30.** ***Blank evaluation for thorium/ uranium analyses***

| Blank ID | Radionuclide | Blank Concentration ± Uncertainty (pCi) | Affected Sample Results | Action |
|---|---|---|---|---|
| PB081199M1 | thorium 228 | 6.5E-01 ± 6.4E-01 | SB-22(48-96")<br>SB-37(168-192")<br>SB49(144-156")<br>SB-59(120-144")<br>SB-82(180-192")<br>SB-89(168-192") | BU |
| PB081199M1 | thorium 230 | 3.2E-01 ± 6.2E-01 | SB-22(48-96")<br>SB-37(168-192")<br>SB49(144-156")<br>SB-59(120-144")<br>SB-82(180-192")<br>SB-89(168-192") | BU |
| PB081199M1 | thorium 232 | 1.2E-01 ± 6.3E-01 | SB-22(48-96")<br>SB-37(168-192")<br>SB-59(120-144")<br>SB-82(180-192")<br>SB-89(168-192") | BU |
| PB081699S1 | thonum 228<br>thorium 230 | 1.5E-01 ± 9.5E-01<br>7.5E-02 ± 9 5E-01 | SB-09E(0-12")<br>SB-37(12-24")<br>SB-40(0-24")<br>SB-41(12-18")<br>SB-23B(108-120") | BU |
| PB081699S1 | thorium 232 | -1 0E-01 ± 1 0E0 | SB-09E(0-12") | BU |
| PB071999S1 | uranium 235/236 | -3.6E-03 ± 7.1E-01 | SB-09E(0-12") | BU |
| PB080499S1 | uranium 235/236 | 3 5E-02 ± 6 4E-01 | SB-82(180-192") | BU |
| PB080499S1 | uranium 233/234<br>uranium 235/236<br>uranium 238 | 9.6E-02 ± 5.2E-01<br>3.5E-02 ± 6.4E-01<br>5.5E-02 ± 5 9E-01 | SB-89(169-192") | BU |

Table 3-30. *Blank evaluation for thorium/ uranium analyses*

| Blank ID | Radionuclide | Blank Concentration ± Uncertainty (pCi) | Affected Sample Results | Action |
|---|---|---|---|---|
| PB082599M1 | uranium 233/234<br>uranium 235/236<br>uranium 238 | 3.3E-01 ± 6.0E-01<br>2.6E-02 ± 7.2E-01<br>1 5E-01 ± 5 9E-01 | SB-22(48-96")<br>SB-37(168-192") | BU |
| PB092199W1 | thorium 228 | 2.5E-02 ± 5.1E-02 | TW-1<br>TW-1FF<br>HG-W-24D<br>HG-W-24<br>HG-W-25<br>MW-1<br>HG-W-25FF | BU |
| PB092199W1 | thorium 230 | 2.4E-01 ± 7.9E-02 | TW-1<br>TW-1FF<br>HG-W-24<br>HG-W-25<br>MW-1 | BU |
| PB092199W1 | thorium 232 | 2.5E-02 ± 5.3E-02 | TW-1FF<br>HG-W-25FF | BU |
| PB082599M1 | uranium 233/234<br>uranium 235/236<br>uranium 238 | 3.3E-01 ± 6.0E-01<br>2.6E-02 ± 7.2E-01<br>1 5E-01 ± 5 9E-01 | TW-1<br>TW-1FF | BU |
| PB090999W1 | uranium 233/234<br>uranium 235/236<br>uranium 238 | 3.9E-02 ± 5.8E-01<br>-3.2E-02 ± 7.2E-01<br>-9.6E-02 ± 5.9E-01 | HG-W-24D<br>HG-W-24<br>HG-W-25<br>MW-1<br>HG-W-25FF | BU |

Note:
pCi indicates picocurnes.
Uncertainty indicates total propagated uncertainty which includes counting error and non-counting error
PB indicates method (preparation) blank

### 3.9.3. Tracer recovery

The tracer recovery in samples was less than the 50-100% recovery criteria. In accordance with the radiochemistry guidelines, samples with tracer recoveries outside of the control limits were qualified as "J". The samples qualified due to tracer recovery excursions are summarized in the following table:

**Table 3-31.** ***Tracer recovery evaluation for thorium/ uranium analyses***

| Sample ID | Analysis | Recovery | Action |
|---|---|---|---|
| SB-24(66-84") | thorium | 37.2% | J |
| SB-04A(2-3") | thorium | 9 55% | J |
| SB-37(12-24") | thorium | 10% | J |
| SB-40(0-24") | thorium | 20.9% | J |
| SB-37(12-24") | uranium | 43 2% | J |
| SB-41(12-18") | uranium | 16 8% | J |
| SB-23B(108-120") | uranium | 33 7% | J |
| SB-49(144-156") | uranium | 36 8% | J |
| TW-2 | uranium | 33 1% | J |
| HG-W-24 | uranium | 248% | J |

Note:
RER indicates relative error ratio

# 4. Summary and data useability

This chapter summarizes the analytical data in terms of its completeness and usability. Data completeness is defined as the percentage of sample results that have been determined to be usable during the data validation process. Overall, 100 percent of the PCB, metal, cyanide, mercury, and radiochemistry data and approximately 98.9 percent of the VOC data and 99.6 percent of the SVOC data were determined to be usable for qualitative and quantitative purposes.

The samples collected from the former Sylvania Electric Products Incorporated facility in Hicksville, New York were evaluated based on QA/QC criteria established by methods as listed in Section 1.2, by the data validation guidelines listed in Section1.2, and by the QAPP (O'Brien & Gere 1999) established for this project. Major deficiencies in the data generation process resulted in data being rejected, indicating that the data is considered unusable for either quantitative or qualitative purposes. Minor deficiencies in the data generation process resulted in some sample data being characterized as approximate. Identification of a data point as approximate indicates uncertainty in the reported concentration of the chemical, but not its assigned identity.

The following paragraphs present the adherence of the data to the precision, sensitivity, accuracy, representativeness, comparability, and completeness (PSARCC) parameters.

Precision is measured through the evaluation of field duplicate samples and MS/MSD samples. For the analyses, none of the data were rejected due to laboratory duplicate excursions.

Sensitivity is established by reported detection limits which represent measurable concentrations of analytes which can be determined with a designated level of confidence. Sensitivity requirements were met for the sample data in this project.

Matrix spike samples, internal standard recoveries, surrogate recoveries, LCS recoveries, and initial and continuing calibration criteria indicate the accuracy of the data. For the VOC analyses, 0.04 percent of the data were rejected due

to internal standard area excursions and 1.1 percent of the data were rejected due to calibration excursions. For the SVOC analyses, 0.4 percent of the data were rejected due to internal standard area excursions.

Holding times, sample preservation, blank analysis, and compound identification and quantification are indicators of the representativeness of the analytical data. None of the data were rejected due to representativeness excursions.

Comparability is not compromised provided that the analytical methods did not change over time. A major component of comparability is the use of standard reference materials for calibration and QC. These standards are compared to other unknowns to verify their concentrations. Since standard analytical methods and reporting procedures were consistently used by the laboratory, the comparability criteria for the analytical data were met.

Overall, 100 percent of the PCBs, metals, mercury, cyanide, and radiochemistry, and approximately 98.9 percent of the VOC data and 99.6 percent of the SVOC were determined to be usable for qualitative and quantitative purposes.

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EXHIBIT 1

# Licensed surveyors map

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