RADON AND THORON EVALUATION REPORT

ST. CROIX ALUMINA (RENAISSANCE PARK) SITE

ST. CROIX, U.S. VIRGIN ISLANDS

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Appendix List

1.0 Introduction

Under the Authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the U.S. Environmental Protection Agency (EPA), Region II Emergency and Remedial Response Division (ERRD) and Weston Solutions, Inc. (WESTON®) Removal Support Team 2 (RST 2) have completed an investigation of the St. Croix Alumina (Renaissance Park) Site (the Site) located in St. Croix, U.S. Virgin Islands (USVI). The Site is listed in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database under EPA ID No. VIN000206465. The Site is a former alumina refinery where bauxite ore processing residues, including red mud and caustic wastewaters, were deposited in on-site disposal areas. The work discussed in this report follows an Expanded Site Inspection (ESI) conducted at the Site in September 2011 under the EPA Region V Superfund Technical Assessment and Response Team III (START III) contract and a Removal Assessment (RA) with radiological measurements under the RST 2 contract [Expanded Site Inspection and Removal Assessment Report, St. Croix Alumina (Renaissance Park) Site, St. Croix, U.S. Virgin Islands, Document Control No 1455-2A-ATIW; Radiological Assessment Report, St. Croix Alumina (Renaissance Park) Site, St. Croix, U.S. Virgin Islands, May 2012].

RST 2 completed a sampling and screening effort at the Site from April 16 through 21, 2012. The investigation was conducted to determine the amount of off-gassing of radionuclides (radon and thoron) from the red mud at on-site source areas, as well as to evaluate the potential for migration of red mud related radionuclides to an adjacent residential neighborhood (Harvey). Methodologies included real-time monitoring, as well as sampling at on-site source areas and in the Harvey community.

1.1 *Site Location*

The Site is located within the south shore industrial complex along the south-central coast of St. Croix, USVI. The subject property, which consists of several parcels and has a total surface area of approximately 1,250 acres, is currently owned by St. Croix Renaissance Group, LLLP (SCRG). The property is zoned for industrial use and is bordered by the HOVENSA oil refinery on the east; USVI government property (Container Port and Molasses Pier) on the southeast; the Caribbean Sea on the south; a municipal landfill, wastewater treatment plant, racetrack, and Henry E. Rohlsen Airport on the west; and the Bethlehem Village/Profit Hills (Harvey community) and Estate Profit residential neighborhoods across a four-lane highway on the north. A Site Location Map and Site Features Map are presented in Appendix A, Figures A-1 and A-2, respectively.

1.2 *Site Description*

The Site is a former alumina refinery where bauxite ore was processed for alumina extraction and residues from the process were deposited on the Site. The refinery was constructed in the mid-1960s, at which time the on-site ship channel (Alucroix Channel, a.k.a. Krause Lagoon Channel) was dredged and Krause Lagoon was filled. Alumina refining operations began in 1968. The former refinery consisted of administrative offices and other buildings; material storage structures (*i.e.*, silos, tanks, and shed); grinding operations; digestion, thickening, filtration, precipitation, and calcination operations; coal- and oil-fired boilers; water desalination units; warehouses; laboratories; maintenance facilities; storm water collection and cooling ponds; bauxite residue (*i.e.*, red mud) disposal areas; recreational areas; and a dock that provides access to the ship channel.

The refinery operated from 1968 through December 2000, with some intervening idle years. SCRG has since begun redevelopment of the Site, including the removal of former refinery tanks and equipment. Currently the Site consists of the dock and ship channel, coal-fired power plant, coal storage area, conveyors, steam-turbine building, desalination units, ethanol dehydration plant (presently inactive), machine shop, maintenance and administration buildings, settling and cooling ponds, and former disposal areas. The former bauxite storage shed also remains for possible future use. In addition, the Diageo Rum Distillery in the northern portion of the property was constructed in 2009-2010 and began operating in November 2010. Molasses tanks for the distillery were installed in the former location of refinery tanks. Appendix A, Figure A-2 shows the Site layout including major features. For a more detailed discussion of the Site description see the Expanded Site Inspection and Removal Assessment Report, St. Croix Alumina (Renaissance Park) Site, St. Croix, U.S. Virgin Islands, Document Control No 1455-2A-ATIW.

1.3 *Site History*

Historically, portions of the Site were used for sugar cane production, as evidenced by pre-1900 ruins in the western and northeastern portions of the property, and the subject property had various owners prior to construction of the alumina refinery. In 1937, the property was transferred from West Indian Sugar Factory, Inc. to private ownership. The U.S government took over the property in 1942, and subsequently transferred it to Municipality of St. Croix in 1949. Harvey Aluminum, Inc. (HAI) purchased the property from the Government of the Virgin Islands in 1962 and constructed the refinery in the mid-1960s.

Martin Marietta Alumina (MMA) purchased HAI in 1968, the year alumina refining operations began, and continued alumina production at the Site until 1985. Refining operations were discontinued from 1985 to 1989. Virgin Islands Aluminum Company (VIALCO) purchased the property from MMA in 1989, and resumed refining operations from 1989 until 1995. St. Croix Alumina, LLC (SCA), a subsidiary of Aluminum Company of America (ALCOA), purchased the property from VIALCO in 1995, and refining operations were suspended from 1995 to 1998. ALCOA resumed refining operations in 1998, which continued through December 2000. Administrative and maintenance staff for ALCOA remained at the facility until 2002. SCRG purchased the property from ALCOA in 2002 and initiated efforts to convert it to a mixed use industrial/commercial site.

2.0 Scope/Field Activities

RST 2 completed sampling and monitoring efforts at the Site from April 16 through 21, 2012. The scope of work was divided into two tasks that included measurements of radon and thoron on- and off-site and the sampling of cisterns in the adjacent Harvey community. The radon and thoron data collection included real-time measurements via a Durridge RAD7 Radon Detector (RAD7), thoron flux measurements with the RAD7, and the sampling of radon flux with activated charcoal canisters for laboratory analysis. Cistern sampling in Harvey was conducted to determine if radionuclides associated with red mud from the Site are impacting cisterns to the north. The work associated with this task included sampling of the residential tap water and the sampling of the sediment from the bottom of the cisterns. Cisterns containing red material were focused on for sampling. Parameters that were analyzed for by RST 2-procured laboratories included radiological, target analyte list (TAL) metals, and biological analysis (see Appendix B, Table B-1, Laboratory List and Analysis).

During the April 2012 sampling event, RST 2 personnel collected a total of 19 radon and thoron gas in air measurements (including background) via the RAD7, two thoron flux measurements with the RAD7, 15 radon flux samples via charcoal canisters, four tap water samples, and four cistern sediment samples. RST 2 logged sample locations electronically using Global Positioning System (GPS) equipment and performed post-processing differential correction of the GPS data in accordance with EPA, Region II GPS Standard Operating Procedures. The processed GPS data for the sample locations has been transferred to the Sample Results Map (Appendix A, Figure A-3, Sample Locations and Results) using Geographic Information Systems (GIS).

2.1 *Rad7 Measurements*

2.1.1 **Measurement Procedure for On-Site and Background Locations**

The RAD7 was configured to ‘sniff’ mode for 1-hour intervals with thoron protocol. An in-line desiccant tube and disc filter was used to prevent moisture and particulates from entering the inner chambers of the unit. A windscreen was constructed from a 30-gallon trash can in which the bottom 10-inches were removed to create an open bottom. Five 1-inch by 1-inch by 1-inch triangular vents were cut into the sides. At the time of deployment the windscreen was placed with the top side down and the inlet of the desiccant tube was mounted 2-to 3-inches above the ground surface. In the presence of a hard surface crust the surface was broken up to enhance soil gas escape.

The RAD7 was deployed in Red Mud Disposal Area A (RMA), Red Mud Disposal Area B (RMB), the Red Mud Settling Pond (RMS), and background sample locations. The specific locations were as directed by the EPA On-Scene Coordinator (OSC) and can be seen in Appendix A, Figure A-3, Sample Locations and Results.

2.1.2 Measurement Procedure for Harvey Community Locations

Similar to the on-site procedures above, the RAD7 was configured to 'sniff' mode for 1-hour intervals with thoron protocol. An in-line desiccant tube and disc filter was used to prevent moisture and particulates from entering the inner chambers of the unit. For measurements taken at the off-site residences the RAD7 was placed near the entrance of the home (usually on a table on the front porch) and the desiccant tube was placed directly on-top of the unit for gas in air measurements. At a measurement location adjacent to the basketball court, the RAD7 was placed in a locked vehicle with the desiccant tube mounted outside of a partially opened window while sampling crews worked elsewhere. Specific measurement locations for the RAD7 within the Harvey community were as directed by the EPA OSC and can be seen in Appendix A, Figure A-3, Sample Locations and Results.

2.2 *Radon Flux Sampling*

The activated charcoal canisters, provided by Eberline Analytical, Oakridge, Tennessee, were 10-inches in diameter and 3-1/4-inch high, with a removable lid that encompassed the entire 10-inch diameter. A small ventilation port (approximately 1/2-inch in diameter) was located on the bottom. The activated charcoal was contained within a mesh bag to prevent the charcoal from spilling out when the canister was deployed. The canisters were received sealed with vinyl tape along the lid edges and vent port to prevent exposure of the charcoal to the outside air prior to deployment.

At the time of deployment the seals of the canisters were removed from the lid and vent port, as well as the removal of the lid itself. The canister was inverted (with the open top down) and placed directly on the ground surface. In the presence of a hard surface crust, the surface was broken up and the canister was placed directly above the broken surface. Once in place the canister was firmly secured to the ground with tent stakes on either side and inspected to ensure that there are no breaks between the surface and rim of the canister. The canister was left to passively collect radon gas over a 24-hour period. At the end of the sample period the canister lid was reattached and the lid and port hole was resealed with vinyl tape. Canisters were collected and shipped the same day via overnight delivery to the laboratory for radon flux analysis.

The placement of the canisters was as directed by the EPA OSC and included locations in RMA, RMB, and RMS (see Appendix A, Figure A-3, Sample Locations and Results). A total of 15 canisters were deployed between the three areas and included 11 in RMA, two in RMB and one in RMS.

2.3 *Thoron Flux Measurements*

As stated above, thoron flux measurements were completed with the RAD7. The unit was configured to 'sniff' mode for a 4-hour interval with thoron protocol. A soil gas capture 'hood' was constructed from the bottom portion of a 30-gallon trash can. The can was bisected 10-

inches from the bottom and two 3/8-inch portholes were drilled through the bottom (one in the center, the other towards the outside edge) for inlet and outlet tubing to be connected. An inline Drierite Laboratory Gas Drying unit filled with desiccant and a disc filter were connected by rubber tubing between the outlet port on the hood and the inlet port of the RAD7. Rubber tubing also connected the outlet of the RAD7 to the inlet port of the hood.

At the time of measurement the hood was placed with the open top down. In the presence of a hard crust the crust was broken up and the hood was placed directly above the broken surface. The hood was secured to the ground with tent stakes and inspected to ensure there were no gaps between the ground surface and the hood.

The measurement locations were as directed by the EPA OSC and included two locations in RMA (see Appendix A, Figure A-3, Sample Locations and Results).

2.4 *Residential Cistern Sediment Sampling*

Prior reconnaissance identified the presence of the reddish material at the bottom of several cisterns in an adjacent residential neighborhood. In order to evaluate the impact to the local residences, sediment samples were collected and the material analyzed for radiological material and TAL metals, similar to the September 2011 sampling event. In addition, the sediment samples were also analyzed for bacteria and algae. Due to the physical constraints of the cisterns that prevented the samples from being collected directly from their bottom (*i.e.*, scooping samples directly into a sample jar), an alternative method for sampling was developed for the extraction of the sediment.

Based on a pool vacuum configuration, RST 2 developed a methodology and fabricated specific components that allowed for the collection of the sediment from the cistern bottom. Using a peristaltic pump, a vacuum head was fabricated from a wallboard pole head sander (see Appendix A, Figure A-4, Schematic of Sediment Sampler). The pump and sander head were connected by plastic tubing and a 17-foot fiberglass telescopic pole was used to extend the sander head to the bottom of the cistern. The materials captured from the pumping process were discharged to 5-gallon buckets where the suspended material settled towards the bottom. The excess water on top was siphoned or decanted off. Enough modified sander heads and piping were available so that they were dedicated to each sample location.

Due to the nature of the material collected (*i.e.*, fine grain size, easily suspended) the sediment never completely separated from the aqueous solution. On-site filtration was attempted but was unsuccessful. Therefore, the decision was made that the samples would be collected as an aqueous sample and shipped to the laboratory for filtration. Once filtered by the laboratory the samples would be analyzed as sediment.

Prior to mobilization EPA identified 17 properties as potential locations for sampling. These locations were based on information gathering during an EPA November 2011 public outreach effort where residents had complained of red material within their cisterns. In some instances visual observations were made by the EPA OSC of these conditions. At the time of the April 2012 sampling event only four of the 17 properties were sampled. In some cases cisterns with reported red material had been cleaned since November 2011. In most others dark brown to black sediment, not believed to be red material deposition, was observed. Appendix C, Table C-1, Property Summary provides a summary of the properties identified in November 2011.

3.0 Analytical Discussion

3.1 *RAD7 Measurements for Radon and Thoron*

Radon and thoron concentrations can vary widely on both a seasonal and diurnal basis. On a seasonal basis, the highest concentrations are observed during the winter, and the lowest concentrations are observed during the summer. On a daily basis, the highest concentrations are typically observed in the early morning, and the lowest at noon. This variability is due to changes in the flux rates, which are the rates at which these noble gases are produced from the decay of their parent radionuclides, allowed to emanate from their particulate matrices into pore spaces and diffuse through the soil pore spaces, and then escape from the ground into the air. Concentrations measured in ambient air are also impacted by atmospheric turbulence that changes with air temperature and wind speed, ground surface characteristics, such as slopes and ravines, that allow these heavier-than-air gases to accumulate at higher concentrations in low-lying areas, and elevation above the ground surface at which measurements are made. Another factor relevant to the Site is the proximity to the sea coast. Most radon and thoron emanates from soil, and only a small fraction from seawater. Since the Site is near the seacoast, if the prevailing wind is from the sea, then measured radon concentrations would be expected to be lower than if the wind were from the land side of the Site. Because of all these factors, radon concentrations in uncontaminated areas have been known to vary by a factor of about four ranging from 0.1 to 0.4 picocuries per liter (pCi/L), and thoron concentrations have been known to vary by an order of magnitude, from 0.05 to 0.5 pCi/L. (Reference: UNSCEAR 1982, "Ionizing Radiation: Sources and Biological Effects", Annex D: Exposure to Radon and Thoron and Their Decay Products.)

Background radon and thoron samples were collected at the Tamarind Reef Hotel (off-site), located approximately 8 miles northeast of the Site, and on the soccer field, northeast of the entrance to the Site, using the RAD7 instrument (see Appendix A, Figure A-3, Sample Locations and Results). The off-site location established island background measurements of 0.0 +/- 1.38 pCi/L for radon and 0.16 +/- 0.79 pCi/L for thoron. The adjacent to the Site background location was selected to complement the background soil and sediment locations that were collected during the ESI in September 2011. The results of these measurements were 0.9 +/- 1.83 pCi/L for radon and 0.49 +/- 0.98 pCi/L for thoron. Neither of these locations had red mud material present based on visual observation.

These values compare favorably with the average values cited from the UNSCEAR report above. However, it is recognized that the standard deviations of these measurements indicate that accurate measurements of expected background concentrations may not have been achieved. Also, these background concentration values are accurate only for the time they were collected since it has been demonstrated that the noble gas concentrations vary widely over the course of a day.

There is no project criterion established to which the radon and thoron outdoor concentrations can be compared. For licensed facilities, the U.S. Nuclear Regulatory Commission (NRC) establishes release limits in 10 CFR 20 Appendix B that are as follows:

- Radon: 10 pCi/L (without particulate daughters) and 0.1 pCi/L (with daughters)
- Thoron: 20 pCi/L (without particulate daughters) and 0.03 pCi/L (with daughters)

The EPA criterion for indoor concentrations of radon is 4 pCi/L.

Nine RAD7 measurements were collected across RMA with radon results ranging from 0.0 to 282 pCi/L, and thoron results ranging from 2.93 to 404 pCi/L (see Appendix E, Table E-1, RAD7 Data Summary). As would be expected, measurements collected from crevices or ravines were generally higher than those collected on the flat surfaces of the pile. The data collected on RMA clearly indicate elevated radon and thoron concentration being released from the red mud in RMA. One measurement was collected on the exposed red mud within RMS. The radon concentration at this location was 0.0 pCi/L and the thoron was 2.73 pCi/L.

Three RAD7 measurements were collected from across RMB with radon results ranging from 0.72 to 4.64 pCi/L, and thoron concentrations ranging from 2.65 to 4.67 pCi/L. Portions of RMB were capped with one to four feet of crushed limestone while other areas had red mud material exposed at the surface. One sample location (R7002-001-SG-0000-001) was collected on limestone cap material while the remaining two (R7002-002-SG-0000-001 and R7002-003-SG-0000-00) were collected on exposed red mud material. Comparing the measurements between capped (4.64 pCi/L for radon and 2.65 pCi/L for thoron) versus uncapped (red mud) (0.92 and 0.72 pCi/L for radon and 4.67 and 2.89 pCi/L for thoron), the data indicates that the crushed limestone cap does not seem to significantly reduce the concentrations of radioactive gases being released from RMB. More sampling would be required to fully evaluate the competency of this cap material and cap thickness.

Four RAD7 measurements were collected from the Harvey community located northwest of the Site. The radon concentrations ranged from 0.0 to 0.33 pCi/L and the thoron ranged from 0.0 to 0.33 pCi/L which are within the off-site background range. The measurements were taken over a two-day period with the winds blowing from the east.

3.2 *Radon Flux Measurements*

As stated above, a total of 15 radon (Rn-222) flux measurements were made across RMA, RMB and RMS using the EPA standard charcoal canister technique. Canisters were emplaced for 24-hours and express shipped to the laboratory for processing by gamma spectrometry to quantify the radon daughters. Of the 15 samples, eight had analytical results reported less than the minimum detectable activity (MDA) (see Appendix E, Table E-2, Radon Flux Summary).

Of the seven samples with analytical results reported greater than the MDA, the results ranged from 0.10 to 0.43 picocuries per square meter per second (pCi/m^2-sec). Of these seven samples, two were located along the western boundary of RMA, two were located along the northern boundary of RMA, two were from RMB and one was from RMS. The criterion to which these samples are compared is 20 pCi/m^2-sec, which is taken from 40 CFR 192.02, the Standards for Control of Residual Radioactive Material from Inactive Uranium Processing Sites. None of the results exceeded this criterion.

Radon flux is highly variable and dependent on the concentration of Ra-226 in soils and many physical factors that can cause the flux to increase or decrease. These factors may vary significantly from one sample location to another and include the physical matrix in which the Ra-226 atoms are bound (which affects the radon emanation rate), soil moisture, soil porosity, depth of contamination, soil density, and atmospheric pressure. Based on an internet search of the average radon flux from soil containing background concentrations of Ra-226 of around 1 pCi/g, the results for the Site are consistent with flux values at uncontaminated locations. Red mud samples were determined during prior field activities to contain Ra-226 concentrations that were mostly within a factor of two or three of typical background soils, which validates the relatively low flux rates that were measured at the Site. We can conclude from these data that over the 24-hour period, when these data were collected, the radon flux across the Site was at rates similar to normal background levels.

3.3 *Thoron Flux Measurement*

Laboratory analyses of red mud samples from a previous study indicated that Th-232 concentrations are generally higher than U-238 concentrations. Radon-222 is a decay product of U-238 and Rn-220 (thoron) is a decay product of Th-232, so Rn-220 concentrations would logically be higher than Rn-222 if sampled under similar conditions. In general, U-238 is normally higher in concentrations than Th-232, making the conditions at the Site unusual.

Charcoal canisters used for the Rn-222 measurements could not be used to conduct thoron flux measurements because the half-life of the thoron decay products that are analyzed on the charcoal are so short (56 seconds) that they would decay to immeasurable levels during the time required to collect, package, and ship the canisters to the laboratory for analysis. Radon-222 is much more commonly identified as a contaminant of concern than thoron, and is more commonly measured and evaluated. As a result, optional methods and instrumentation for measuring thoron flux are limited.

The RAD7 instrument measures both Rn-222 and Rn-220 and the instrument operator's manual provides a brief description of a configuration and method for analyzing flux rates for either or both of the gases. As part of this sampling event, the RAD7 was set up to collect thoron data at two RMA locations. However, the thoron gas measurements collected in the field were not usable to calculate thoron flux rates. Thoron flux rates can be estimated from Th-232 concentration data if reliable values are available for relevant factors such as the emanation rate and diffusion rate of the gas in the given soil matrix. Those variables have not been evaluated at the Site.

3.4 *Residential Tap Water Samples*

3.4.1 **Radiological Analysis**

Tap water samples were collected from four cisterns within the Harvey community; three in Profit Hill and one in Bethlehem Village. Sediment samples were collected from these same cisterns and the analytical results from those samples are discussed in Section 3.5 of this report.

The project criteria to which these analytical results are compared are taken from the EPA maximum contaminant levels (MCLs) for drinking water, as listed below:

1. The sum of the Ra-226 and Ra-228 results (which are determined independently in the laboratory procedure) should be less than 5 pCi/L, and
2. The total uranium should be less than 30 ug/L.

Results of radiological analyses of the tap water samples are provided in Table 1. See Appendix E, Table E-3, Residential Tap Water Samples Radiological Parameters as reported by the laboratory.

Table 1: Radiological Analyses of Tap Water

	Ra-226, pCi/L			Ra-228, pCi/L			Ra-226 + Ra-228, pCi/L	Total Uranium, pCi/L		
	Result	2-σ	MDA	Result	2-σ	MDA	Sum	Result	2-σ	MDA
BV077-TW-01-001	0.12	0.14	0.2	0.99	0.58	1.03	1.11	-0.09	0.01	1.02
PH118-TW-01-001	0.09	0.12	0.18	0.67	0.52	0.98	0.76	0.14	0.02	1.02
PH199-TW-01-001	0.03	0.06	0.13	-0.06	0.39	0.84	-0.03	0	0	1.02
PH200-TW-01-001	0.1	0.15	0.25	0.3	0.44	0.91	0.4	-0.05	0.01	1.02

MDA – Minimum Detected Activity

These data were evaluated for two purposes: to evaluate the data versus maximum contaminant levels, and to determine if there is any impact to the water from the red mud related radionuclides at the Site. Two conclusions are summarized below:

1. The drinking water MCLs were not exceeded in any of the four tap water samples.
2. The concentrations measured in the water samples were so low that the results were less than the MDA for each analysis and the relative concentrations of uranium and thorium could not be determined. As a result, these data does not seem to suggest any radiological impact to tap water from the Site.

3.4.2 **TAL Metals Analysis**

Tap water samples for TAL metals analysis were compared against the National Primary Drinking Water Regulations MCL criteria. There were no exceedances of the MCLs in any of the tap water samples. However, there were elevated measurements for calcium and sodium (see Appendix E, Table E-4, Residential Tap Water Samples TAL Metals Analysis).

A comparison of the chemical signature of the tap water samples to those of RMA red mud samples (see Section 3.5.2) was conducted to determine if there was any similarity. RMA red mud samples collected by EPA in September 2011 had detections for all TAL metals parameters except thallium. The tap water samples from the Harvey residences had 12 of the 22 TAL metals parameters detected, including aluminum, arsenic, barium, calcium, copper, iron, magnesium, manganese, potassium, sodium, vanadium, and zinc. The five highest parameter concentrations (in order from highest to lowest) for RMA red mud were iron, aluminum, sodium, calcium, and magnesium. For the tap water samples the five highest concentrations were sodium, calcium, potassium, magnesium, and iron. Based on the comparison of chemical signatures, the tap water and RMA samples do not appear to exhibit a strong match. Though this comparison of solid to aqueous metals results is not conclusive, the data suggests the water within the cisterns does not appear to be impacted from Site-related contamination. Further, even if the metals in the cistern water were from the Site, concentrations in the tap water do not exceed the MCLs.

3.5 *Residential Cistern Sediment Sampling*

3.5.1 **Radiological Analysis**

Cistern sediment samples were collected at the four residences in the Harvey community where tap water was sampled as described in 3.4 above. Trace amounts of radioisotopes were identified in the cistern sediments at near background concentrations (see Appendix E, Table E-5, Residential Cistern Sediment Samples Radiological Analysis as reported by the laboratory).

Table 2 below summarizes the data from the cistern samples and the respective average isotope concentrations of the 11 background soil samples that were collected during earlier field sampling activities. See Appendix E, Table E-5, Residential Cistern Sediment Samples Radiological Analysis as reported by the laboratory for a complete listing of the analytical results including the MDA for each sample.

Table 2: Summary of Radiological Results for Cistern Sediment Samples

	U-238 Decay Chain, pCi/g				Th-232 Decay Chain, pCi/g		
	U-238[b]	U-234[b]	Th-230[b]	Ra-226[b]	Th-232[b]	Th-228[b]	Ra-228[a]
BV077-CS-01-001	0.64+/-0.11	0.73+/-0.09	1.23+/-0.12	1.23+/-0.16	1.15+/-0.13	1.56+/-0.13	1.89+/-0.89
PH118-CS-01-001	2.44+/-0.18	2.61+/-0.16	0.92+/-0.08	0.98+/-0.14	0.26+/-0.09	0.34+/-0.09	1.67+/-1.17
PH199-CS-01-001	1.88+/-0.07	2.15+/-0.79	1.35+/-0.10	0.77+/-0.14	0.34+/-0.08	0.62+/-0.07	2.77+/-2.81
PH200-CS-01-001	1.65+/-0.08	2.07+/-0.74	1.02+/-0.08	1.14+/-0.17	0.48+/-0.06	0.80+/-0.01	2.33+/-0.84
Background[c]	0.23	0.23	0.46	0.28	0.36	--	0.34

a – Analysis by gamma spectrometry

b – Analysis by alpha spectrometry

c – Background results are taken from Section 5 of the St Croix Radiological Assessment Report, May 2012; average values calculated from multiple samples.

When compared to the average background values, all four samples contained slightly elevated concentrations of uranium decay series isotopes. Review of the thorium decay series isotopes is not consistent. The analytical results for two samples, BV077-CS-01-001 and PH200-CS-01-001 are slightly elevated above background. Analytical results for PH118-CS-01-001 and PH199-CS-01-001 may be slightly elevated, based upon the results for Ra-228. However, results for Th-232 in those two samples are indistinguishable from the background values.

While it appears that the concentrations of U-238 and Th-232 are, or may be, slightly elevated compared to the average background concentrations, this by itself does not conclusively demonstrate that the sediment in the cisterns is being impacted by red mud from the Site. From soil data collected during an earlier Site survey, and reported in Tables 5-9A and 5-9B in the St. Croix Radiological Assessment Report (May 2012), it is observed that in the samples from the RMA and RMB that are clearly elevated in radionuclides, the Th-232 is generally greater than the U-238 by a factor of 3 to 5. However, in three of the four cistern sediment samples the U-238 is greater than the Th-232, and in the one sample where the Th-232 is greater than the U-238, it is greater by a factor of less than 2.

A second method to assess these data is to compare the analytical results to the project criteria to determine if corrective actions may be necessary. These criteria are:

1.) The sum of the Ra-226 and Ra-228 results should be less than 5 pCi/g, and
2.) The sum of the Th-230 and Th-232 results should be less than 5 pCi/g.

These criteria are compared to the analytical data in Table 3 below.

Table 3: Summing of Radium and Thorium Results

	Ra-226 + Ra-228	Th-232 + Th-230
BV077-CS-01-001	3.12 +/- 0.90	2.38 +/- 0.18
PH118-CS-01-001	2.65 +/- 1.18	1.18 +/- 0.12
PH199-CS-01-001	3.54 +/- 2.81	1.69 +/- 0.12
PH200-CS-01-001	3.47 +/- 0.86	1.50 +/- 0.10

These criteria are not exceeded in any of the four cistern sediment samples. Radiological criteria are typically applied to concentrations above ambient background values, which would require subtraction of an applicable background value from the analytical result. All of these data were below the criteria without further reducing their values by subtracting background.

In summary, the sediment of the four cistern samples contains very low concentrations of Th-232 and U-238 (and their associated daughter products) compared to the average background concentrations for these radionuclides. However, based upon the Th-232 to U-238 ratios in these samples it does not appear that the source of this slightly elevated radioactivity originates from the red mud on the Site. It can be conclusively stated that while the concentrations are slightly elevated, all four sediment samples are below the stated criteria.

3.5.2 **TAL Metals Analysis**

TAL metals analysis was conducted for all four cistern sediment samples. The territory of the USVI and/or EPA does not publish cleanup standards for sediment within cisterns. Therefore, the results of the TAL metals analysis for sediment were not compared to a particular standard. The chemical TAL metals signature of the four cistern sediment samples was compared to the chemical signature of the red mud samples collected from RMA and the background samples taken during the September 2011 sampling event. RMA was selected for comparison due to its potential for transport by wind processes (due to its topographic relief above the rest of the landscape) while the background location was used to provide a baseline comparison. Approximately 44 samples were collected from RMA and 11 samples from the background location. The geometric mean of the TAL metals was calculated for each of these areas and plotted on a logarithmic scale graph with the cistern sediment samples (see Appendix F, Figure F-1, Chemical (TAL Metals) Signature Comparison – Soil/Sediment). Individual parameter plots for RMA were also generated for all detected TAL metal values as well as the corresponding arithmetic and geometric means. The results for the cistern samples were also included on the graphs for comparison (see Appendix F, Figures F-2 through F-22).

Review of Figure F-1 would initially indicate that there is a moderate similarity between RMA, background, and cistern samples in the distribution of the parameter values. That is, the pattern for high/low values between parameters for the three samples areas is nearly consistent. However, a review of the individual parameter plots (Appendix F, Figure F-2 through F-22) revealed significant differences between the range of results for RMA and the cisterns samples.

Cistern results for antimony, arsenic, calcium, cobalt, potassium, and selenium were within the min/max range for RMA samples. However, with the exception of arsenic, calcium, and potassium, the majority of RMA samples for these parameters were non-detect and not included in the sample group for comparison. With the reduction in number of usable samples the use of these parameters does not provide a strong correlation between the cistern samples and RMA signature.

Cistern results for aluminum, barium, beryllium, chromium, copper, lead, magnesium, manganese, nickel, silver, sodium, vanadium, and zinc were out of RMA min/max range of values. With the exception of aluminum, chromium, sodium, and vanadium the above parameters were well above the maximum range of values for RMA. In most instances the difference between the cistern values and the geometric mean was greater than 50%. However, the cisterns are not closed systems and may have other sources of these metals including dirt and debris from the residential structure, silt and sediment from trucked in water, and/or other sources. The presence of these metals at higher concentration within the cisterns may be cumulative and does not necessarily discount RMA as a source area for the red sediment.

Results for iron from the cistern samples varied greatly from 42,400 to 430,000 milligram per kilogram (mg/kg). This wide range of values makes it difficult to correlate to the RMA with only two of the four samples being within the RMA min/max range.

In addition to issues related to other sources mentioned above, the depositional environments between RMA and within the cisterns vary greatly and can affect the comparison of the chemical signature. RMA is an aerobic environment subject to weathering processes. The cisterns are anaerobic and due to the potential for elevated bacterial counts, metals may be subject to reduction.

Based on the review of the chemical signatures presented above, the red material at the bottom of the cistern is most likely not the red mud material from the Site. However, these results are not conclusive. Though the chemical signature comparison for all parameters on a logarithmic scale provided a near consistent pattern, review of the individual parameters indicates significant differences. In addition, with the potential for input of other source material into the system and the differences in environmental conditions makes it difficult to definitively determine with certainty the source of the material.

See Appendix E, Table E-6, Residential Cistern Sediment Samples TAL Metals Analysis, Appendix F, Figure F-1, Chemical (TAL Metals) Signature Comparison – Soil/Sediment, and Appendix F, Figures F-2 through F-22.

3.5.3 **Biological Analysis**

Bacteria and algae analysis was conducted for the four cistern samples. Specific parameters included E.coli, heterotrophic plate counts, fecal streptococcus, total coliform, total salmonella, and algae and protozoa (see Appendix E, Table E-7, Residential Cistern Sediment Samples Biological Analysis). Of the results returned by the laboratory, E.Coli, fecal streptococcus, salmonella, and total coliform were absent. Heterotrophic plate count is a measurement of bacteria. All though there is no water quality standard to compare it to, the measurement is used to gage the relative cleanliness of the system. The measurements between the four cisterns varied significantly and are representative of how well the individual systems are maintained.

A common particle test was used for the algae and protozoa analysis by polarized light, epi-reflected light, and stereo microscopy. This was a materials test and identified a small percentage of cellulose and synthetics in the samples. No algae or protozoa were identified.

Based on the above analysis the red material found in the bottom of the four cisterns are not biological in nature.

4.0 Summary

The purpose of this investigation was to determine the amount of off-gassing of radionuclides (radon and thoron) from the red mud at on-site source areas, as well as to evaluate the potential for migration of red mud related radionuclide to an adjacent residential neighborhood (Harvey). During the April 2012 sampling event, RST 2 personnel collected a total of 19 RAD7 measurements (including background), 15 radon flux samples, two thoron flux measurements, four tap water samples, and four cistern sediment samples.

RAD7 measurements indicate an elevated radon and thoron concentration above the ground surface at RMA, RMB, and RMS. The use of the crushed limestone cap at RMB appears to have little impact in reducing the release of radon and thoron gas. RAD7 measurements at the Harvey community were significantly lower and comparable to the off-site location. It appears that the ambient air in the neighborhood, at least on that day of sampling, is not being impacted by Site-related radon and thoron gasses.

Radon flux measurements across the Site had rates comparable to normal background levels. These measurements were consistent with prior sampling events in which red mud samples were determined to contain Ra-226 concentrations that were mostly within a factor of two or three of typical background soils. These concentrations validate the relatively low flux rates that were measured at the Site.

Thoron flux measurements were attempted at two locations at the Site. However, due to issues with the field data collection the measurements were not usable for a thoron flux calculation.

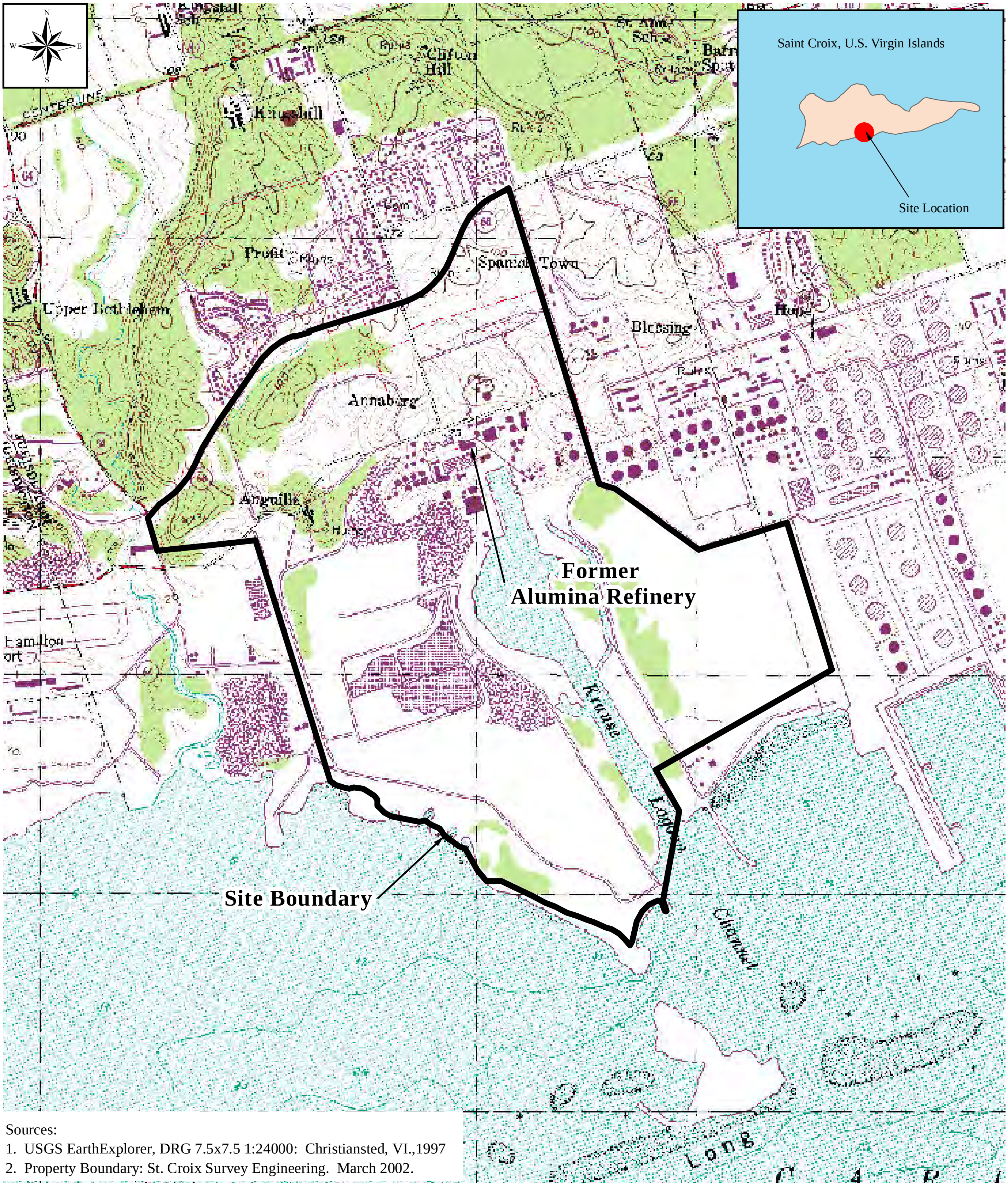
Tap water samples collected from the residential cisterns in the Harvey community were tested for radiological parameters and for TAL metals. The radiological results were below MDA and did not exceed MCLs for drinking water. Results for TAL metals were compared to the National Primary Drinking Water Regulations criteria as well as the chemical signature for RMA samples collected from the Site in the September 2011. None of the cistern water samples exceeded the Drinking Water Regulations criteria and chemical signature of the RMA did not correlate well with the cistern water samples. Based on the samples collected, tap water from the cisterns does not appear to be impacted by Site-related contamination.

Sediment samples collected from the bottom of the residential cisterns in the Harvey community were analyzed for radiological parameters and TAL metals. The sediment in the four cisterns appears to be slightly elevated in radionuclides Th-232 and U-238 (and their associated daughter products) compared to the average background concentrations. However, though elevated above background these results are below the 5 pCi/g threshold criteria. Further, based upon the Th-232 to U-239 ratios of the samples it does not appear that the source of the radionuclides originates from the red mud from the Site. The TAL metals results for the cistern sediment was compared to the chemical signature of the RMA and background samples collected from the Site in September 2011. This comparison did not conclude a definitive match between the RMA red mud and the sediment samples. However, these results are not conclusive and may be influenced by other factors, including input from other sources, aerobic versus anaerobic conditions, and bacterial reduction.

Biological analysis indicated that the sediment from the cisterns had elevated levels of bacteria; however specific bacteria including E.Coli, fecal streptococcus, total coliform, and salmonella, as well as algae and protozoa, were absent. The red sediment does not appear to be biological in origin.

Though it cannot be conclusively determined if the sediment at the bottom of the cistern originated from the Site, it has been determined that the drinking water within the four cisterns does not contain elevated radionuclides, inorganics (TAL metals), or measured biological elements of concern.

Appendix A: Report Figures



Sources:
1. USGS EarthExplorer, DRG 7.5x7.5 1:24000: Christiansted, VI.,1997
2. Property Boundary: St. Croix Survey Engineering. March 2002.

SCALE:

2,000 1,000 0 2,000

Graphic Scale In Feet

TITLE:

FIGURE A-1 - SITE LOCATION MAP
ST. CROIX ALUMINA (RENAISSANCE PARK)
ST. CROIX, USVI

PROJECT:
ST. CROIX ALUMINA (RENAISSANCE PARK)

CLIENT NAME:
EPA

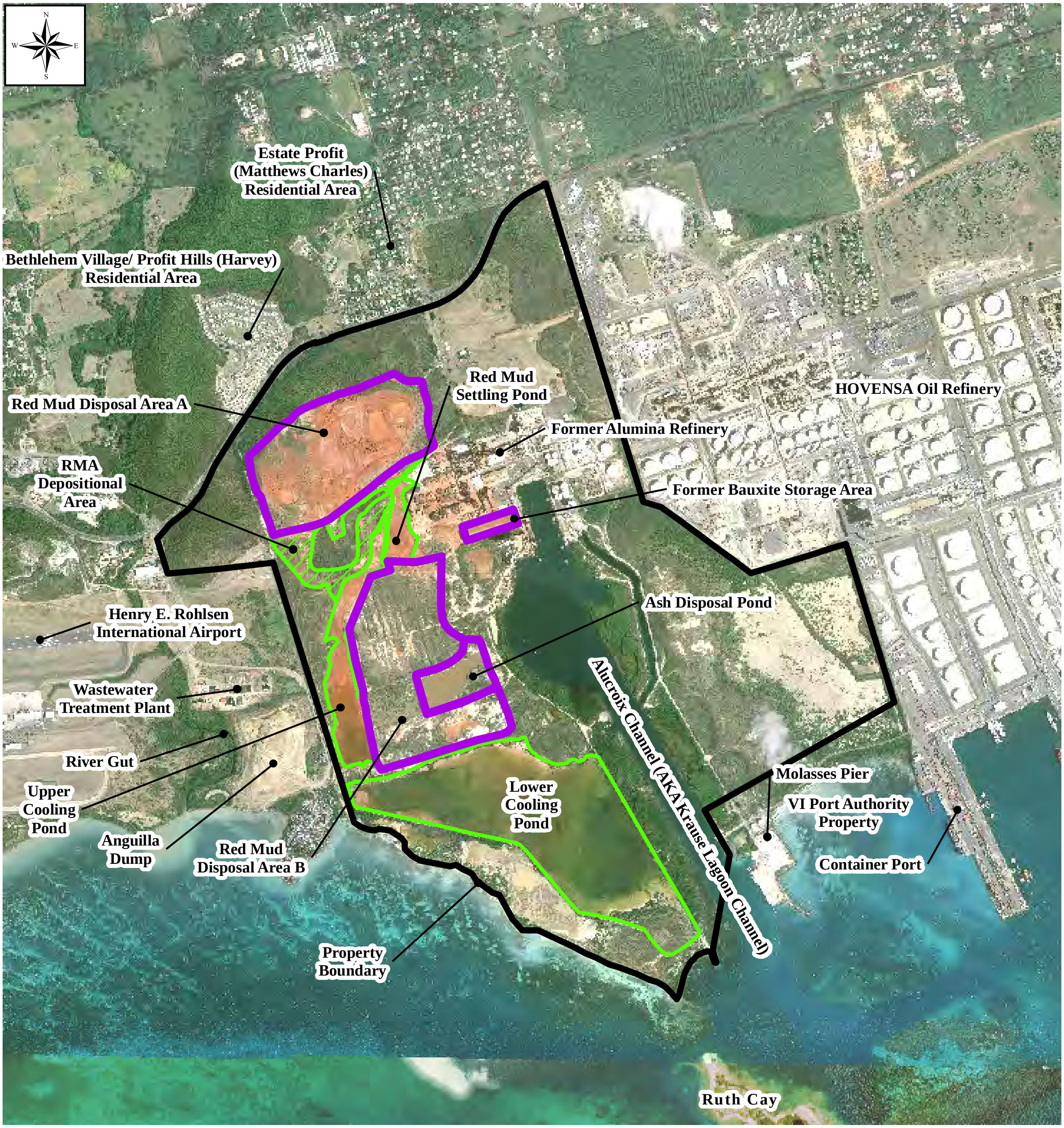
WESTON SOLUTIONS

DATE:
MAY 2012

FIGURE #:
A-1

SAT2\St. Croix Alumina (1455)\MXD\2012_02_HRS\10905_SCA_Site_Map.mxd

SCRG141092



Sources:

MAY 2012

1. Imagery Source: United States Army Corps of Engineers, 17064_F7_03, 17064_F7_04, 17064_F7_07 and17064_F7_08, Photo Date November 2006; Published February 17, 2008. http://edcsns17.cr.usgs.gov/EarthExplorer/
2. Property Boundary: St. Croix Survey Engineering. March 2002.
3. Weston Solutions, Inc. Field Logbooks, St. Croix Alumina, TDD # S05-0013-1104-030. June-September 2011.

LEGEND:

0 500 1,000 2,000 3,000 4,000

Graphic Scale In Feet

TITLE:

FIGURE A-2 - SITE FEATURES MAP
ST. CROIX ALUMINA (RENAISSANCE PARK)
ST. CROIX, USVI

PROJECT:
ST CROIX ALUMINA (RENAISSANCE PARK)

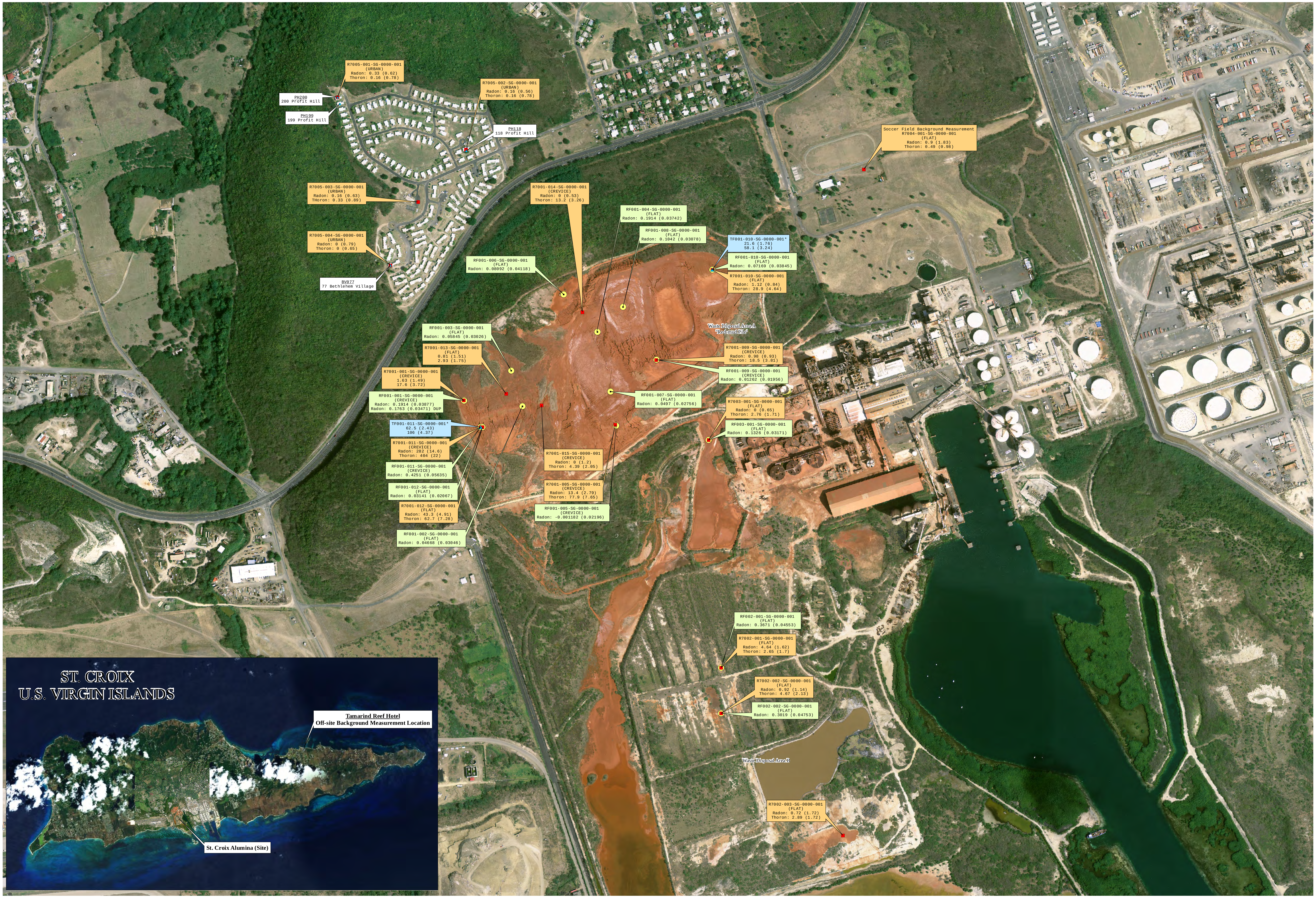
CLIENT NAME:
EPA

DATE:
MAY 2012

FIGURE #:
A-2

P:\SAT2\St. Croix Alumina (1455)\MXD\2012_02_HRS\10906_SCA_TAerial_Map.mxd

SCRG141093



Legend

- Thoron Flux Measurement Location*
- RAD7 Measurement (pCi/L)
- Radon Flux (pCi/m2sec)
- Residential Sample Location

Call-out Description

SAMPLE NAME
(Location Type - Cravice, Flat or Urban)
Radon: Result (Statistical Variability)
Thoron: Result (Statistical Variability)

NOTES:

1) * Measurements presented here at Thoron Flux locations are raw values collected in the field (pCi/L). Actual Thoron Flux has not been calculated.

2) Location Type:
Crevice: Location is a deep crack (>4') within the red material.
Flat: Measurement location is a relatively flat area on top of red material.
Urban: Outdoor measurement location within Harvey Residential neighborhood.

3) RAD7 Off-Site Background Measurement: Tamarind Reef Hotel
R7500-001-SG-0000-001
(FLAT)
Radon: 0 (1.38)
Thoron: 0.16 (0.79)

250 125 0 250 500
Graphic Scale in Feet

Weston Solutions, Inc.
1090 King Georges Post Road, Suite 201, Edison, NJ 08837
TEL: (732) 585-4400 Fax: (732) 225-7037
http://www.westonsolutions.com

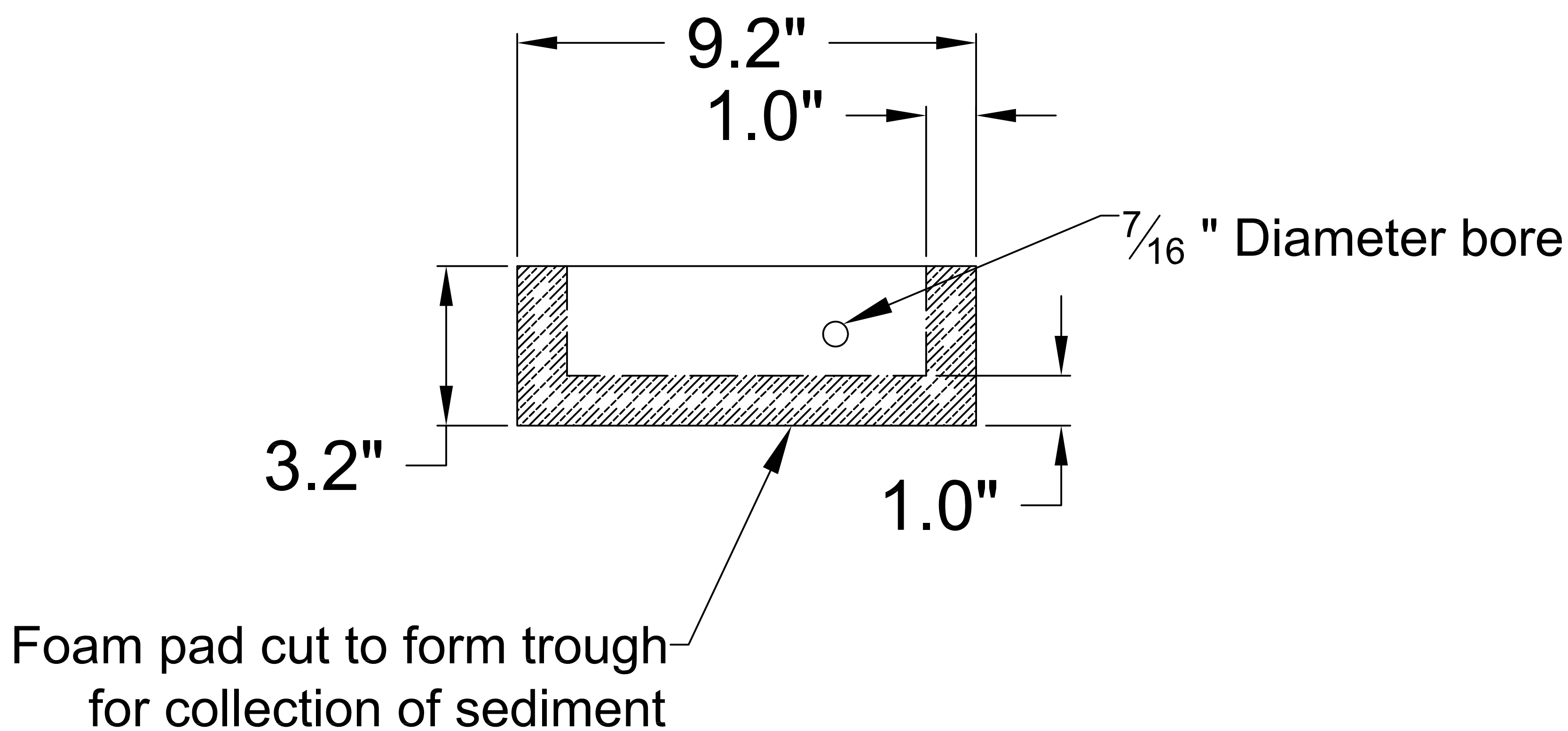
REMOVAL SUPPORT TEAM 2
In Association With
Avatar Environmental, LLC,
H & S Environmental, Inc. &
Scientific and Environmental Associates, Inc.

N S W E

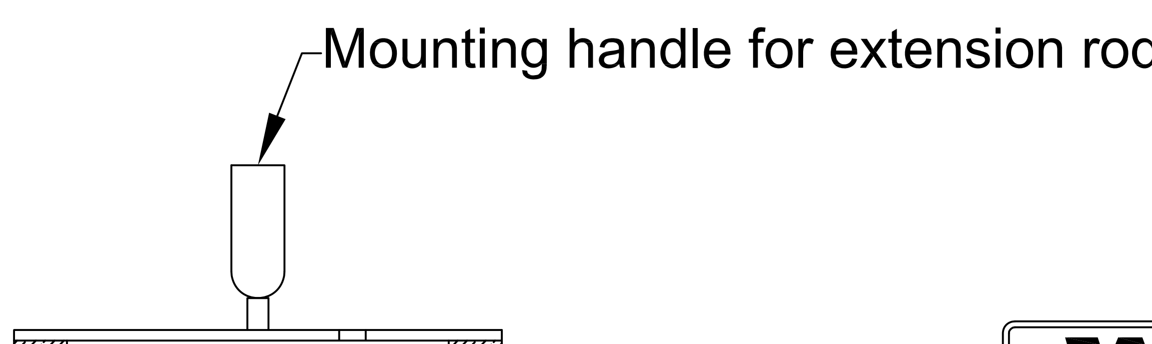
REPORT DATE: JUNE 2012	EPA OSC: D. ROSOFF	CLIENT NAME: UNITED STATES ENVIRONMENTAL PROTECTION AGENCY	DRAWING TITLE: FIGURE A-3 SAMPLE LOCATIONS AND RESULTS
DRAWING: SCA_DataSummary.mxd PATH: Z:\St. Croix Alumina\MXD	RST SPM: P. LISICHENKO		
REVISION No. 2	CONTRACT No. EP-W-06-072	PROJECT NAME: ST, CRIOX ALUMINA	
WORK ORDER No. 20401.132.022.5068	GIS ANALYST: P. LISICHENKO DATE CREATED: 4/25/2012		FIGURE: A-3 SCALE: 1:3,000 DATE: 6/25/2012

SCRG141094

Bottom View



Side View



Using a wallboard pole head sander, the foam surface on the sander bottom was cut and portions of the foam removed so that a 1-inch wide section of the foam remained on 3 of the 4 sides. The intent was to provide a catchment for the sediment as the sander head is moved across the bottom of the cistern. A 7/16" hole was drilled through the top plate and a quarter-inch hose adapter with 3/8"-inch barb was inserted to the top of the plate. 3/8" inch plastic tubing was connected between the barb and a peristaltic pump that provide the suction for the vacuum. A telescopic fiberglass extension rod (17-foot max extent) was used to extend the sander to the bottom of the cisterns.

WESTON SOLUTIONS	TITLE: Figure A-4 Schematic of Sediment Sampler
PROJECT: ST. CROIX ALUMINA Residential Cistern Sampling	
CLIENT NAME: USEPA	SCALE: NA | DATE: 4/01/2012 | FIGURE #: A-4

SCRG141095

Z:\St Croix Alumina\April 2012 Sampling Event\CAD\StCroixAluminaSampling.dwg

Appendix B: Laboratory Information

Table B-1, Laboratory List and Analysis

Appendix B: Labratory Information
Table B-1, Laboratory List and Analysis
USEPA - St. Croix Alumina (Renaissance Park) Site

Laboratory Name	Matrix	Analysis
Eberline Analytical Oak Ridge, TN	Soil Gas	Radon Flux
	Sediment	Gamma Spectroscopy (Ra-226, Ra-228, and K-40) Alpha Spectroscopy Parameters (U-238, Th-228, Th-232, and Ra-226)
	Aqueous	Ra-226, Ra-228, Unranium Total, Th-228, Throrium-232
GEL Labratories LLC[1] Charleston, SC	Sediment	TAL Metals
	Aqueous	TAL Metals
EMSL Analytical, Inc. Cinnaminson, NJ	Sediment	E.coli, Total Coliform, Fecal Streptococcus, Heterotrophic Plate Count, Total Salmonella, Algae and Protozoa

[1] - Samples shipped from Lionville Laboratory, Exton, PA, to GEL Labratories, Charlseton, SC.

Appendix C: Residential Properties

Confidential Information - Not Intended for Public Dissemination

Table C-1, Property Summary

Appendix C: Residential Properties
Table C-1, Property Summary
USEPA - St. Croix Alumina (Renaissance Park) Site

Neighborhood	House Number	Sampled	Resident Name*	Notes
Bethlehem Village	4	No		Resident requested EPA to inspect cistern after November 2011 public meeting. Cistern inspected by EPA during April 2012 sampling event, material was black sediment.
Bethlehem Village	11	No		Inspected by EPA during April 2012 sampling event. Cistern had black sediment.
Bethlehem Village	25	No		Resident stated that water from cistern was red in November 2011. Also stated that red material was observed on the bottom of the cistern. Since that time resident has moved out, property is currently unoccupied.
Bethlehem Village	26	No		Resident stated that red material was observed on the bottom of cistern during April 2012 sampling event. Cistern was inspected by EPA during April 2012 sampling event, material was black sand.
Bethlehem Village	50	No		Inspected by EPA during April 2012 sampling event. Cistern had black sediment.
Bethlehem Village	52	No		Inspected by EPA during April 2012 sampling event. Cistern had black sediment.
Bethlehem Village	61	No		Resident stated that red material was observed on the bottom of cistern in November 2011. Cistern inspected by EPA during April 2012 sampling event, material was black-brown sand.
Bethlehem Village	77	Yes	Sanes, Dolores	Resident stated that red material was observed on the bottom of cistern in November 2011. Cistern inspected by EPA during April 2012 sampling event, material was black sediment. Cistern sampled.
Bethlehem Village	78	No		Resident stated that red material was observed on the bottom of cistern in November 2011. Cistern inspected by EPA during April 2012 sampling event, material was black sediment.
Bethlehem Village	93	No		Resident stated that red material was observed on the bottom of cistern in November 2011. Cistern inspected by EPA during April 2012 sampling event, material was black sediment.
Bethlehem Village	94	No		Resident stated that red material was observed on the bottom of cistern in November 2011. Cistern inspected by EPA during April 2012 sampling event, material was black sediment.
Profit Hill	118	Yes	Bonnie, Albertha	Resident stated that red material was observed on the bottom of cistern in November 2011, dark red material observed on the bottom of the cistern during sampling in April 2012. Cistern sampled.
Profit Hill	143	No		Resident stated water from cistern was red in November 2011. Since then water supply has been switched to Water and Power Authority supplied line. Resident states cistern is clean.
Profit Hill	165	No		Resident stated red material on bottom of cistern in November 2011 (cistern was not inspected by EPA). Cistern cleaned in March 2012.
Profit Hill	197	No		Resident stated that red material was observed on the bottom of cistern in November 2011 (cistern was not inspected by EPA). Cistern cleaned in March 2012.
Profit Hill	199	Yes	Emanual, Thecia	Resident stated that red material was observed on the bottom of cistern during the April 2012 sampling event. Cistern sampled.
Profit Hill	200	Yes	Bermudey, Delma	Resident stated that red material was observed on the bottom of cistern in November 2011, red material observed on the bottom of the cistern during sampling in April 2012. Cistern sampled.

* Name displayed only if location was sampled.

Appendix D: Chain of Custody and FedEx Airbill Records

SCRG141101

WESTON
DateShipped: 04/19/2012
Carrier: FedEx
AirbillNo: 8559-9051-5913

CHAIN OF CUSTODY RECORD
St. Croix Alumina (Renaissance Park)/NJ
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-042012-115608-0051
Project Code: RFP 218
Lab: Eberline Analytical
Lab Phone: 865-481-0683

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	BV077-CS-01-001	BV077	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Sediment	4/18/2012	11	6 x 1-L Poly, 5 x 8-oz Glass		
	BV077-TW-01-001	BV077	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Water	4/18/2012	4	3 x 1-L Poly, 1 x 500-mL Poly	HNO3 pH<2	
	PH118-CS-01-001	PH118	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Sediment	4/19/2012	13	13 x 1-L Poly		
	PH118-TW-01-001	PH118	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Water	4/19/2012	4	3 x 1-L Poly, 1 x 500-mL Poly	HNO3 pH<2	
	PH199-CS-01-001	PH199	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Sediment	4/19/2012	10	10 x 1-L Poly		
	PH199-TW-01-001	PH199	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Water	4/19/2012	4	3 x 1-L Poly, 1 x 500-mL Poly	HNO3 pH<2	
	PH200-CS-01-001	PH200	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Sediment	4/19/2012	13	12 x 1-L Poly, 1 x 8-oz Glass		
	PH200-TW-01-001	PH200	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Water	4/19/2012	8	6 x 1-L Poly, 2 x 500-mL Poly	HNO3 pH<2	Y
	PH200-TW-01-002	PH200	Ra-226 + Ra-228 + Th-228 + Th-232 + Total Uranium	Water	4/19/2012	4	3 x 1-L Poly, 1 x 500-mL Poly	HNO3 pH<2	

Special Instructions:

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time

SCRG141102

WESTON
DateShipped: 04/19/2012
Carrier: FedEx
AirbillNo: 8559-9051-5913

CHAIN OF CUSTODY RECORD
St. Croix Alumina (Renaissance Park)/NJ
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-042012-123920-0052
Project Code: RFP 219
Lab: Lionville Labratory
Lab Phone: 610-280-3029

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	BV077-TW-02-001	BV077	TAL Metals	Water	4/18/2012	1	1 x 1-L Poly	HNO3 pH<2	
	PH118-TW-02-001	PH118	TAL Metals	Water	4/19/2012	1	1 x 1-L Poly	HNO3 pH<2	
	PH199-TW-02-001	PH199	TAL Metals	Water	4/19/2012	1	1 x 1-L Poly	HNO3 pH<2	
	PH200-TW-02-001	PH200	TAL Metals	Water	4/19/2012	1	1 x 1-L Poly	HNO3 pH<2	Y
	PH200-TW-02-002	PH200	TAL Metals	Water	4/19/2012	1	1 x 1-L Poly	HNO3 pH<2	

Special Instructions:

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time

SCRG141103

WESTON
DateShipped: 04/19/2012
Carrier: FedEx
AirbillNo: 8559-9051-5913

CHAIN OF CUSTODY RECORD
St. Croix Alumina (Renaissance Park)/NJ
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-041912-093746-0050
Project Code: 5068
Lab: Eberline Analytical
Lab Phone: 865-481-0683

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	RF001-001-SG-0000-001	RF001-001	Radon Flux	Gas	4/19/2012	1			
	RF001-002-SG-0000-001	RF001-002	Radon Flux	Gas	4/19/2012	1			
	RF001-003-SG-0000-001	RF001-003	Radon Flux	Gas	4/19/2012	1			
	RF001-004-SG-0000-001	RF001-004	Radon Flux	Gas	4/19/2012	1			
	RF001-005-SG-0000-001	RF001-005	Radon Flux	Gas	4/19/2012	1			
	RF001-006-SG-0000-001	RF001-006	Radon Flux	Gas	4/19/2012	1			
	RF001-007-SG-0000-001	RF001-007	Radon Flux	Gas	4/19/2012	1			
	RF001-008-SG-0000-001	RF001-008	Radon Flux	Gas	4/19/2012	1			
	RF001-009-SG-0000-001	RF001-009	Radon Flux	Gas	4/19/2012	1			
	RF001-010-SG-0000-001	RF001-010	Radon Flux	Gas	4/19/2012	1			
	RF001-011-SG-0000-001	RF001-011	Radon Flux	Gas	4/19/2012	1			

Special Instructions:

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time

WESTON
DateShipped: 04/19/2012
Carrier: FedEx
AirbillNo: 8559-9051-5913

CHAIN OF CUSTODY RECORD
St. Croix Alumina (Renaissance Park)/NJ
Contact Name: Peter Lisichenko
Contact Phone: 603-512-4350

No: 2-041912-093746-0050
Project Code: 5068
Lab: Eberline Analytical
Lab Phone: 865-481-0683

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	RF001-012-SG-0000-001	RF001-012	Radon Flux	Gas	4/19/2012	1			
	RF002-001-SG-0000-001	RF002-001	Radon Flux	Gas	4/19/2012	1			
	RF002-002-SG-0000-001	RF002-002	Radon Flux	Gas	4/19/2012	1			
	RF003-001-SG-0000-001	RF003-001	Radon Flux	Gas	4/19/2012	1			

Special Instructions:

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time

SCRG141104

361201498
371207058

Page 1 of 1

WESTON

Date Shipped: 05/03/2012

SAMPLES ACCEPTED
FOR ANALYSIS BY
EMSL ANALYTICAL INC.
cb 97

3612 01498
~~3712 07058~~ (KT)

CHAIN OF CUSTODY RECORD

No: 2-050312-064921-0054

Contact Name: Peter Lisichenko
Contact Phone: 303-612-4350

Lab: EMSL Analytical
Lab Phone: 856-303-2536

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	BV077-CS-01-001	BV077	* M017, M015, M048, CPID, M020, M017	Sediment	4/18/2012	1			
	PH118-CS-01-001	PH118	* M017, M015, M048, CPID, M020, M017	Sediment	4/19/2012	1			
	PH199-CS-01-001	PH199	* M017, M015, M048, CPID, M020, M017	Sediment	4/19/2012	1			
	PH200-CS-01-001	PH200	* M017, M015, M048, CPID, M020, M017	Sediment	4/19/2012	1			

RECEIVED
EMSL
CINNAMINSON, NJ
12 MAY -7 AM 9:28

Special Instructions: * Total Bacteria - M015; Total Streptococci - M020; Total Salmonella sp count - M048; Total coliform and E.coli - M017; Algae and protozoa - CPID

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time
	Kathy Shanta 17:00	5/3/12	DMcDonn	5/7/12	8:45 AM						

4XB

SCRG141105

FedEx Express **International Air Waybill** For FedEx services worldwide

Sender's Copy

From *Please print and press hard.*

Date 4/20/12 Sender's FedEx Account Number 402 356 103

Sender's Name Scott T. Snyder Phone 973-219-7394

Company Weston Solutions, Inc.

Address c/o Tamarind Reef Hotel

Address 5001 Tamarind Reef

City Christiansted State Province USVI

Country USVI ZIP Postal Code 00820

To

Recipient's Name Judy Stern Phone 610-280-3029

Company Lionville Laboratory

Address 264 Welsh Pool Rd.

Dept./Floor

Address

City Exton State Province PA

Country USA ZIP Postal Code 19341

Recipient's Tax ID number for Customs purposes
e.g. GST/RFC/VAT/IN/EIN, or as locally required

Shipment Information ☐ For EU Only: Tick here if goods are not in free circulation and provide C.I.

Total Packages Shipper's Load and Count/SLAC 1 Total Weight 36 lbs. ☒ kg ☐ DIM L / W / H in. ☐ cm ☐

Commodity Description REQUIRED	Harmonized Code	Country of Manufacture	Value for Customs REQUIRED
Environmental Samples		USA	$500
COMPLETE IN ENGLISH.			

Export Only: Check One No SED required per Exemption ☐ No SED required, value $2500 or less per Schedule B Commodity number | Total Declared Value for Carriage | Total Value for Customs (Specify Currency) $500 USD

☐ SED attached (provide export license no. and exp. date or license exception symbol, w/ECCN if applicable)

4 Express Package Service *Packages up to 150 lbs. / 68 kg* *For packages over 150 lbs. (68 kg), use the FedEx Expanded Service Intl. Air Waybill.*

☒ FedEx Intl. Priority ☐ FedEx Intl. First Available to select locations Higher rates apply.

☐ ☐ FedEx Intl. Economy FedEx Envelope and FedEx Pak rate not available

5 Packaging *These unique brown boxes with special pricing are provided by FedEx for FedEx Intl. Priority only.

☐ FedEx Envelope ☐ FedEx Pak ☐ FedEx Box ☐ FedEx Tube ☐ Other ☐ FedEx 10kg Box* ☐ FedEx 25kg Box*

6 Special Handling

☐ HOLD at FedEx Location ☒ SATURDAY Delivery Available to select locations for FedEx Intl. Priority only

7a Payment *Bill transportation charges to:*

Enter FedEx Acct. No. or Credit Card No. below.

☐ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☒ Third Party ☐ Credit Card ☐ Cash Check/ Cheque

FedEx Acct No. 402 356 103 FedEx Use Only

Credit Card No.

Credit Card Exp. Date

7b Payment *Bill duties and taxes to:* ALL shipments can be subject to Customs charges, which FedEx does not estimate prior to clearance.

Enter FedEx Acct. No. below.

☐ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☒ Third Party

FedEx Acct. No. 402 356 103

8 Your Internal Billing Reference First 24 characters will appear on invoice.

20401.135.02415062

9 Required Signature

Use of this Air Waybill constitutes your agreement to the Conditions of Contract on the back of this Air Waybill, and you represent that this shipment does not require a U.S. State Department License or contain dangerous goods. Certain international treaties, including the Warsaw Convention, may apply to this shipment and limit our liability for damage, loss, or delay, as described in the Conditions of Contract. WARNING: These commodities, technology, or software were exported from the United States in accordance with Export Administration Regulations. Diversion contrary to U.S. law prohibited.

Sender's Signature: [signature]

This is not authorization to deliver this shipment without a recipient signature.

For Completion Instructions, see back of fifth page.

FedEx Tracking Number 8559 9051 5843 Form ID No. 0402

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Questions? Visit our Web site at fedex.com.
Or in the U.S., call 800.247.4747. Outside the U.S., call your local FedEx office.

Not all services and options are available to all destinations. Dangerous goods canno[t] be shipped using this Air Waybill.

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SCRG141106

FedEx Express **International Air Waybill** For FedEx services worldwide

Sender's Copy

From *Please print and press hard.*

Date 4/20/12 Sender's FedEx Account Number 402356103

Sender's Name Scott T. Snyder Phone 973-219-7394

Company Weston Solutions, Inc.

Address c/o Tamarind Reef Hotel

Address 5001 Tamarind Reef

City Christiansted State Province USVI

Country USVI ZIP Postal Code 00820

To

Recipient's Name Mike McDougal Phone 865-481-0683

Company Eberline Analytical

Address 601 Scarboro Rd. Dept./Floor

Address

City Oak Ridge State Province TN

Country USA ZIP Postal Code 37830

Recipient's Tax ID number for Customs purposes
e.g., GST/RFC/VAT/IN/EIN, or as locally required

Shipment Information ☐ For EU Only: Tick here if goods are not in free circulation and provide C.I.

Total Packages (Shipper's Load and Count/SLAC) 4 Total Weight 255 ☒ lbs. ☐ kg DIM L / W / H ☐ in. ☐ cm

Commodity Description REQUIRED	Harmonized Code	Country of Manufacture	Value for Customs REQUIRED
Environmental Samples		USA	500
COMPLETE IN ENGLISH.			

Export Only: Check One ☐ No SED required per Exemption ☐ No SED required, value $2500 or less per Schedule B Commodity number | Total Declared Value for Carriage | Total Value for Customs (Specify Currency) 500.00 USD

☐ SED attached (provide export license no. and exp. date or license exception symbol, w/ECCN if applicable)

4 Express Package Service *Packages up to 150 lbs./68 kg* *For packages over 150 lbs. (68 kg), use the FedEx Expanded Service Intl. Air Waybill.*

☒ FedEx Intl. Priority ☐ FedEx Intl. First Available to select locations Higher rates apply.

☐ ☐ FedEx Intl. Economy FedEx Envelope and FedEx Pak rate not available

Not all services and options are available to all destinations. Dangerous goods cannot be shipped using this Air Waybill.

5 Packaging *These unique brown boxes with special pricing are provided by FedEx for FedEx Intl. Priority only.

☐ FedEx Envelope ☐ FedEx Pak ☐ FedEx Box ☐ FedEx Tube ☒ Other ☐ FedEx 10kg Box* ☐ FedEx 25kg Box*

6 Special Handling

☐ HOLD at FedEx Location ☒ SATURDAY Delivery Available to select locations for FedEx Intl. Priority only

7a Payment *Bill transportation charges to:* Enter FedEx Acct. No. or Credit Card No. below.

☐ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☒ Third Party ☐ Credit Card ☐ Cash Check/ Cheque

FedEx Acct. No. 402 356 103 FedEx Use Only

Credit Card No.

Credit Card Exp. Date

7b Payment *Bill duties and taxes to:* ALL shipments can be subject to Customs charges, which FedEx does not estimate prior to clearance.

Enter FedEx Acct. No. below.

☐ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☒ Third Party

FedEx Acct. No. 402 356 103

8 Your Internal Billing Reference First 24 characters will appear on invoice.

20401.135.024.5063

9 Required Signature

Use of this Air Waybill constitutes your agreement to the Conditions of Contract on the back of this Air Waybill, and you represent that this shipment does not require a U.S. State Department License or contain dangerous goods. Certain international treaties, including the Warsaw Convention, may apply to this shipment and limit our liability for damage, loss, or delay, as described in the Conditions of Contract. WARNING: These commodities, technology, or software were exported from the United States in accordance with Export Administration Regulations. Diversion contrary to U.S. law prohibited.

Sender's Signature:

This is not authorization to deliver this shipment without a recipient signature.

500

For Completion Instructions, see back of fifth page.

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FedEx Tracking Number 8559 9051 5924 Form ID No. 0402

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SCRG141107

Appendix E: Data Summary

Appendix E: Data Summary

Table E-1, RAD7 Data Summary

USEPA - St. Croix Alumina (Renaissance Park) Site

RAD7 MEASUREMENTS

Sample ID	Radon	Radon SV	Thoron	Thoron SV	Notes
R7001-001-SG-0000-001	1.63	1.49	17.6	3.72	Crevice
R7001-005-SG-0000-001	13.4	2.79	77.9	7.65	Crevice
R7001-009-SG-0000-001	0.98	0.93	18.5	3.81	Crevice
R7001-010-SG-0000-001	1.12	0.84	28.9	4.64	Flat
R7001-011-SG-0000-001	282	14.6	404	22	Crevice
R7001-012-SG-0000-001	43.3	4.91	62.7	7.28	Flat
R7001-013-SG-0000-001	0.81	1.51	2.93	1.75	Flat
R7001-014-SG-0000-001	0	0.53	13.2	3.26	Crevice
R7001-015-SG-0000-001	0	1.2	4.39	2.05	Crevice
R7002-001-SG-0000-001	4.64	1.62	2.65	1.7	Flat
R7002-002-SG-0000-001	0.92	1.14	4.67	2.13	Flat
R7002-003-SG-0000-001	0.72	1.72	2.89	1.72	Flat
R7003-001-SG-0000-001	0	0.65	2.76	1.71	Flat
R7004-001-SG-0000-001	0.9	1.83	0.49	0.98	Flat
R7005-001-SG-0000-001	0.33	0.62	0.16	0.78	Urban
R7005-002-SG-0000-001	0.16	0.56	0.16	0.78	Urban
R7005-003-SG-0000-001	0.16	0.63	0.33	0.89	Urban
R7005-004-SG-0000-001	0	0.79	0	0.65	Urban
R7500-001-SG-0000-001	0	1.38	0.16	0.79	Flat

Units: picoCuries per liter

SV - Statistical Variability

R7001 - Red Mud Disposal Area A

R7002 - Red Mud Disposal Area B

R7003 - Red Mud Settling Pond

R7004 - Soccer field background measurement

R7005 - Harvey Community

R7500 - Off-Site background measurement taken at the Tamarind Reef Hotel, Christiansted, USVI

Table E-2, Radon Flux Summary

USEPA - St. Croix Alumina (Renaissance Park) Site

Sample ID	Sample Type	Sample Date Time	Period	Analyte	Method	Result	CU	CSU	MDA	Report Units
RF001-001-SG-0000-001	TRG	04/19/12 09:55	24-hr	Radon-222	EPA 903.1 Modified	1.91E-01	3.88E-02	4.82E-02	5.20E-02	pCi/m^2-sec
RF001-002-SG-0000-001	TRG	04/19/12 09:50	24-hr	Radon-222	EPA 903.1 Modified	4.67E-02	3.05E-02	3.13E-02	7.15E-02	pCi/m^2-sec
RF001-003-SG-0000-001	TRG	04/19/12 10:30	24-hr	Radon-222	EPA 903.1 Modified	5.85E-02	3.03E-02	3.15E-02	8.15E-02	pCi/m^2-sec
RF001-004-SG-0000-001	TRG	04/19/12 11:30	24-hr	Radon-222	EPA 903.1 Modified	1.91E-01	3.74E-02	4.72E-02	4.72E-02	pCi/m^2-sec
RF001-005-SG-0000-001	TRG	04/19/12 12:25	24-hr	Radon-222	EPA 903.1 Modified	-1.18E-03	2.20E-02	2.20E-02	4.96E-02	pCi/m^2-sec
RF001-006-SG-0000-001	TRG	04/19/12 11:50	24-hr	Radon-222	EPA 903.1 Modified	8.09E-02	4.12E-02	4.29E-02	9.76E-02	pCi/m^2-sec
RF001-007-SG-0000-001	TRG	04/19/12 12:20	24-hr	Radon-222	EPA 903.1 Modified	4.97E-02	2.76E-02	2.86E-02	7.51E-02	pCi/m^2-sec
RF001-008-SG-0000-001	TRG	04/19/12 11:58	24-hr	Radon-222	EPA 903.1 Modified	1.04E-01	3.08E-02	3.45E-02	4.24E-02	pCi/m^2-sec
RF001-009-SG-0000-001	TRG	04/19/12 12:10	24-hr	Radon-222	EPA 903.1 Modified	1.26E-02	1.96E-02	1.97E-02	5.32E-02	pCi/m^2-sec
RF001-010-SG-0000-001	TRG	04/19/12 12:00	24-hr	Radon-222	EPA 903.1 Modified	7.17E-02	3.85E-02	3.99E-02	9.57E-02	pCi/m^2-sec
RF001-011-SG-0000-001	TRG	04/19/12 11:05	24-hr	Radon-222	EPA 903.1 Modified	4.25E-01	5.64E-02	8.51E-02	7.16E-02	pCi/m^2-sec
RF001-012-SG-0000-001	TRG	04/19/12 11:10	24-hr	Radon-222	EPA 903.1 Modified	3.14E-02	2.07E-02	2.12E-02	5.92E-02	pCi/m^2-sec
RF002-001-SG-0000-001	TRG	04/19/12 09:55	24-hr	Radon-222	EPA 903.1 Modified	3.67E-01	4.55E-02	7.15E-02	4.33E-02	pCi/m^2-sec
RF002-002-SG-0000-001	TRG	04/19/12 09:50	24-hr	Radon-222	EPA 903.1 Modified	3.02E-01	4.75E-02	6.56E-02	4.83E-02	pCi/m^2-sec
RF003-001-SG-0000-001	TRG	04/19/12 10:30	24-hr	Radon-222	EPA 903.1 Modified	1.33E-01	3.17E-02	3.74E-02	5.24E-02	pCi/m^2-sec

TRG - Target

CU - Counting Uncertainty

CSU - Counting Error

MDA - Minimum Detectable Activity

Appendix E: Data Summary
Table E-3, Residential Tap Water Samples
Radiological Parameters
USEPA - St. Croix Alumina (Renaissance Park) Site

Sample ID	Sample Type	Sample Date	Analyte	Method	Result	CU	CSU	MDA	Report Units
BV077-TW-01-001	TRG	4/18/2012	Radium-226	EPA 903.0 Modified	1.17E-01	1.40E-01	1.42E-01	1.98E-01	pCi/l
PH118-TW-01-001	TRG	4/19/2012	Radium-226	EPA 903.0 Modified	8.60E-02	1.19E-01	1.20E-01	1.81E-01	pCi/l
PH199-TW-01-001	TRG	4/19/2012	Radium-226	EPA 903.0 Modified	2.65E-02	6.34E-02	6.37E-02	1.33E-01	pCi/l
PH200-TW-01-001	TRG	4/19/2012	Radium-226	EPA 903.0 Modified	9.80E-02	1.50E-01	1.51E-01	2.54E-01	pCi/l
PH200-TW-01-002	TRG	4/19/2012	Radium-226	EPA 903.0 Modified	4.56E-03	1.05E-01	1.05E-01	2.65E-01	pCi/l
BV077-TW-01-001	TRG	4/18/2012	Radium-228	EPA 904.0 Modified	9.93E-01	5.33E-01	5.79E-01	1.03E+00	pCi/l
PH118-TW-01-001	TRG	4/19/2012	Radium-228	EPA 904.0 Modified	6.71E-01	4.96E-01	5.19E-01	9.85E-01	pCi/l
PH199-TW-01-001	TRG	4/19/2012	Radium-228	EPA 904.0 Modified	-5.91E-02	3.90E-01	3.90E-01	8.44E-01	pCi/l
PH200-TW-01-001	TRG	4/19/2012	Radium-228	EPA 904.0 Modified	6.25E-01	4.56E-01	4.78E-01	9.04E-01	pCi/l
PH200-TW-01-002	TRG	4/19/2012	Radium-228	EPA 904.0 Modified	2.94E-01	4.40E-01	4.45E-01	9.08E-01	pCi/l
BV077-TW-01-001	TRG	4/18/2012	Thorium-228	EML Th-01 Modified	7.35E-02	1.10E-01	1.11E-01	1.79E-01	pCi/l
PH118-TW-01-001	TRG	4/19/2012	Thorium-228	EML Th-01 Modified	3.32E-02	8.30E-02	8.31E-02	1.73E-01	pCi/l
PH199-TW-01-001	TRG	4/19/2012	Thorium-228	EML Th-01 Modified	2.76E-02	6.90E-02	6.90E-02	1.44E-01	pCi/l
PH200-TW-01-001	TRG	4/19/2012	Thorium-228	EML Th-01 Modified	9.14E-02	1.05E-01	1.05E-01	1.37E-01	pCi/l
PH200-TW-01-002	TRG	4/19/2012	Thorium-228	EML Th-01 Modified	5.70E-02	9.72E-02	9.73E-02	1.71E-01	pCi/l
BV077-TW-01-001	TRG	4/18/2012	Thorium-230	EML Th-01 Modified	4.09E-01	2.41E-01	2.47E-01	1.89E-01	pCi/l
PH118-TW-01-001	TRG	4/19/2012	Thorium-230	EML Th-01 Modified	2.77E-01	1.84E-01	1.87E-01	1.37E-01	pCi/l
PH199-TW-01-001	TRG	4/19/2012	Thorium-230	EML Th-01 Modified	4.65E-01	2.22E-01	2.29E-01	1.25E-01	pCi/l
PH200-TW-01-001	TRG	4/19/2012	Thorium-230	EML Th-01 Modified	3.12E-01	1.91E-01	1.95E-01	1.56E-01	pCi/l
PH200-TW-01-002	TRG	4/19/2012	Thorium-230	EML Th-01 Modified	1.60E-01	1.39E-01	1.41E-01	1.35E-01	pCi/l
BV077-TW-01-001	TRG	4/18/2012	Thorium-232	EML Th-01 Modified	2.61E-02	6.26E-02	6.26E-02	1.31E-01	pCi/l
PH118-TW-01-001	TRG	4/19/2012	Thorium-232	EML Th-01 Modified	0.00E+00	7.94E-02	7.94E-02	1.72E-01	pCi/l
PH199-TW-01-001	TRG	4/19/2012	Thorium-232	EML Th-01 Modified	2.69E-02	8.51E-02	8.51E-02	1.80E-01	pCi/l
PH200-TW-01-001	TRG	4/19/2012	Thorium-232	EML Th-01 Modified	8.32E-03	5.38E-02	5.38E-02	1.47E-01	pCi/l
PH200-TW-01-002	TRG	4/19/2012	Thorium-232	EML Th-01 Modified	2.35E-02	5.64E-02	5.64E-02	1.18E-01	pCi/l
BV077-TW-01-001	TRG	4/18/2012	Total Uranium	ASTM D5174 Modified	-9.16E-02	2.13E-03	1.03E-02	1.02E+00	ug/l
PH118-TW-01-001	TRG	4/19/2012	Total Uranium	ASTM D5174 Modified	1.35E-01	3.95E-03	1.55E-02	1.02E+00	ug/l
PH199-TW-01-001	TRG	4/19/2012	Total Uranium	ASTM D5174 Modified	-3.57E-03	9.30E-05	4.05E-04	1.02E+00	ug/l
PH200-TW-01-001	TRG	4/19/2012	Total Uranium	ASTM D5174 Modified	-5.03E-02	1.22E-03	5.69E-03	1.02E+00	ug/l
PH200-TW-01-002	TRG	4/19/2012	Total Uranium	ASTM D5174 Modified	-6.80E-02	1.74E-03	7.72E-03	1.02E+00	ug/l

pCi/l - picocurie per liter
TRG - Target
CU - Counting Uncertainty
CSU - Total Laboratory Errors
MDA - Minimum Detectable Activity

Appendix E: Data Summary
Table E-4, Residential Tap Water Samples
TAL Metals Analysis
USEPA - St. Croix Alumina (Renaissance Park) Site

			Sample ID:	BV077-TW-02-001		PH118-TW-02-001		PH199-TW-02-001		PH200-TW-02-001		PH200-TW-02-002	
			Date:	4/18/2012		4/19/2012		4/19/2012		4/19/2012		4/19/2012	
		Matrix	Standard	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
METALS	Aluminum	Water	NA	277		77.7	B	90.8	B	122	B	118	B
METALS	Antimony	Water	6	3.5	U	3.5	U	3.5	U	3.5	U	3.5	U
METALS	Arsenic	Water	0	5	U	5	U	5.54	B	5	U	5	U
METALS	Barium	Water	2,000	5.19		3.89	B	2.44	B	1.79	B	1.86	B
METALS	Beryllium	Water	40	1	U	1	U	1	U	1	U	1	U
METALS	Cadmium	Water	50	1	U	1	U	1	U	1	U	1	U
METALS	Calcium	Water	NA	14,700		4,670		4,600		4,340		4,500	
METALS	Chromium	Water	1,000	1	U	1	U	1	U	1	U	1	U
METALS	Cobalt	Water	NA	1	U	1	U	1	U	1	U	1	U
METALS	Copper	Water	1,300	37.5		10.8		8.76	B	13		3	U
METALS	Iron	Water	NA	56.1	B	374		906		324		241	
METALS	Lead	Water	0	3.3	U	3.3	U	5.98	B	3.3	U	3.3	U
METALS	Magnesium	Water	NA	615		1,070		1,090		1,240		1320	
METALS	Manganese	Water	NA	2	U	3.04	B	8.64	B	3.11	B	2.49	B
METALS	Nickel	Water	NA	1.5	U	1.5	U	1.5	U	1.5	U	1.5	U
METALS	Potassium	Water	NA	627		1,850		2,170		1,930		1,980	
METALS	Selenium	Water	500	6	U	6	U	6	U	6	U	6	U
METALS	Silver	Water	NA	1	U	1	U	1	U	1	U	1	U
METALS	Sodium	Water	NA	4,260		42,200		40,800		43,700		45,200	
METALS	Thallium	Water	0.5	5	U	5	U	5	U	5	U	5	U
METALS	Vanadium	Water	NA	2.46	B	1	U	1.43	B	1.16	B	1.26	B
METALS	Zinc	Water	NA	6.63	B	8.43	B	236		141		6.88	B

Units: microgram per liter (ug/L)

B − Either presence of analyte detected in the associated blank, or MDL/IDL < sample value < PQL

U - Non-detect

Standard: Natioanal Primary Drinking Water Regulations (http://water.epa.gov/drink/contaminants/index.cfm)

Appendix E: Data Summary
Table E-5, Residential Cistern
Sediment Samples Radiological Analysis
USEPA - St. Croix Alumina (Renaissance Park) Site

Sample ID	Sample Type	Sample Date	Receipt Date	Analysis Date	Analyte	Method	Result	CU	CSU	MDA	Report Units
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/29/2012	Radium-226	EPA 903.0 Modified	1.23E+00	3.98E-01	4.75E-01	1.56E-01	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/29/2012	Radium-226	EPA 903.0 Modified	9.84E-01	3.41E-01	3.99E-01	1.44E-01	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/29/2012	Radium-226	EPA 903.0 Modified	7.66E-01	3.00E-01	3.41E-01	1.43E-01	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/29/2012	Radium-226	EPA 903.0 Modified	1.14E+00	4.28E-01	4.92E-01	1.71E-01	pCi/g
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/25/2012	Potassium-40	LANL ER-130 Modified	1.67E+01	3.99E+00	4.08E+00	2.30E+00	pCi/g
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/25/2012	Radium-226	LANL ER-130 Modified	1.15E+00	4.83E-01	4.86E-01	5.01E-01	pCi/g
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/25/2012	Radium-228	LANL ER-130 Modified	1.89E+00	6.98E-01	7.05E-01	8.92E-01	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Potassium-40	LANL ER-130 Modified	1.56E+00	1.96E+00	1.96E+00	4.46E+00	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Radium-226	LANL ER-130 Modified	2.97E-01	4.10E-01	4.10E-01	8.51E-01	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Radium-228	LANL ER-130 Modified	1.67E+00	6.83E-01	6.88E-01	1.17E+00	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Potassium-40	LANL ER-130 Modified	6.88E+00	4.40E+00	4.41E+00	6.56E+00	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Radium-226	LANL ER-130 Modified	-2.63E-01	1.08E+00	1.08E+00	2.06E+00	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Radium-228	LANL ER-130 Modified	2.77E+00	1.68E+00	1.68E+00	2.81E+00	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Potassium-40	LANL ER-130 Modified	2.09E+00	2.13E+00	2.13E+00	2.22E+00	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Radium-226	LANL ER-130 Modified	8.51E-01	4.40E-01	4.42E-01	4.99E-01	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/25/2012	Radium-228	LANL ER-130 Modified	2.33E+00	6.38E-01	6.49E-01	8.36E-01	pCi/g
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/27/2012	Thorium-228	EML Th-01 Modified	1.56E+00	5.08E-01	5.29E-01	1.31E-01	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-228	EML Th-01 Modified	3.35E-01	1.69E-01	1.72E-01	9.06E-02	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-228	EML Th-01 Modified	6.15E-01	2.29E-01	2.37E-01	7.16E-02	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-228	EML Th-01 Modified	8.03E-01	2.34E-01	2.46E-01	9.91E-02	pCi/g

pCi/g - picocurie per gram

TRG - Target

CU - Counting Uncertainty

CSU - Counting Error

MDA - Minimum Detectable Activity

Appendix E: Data Summary
Table E-5, Residential Cistern
Sediment Samples Radiological Analysis
USEPA - St. Croix Alumina (Renaissance Park) Site

Sample ID	Sample Type	Sample Date	Receipt Date	Analysis Date	Analyte	Method	Result	CU	CSU	MDA	Report Units
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/27/2012	Thorium-230	EML Th-01 Modified	1.23E+00	4.30E-01	4.56E-01	1.18E-01	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-230	EML Th-01 Modified	9.19E-01	3.09E-01	3.29E-01	7.85E-02	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-230	EML Th-01 Modified	1.35E+00	3.82E-01	4.17E-01	1.02E-01	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-230	EML Th-01 Modified	1.02E+00	2.71E-01	2.99E-01	7.75E-02	pCi/g
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/27/2012	Thorium-232	EML Th-01 Modified	1.15E+00	4.11E-01	4.23E-01	1.30E-01	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-232	EML Th-01 Modified	2.57E-01	1.46E-01	1.48E-01	8.98E-02	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-232	EML Th-01 Modified	3.35E-01	1.61E-01	1.63E-01	8.14E-02	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Thorium-232	EML Th-01 Modified	4.75E-01	1.67E-01	1.72E-01	5.87E-02	pCi/g
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/27/2012	Uranium-234	EML U-02 Modified	7.28E-01	2.43E-01	2.48E-01	9.43E-02	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-234	EML U-02 Modified	2.61E+00	7.64E-01	7.86E-01	1.58E-01	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-234	EML U-02 Modified	2.15E+00	4.31E-01	4.57E-01	7.93E-02	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-234	EML U-02 Modified	2.07E+00	3.92E-01	4.19E-01	7.36E-02	pCi/g
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/27/2012	Uranium-235	EML U-02 Modified	2.22E-02	6.15E-02	6.16E-02	1.33E-01	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-235	EML U-02 Modified	3.19E-01	2.49E-01	2.50E-01	1.95E-01	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-235	EML U-02 Modified	2.14E-01	1.29E-01	1.30E-01	9.78E-02	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-235	EML U-02 Modified	1.66E-01	1.07E-01	1.07E-01	9.08E-02	pCi/g
BV077-CS-01-001	TRG	4/18/2012	4/23/2012	4/27/2012	Uranium-238	EML U-02 Modified	6.44E-01	2.28E-01	2.32E-01	1.07E-01	pCi/g
PH118-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-238	EML U-02 Modified	2.44E+00	7.30E-01	7.51E-01	1.80E-01	pCi/g
PH199-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-238	EML U-02 Modified	1.88E+00	3.93E-01	4.15E-01	7.19E-02	pCi/g
PH200-CS-01-001	TRG	4/19/2012	4/23/2012	4/27/2012	Uranium-238	EML U-02 Modified	1.65E+00	3.39E-01	3.59E-01	8.19E-02	pCi/g

pCi/g - picocurie per gram

TRG - Target

CU - Counting Uncertainty

CSU - Counting Error

MDA - Minimum Detectable Activity

Appendix E: Data Summary
Table E-6, Residential Cistern
Sediment Samples TAL Metals Analysis
USEPA - St. Croix Alumina (Renaissance Park) Site

			Sample ID:	BV077-CS-01-001		PH118-CS-01-001		PH199-CS-01-001		PH200-CS-01-001	
			Date:	4/18/2012		4/19/2012		4/19/2012		4/19/2012	
		Matrix	Units	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
METALS	Aluminum	Sediment	mg/kg	32,200		9,020		5,390		16,600	
METALS	Antimony	Sediment	mg/kg	4.05		11.3	B	11.5	B	8.42	B
METALS	Arsenic	Sediment	mg/kg	12.7		13.8	U	8.89	U	11.5	U
METALS	Barium	Sediment	mg/kg	152		766		213		530	
METALS	Beryllium	Sediment	mg/kg	0.856		2.77	U	1.78	U	2.37	B
METALS	Cadmium	Sediment	mg/kg	1.22		2.77	U	1.78	U	2.31	U
METALS	Calcium	Sediment	mg/kg	39,700		32,100		20,900		62,900	
METALS	Chromium	Sediment	mg/kg	59		5.74	B	4.19	B	12	
METALS	Cobalt	Sediment	mg/kg	18.5		11.4	B	5.65	B	18.6	
METALS	Copper	Sediment	mg/kg	718		3,750		1,720		4,900	
METALS	Iron	Sediment	mg/kg	42,400		430,000		162,000		291,000	
METALS	Lead	Sediment	mg/kg	176		421		883		1,480	
METALS	Magnesium	Sediment	mg/kg	10,900		10,800		4,800		19,500	
METALS	Manganese	Sediment	mg/kg	850		4,450		1,910		4,480	
METALS	Nickel	Sediment	mg/kg	90.9		88.5		44.2		134	
METALS	Potassium	Sediment	mg/kg	3,510		439	B	386	B	1,020	
METALS	Selenium	Sediment	mg/kg	2.69	BN	20.2	BN	8.89	UN	12.2	BN
METALS	Silver	Sediment	mg/kg	1.41		10.3	B	4.19	B	8.77	B
METALS	Sodium	Sediment	mg/kg	294		2,050		1,810		2,440	
METALS	Thallium	Sediment	mg/kg	0.824	UN	13.8	UN	8.89	UN	11.5	UN
METALS	Vanadium	Sediment	mg/kg	94.1		224		120		249	
METALS	Zinc	Sediment	mg/kg	3,830		3,820		2,810		4,960	

Units: milligrams per kilogram (mg/kg)

B − Either presence of analyte detected in the associated blank, or MDL/IDL < sample value < PQL

U - Non-detect

N - The Matrix spike sample recovery is not within specified control limits

SCRG141115

Appendix E: Data Summary
Table E-7, Residential Cistern
Sediment Samples Biological Analysis
USEPA - St. Croix Alumina (Renaissance Park) Site

			Sample ID:	BV077-CS-01-001	PH118-CS-01-001	PH199-CS-01-001	PH200-CS-01-001
			Date:	4/18/2012	4/19/2012	4/19/2012	4/19/2012
		Matrix	Unit	Result	Result	Result	Result
BIOLOGICAL	Hetrophic Plate Count	Sediment	CFU/g	56,000	37,000	600	100
BIOLOGICAL	E. coli	Sediment	P/A	Absent	Absent	Absent	Absent
BIOLOGICAL	Total Coliform	Sediment	P/A	Absent	Absent	Absent	Absent
BIOLOGICAL	Salmonella sp.	Sediment	CFU/g	ND	ND	ND	ND
BIOLOGICAL	Asbestos	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Fiberous Glass	Sediment	%	<1	ND	ND	ND
BIOLOGICAL	Mineral Wool	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Ceramic Fibers	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Glass Fragments	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Processed Cellulose	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Natural Cellulose	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Wood Cellulose	Sediment	%	ND	ND	<1	ND
BIOLOGICAL	Paper Pulp Cellulose	Sediment	%	<1	<1	<1	ND
BIOLOGICAL	Starch Cellulose	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Synthetics	Sediment	%	ND	<1	<1	<1
BIOLOGICAL	Hair (Human)	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Hair (Animal)	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Skin Fragments	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Insect Fragments	Sediment	%	ND	ND	2	ND
BIOLOGICAL	Dust Mites	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Spider Silk	Sediment	%	ND	ND	ND	ND
BIOLOGICAL	Mold	Sediment	%	<1	ND	ND	ND
BIOLOGICAL	Pollon	Sediment	%	<1	ND	ND	ND
BIOLOGICAL	Quartz (sand)	Sediment	%	15	3	2	2
BIOLOGICAL	Calcite	Sediment	%	10	3	15	20
BIOLOGICAL	Unidentifiable by method	Sediment	%	69	92	78	77

CFU/g - Colony-Forming Units per gram

% - Percentage of Sample

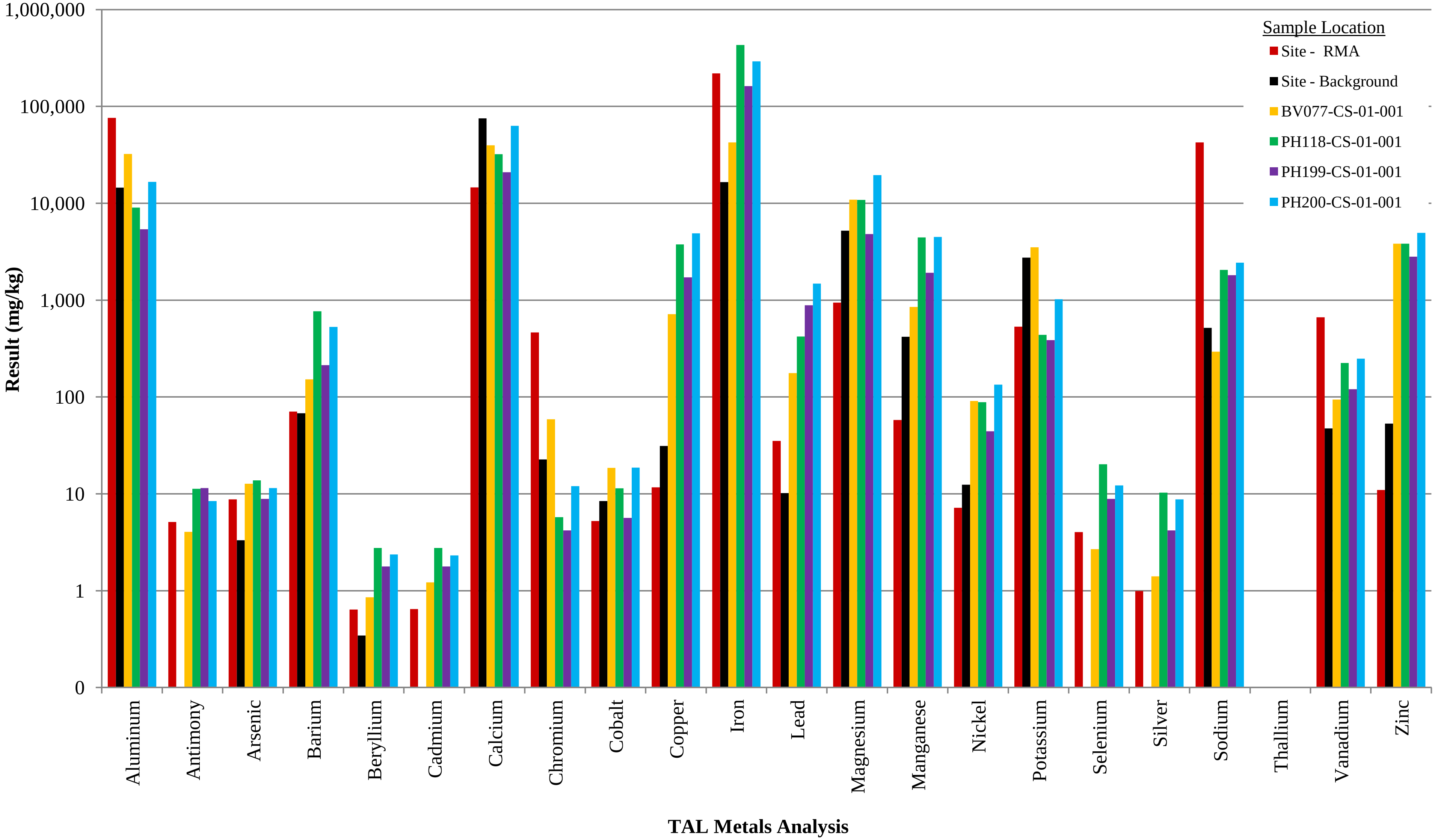
P/A - Present or Absent

ND - Non Detect

SCRG141116

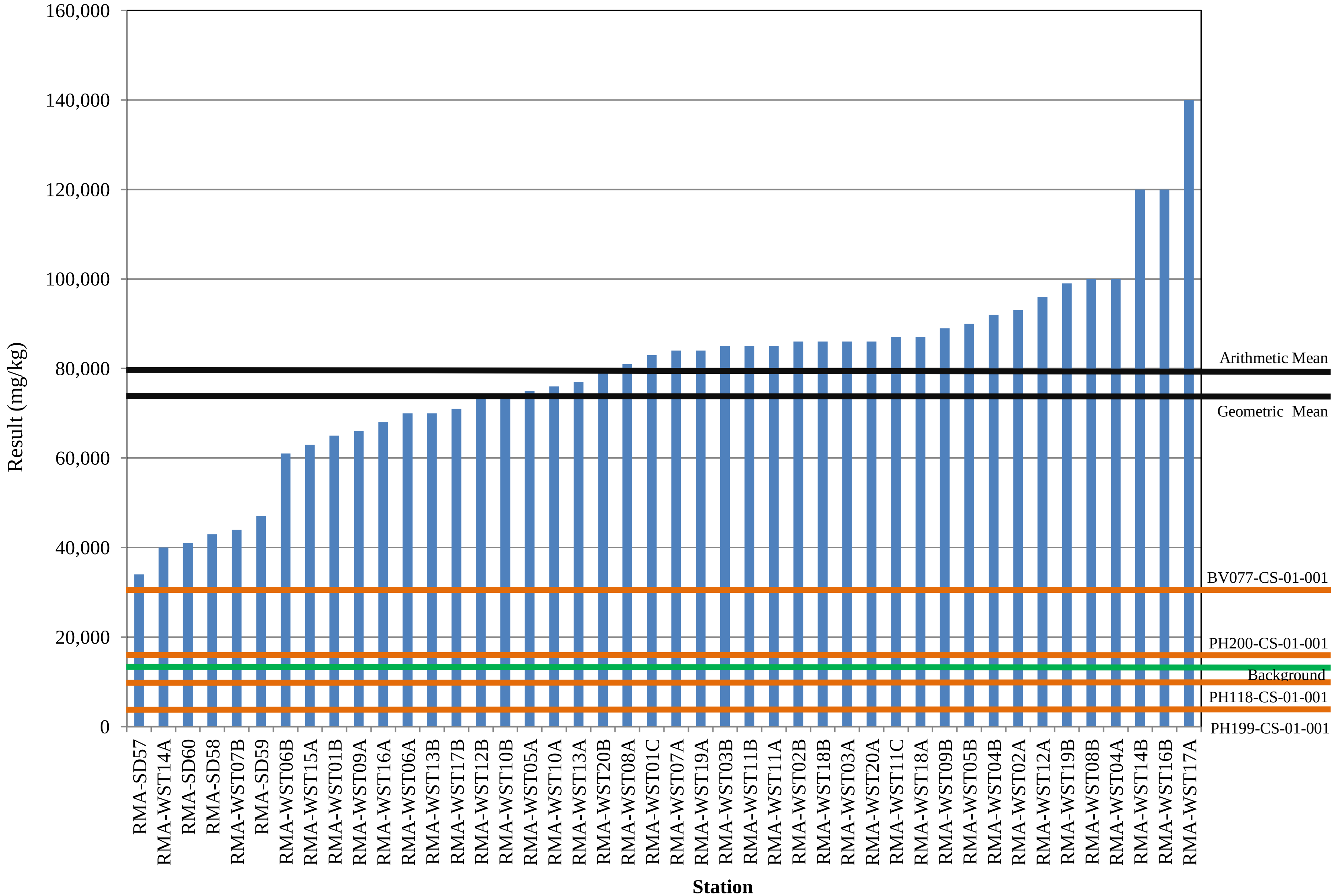
Appendix F: Data Summary Figures

Figure F-1, Chemical (TAL Metals) Signature Comparison Fall 2011 Red Mud Area A (RMA) and Background Soil Geometric Mean Compared to the Spring 2012 Cistern Sediment Sampling



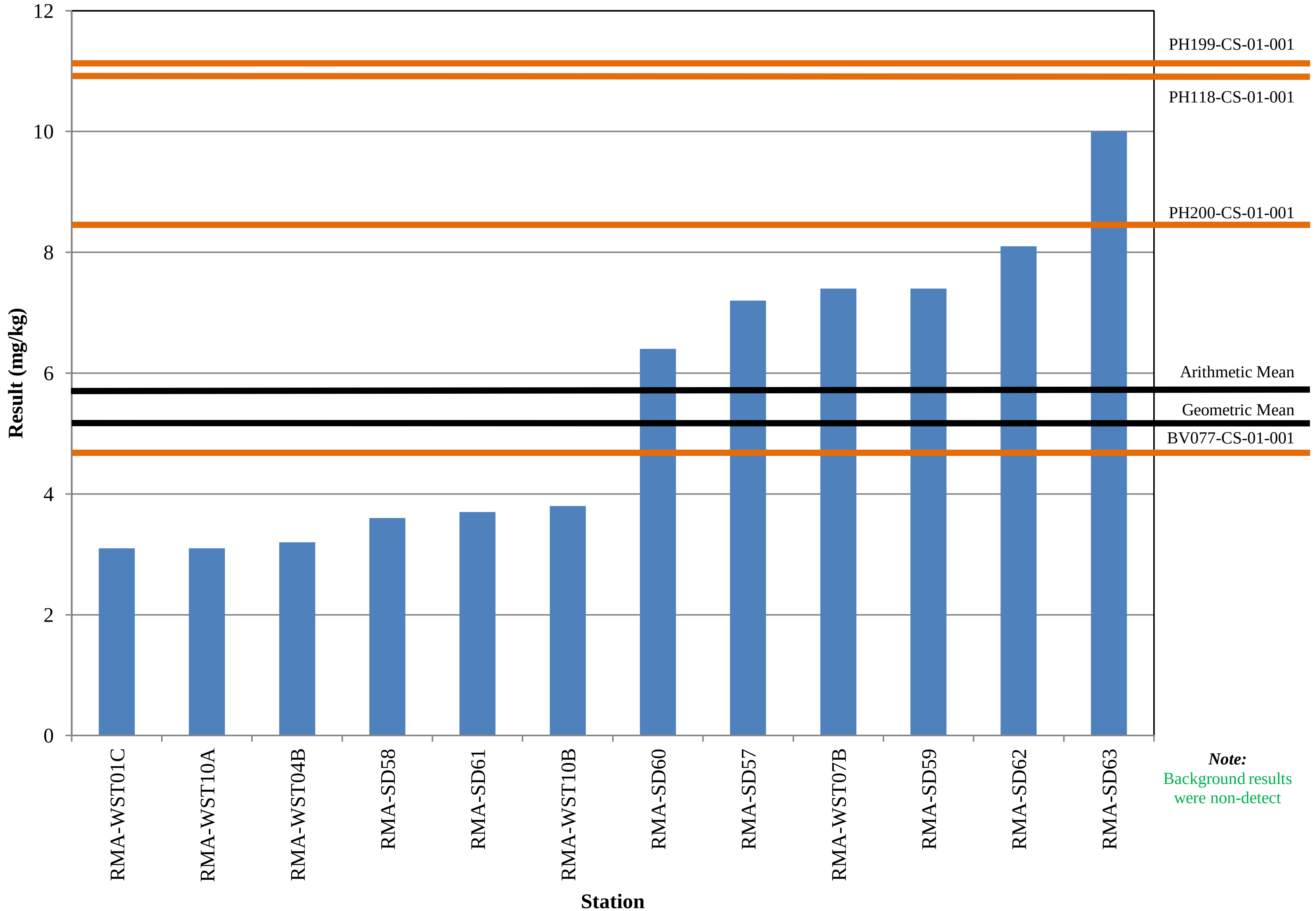
SCRG141118

Figure F-2, Fall 2011 RMA Soil Sample Results for Aluminum Compared to the Spring 2012 Cistern Sediment Results



SCRG141119

Figure F-3, Fall 2011 RMA Soil Sample Results for Antimony Compared to the Spring 2012 Cistern Sediment Results



SCRG141120

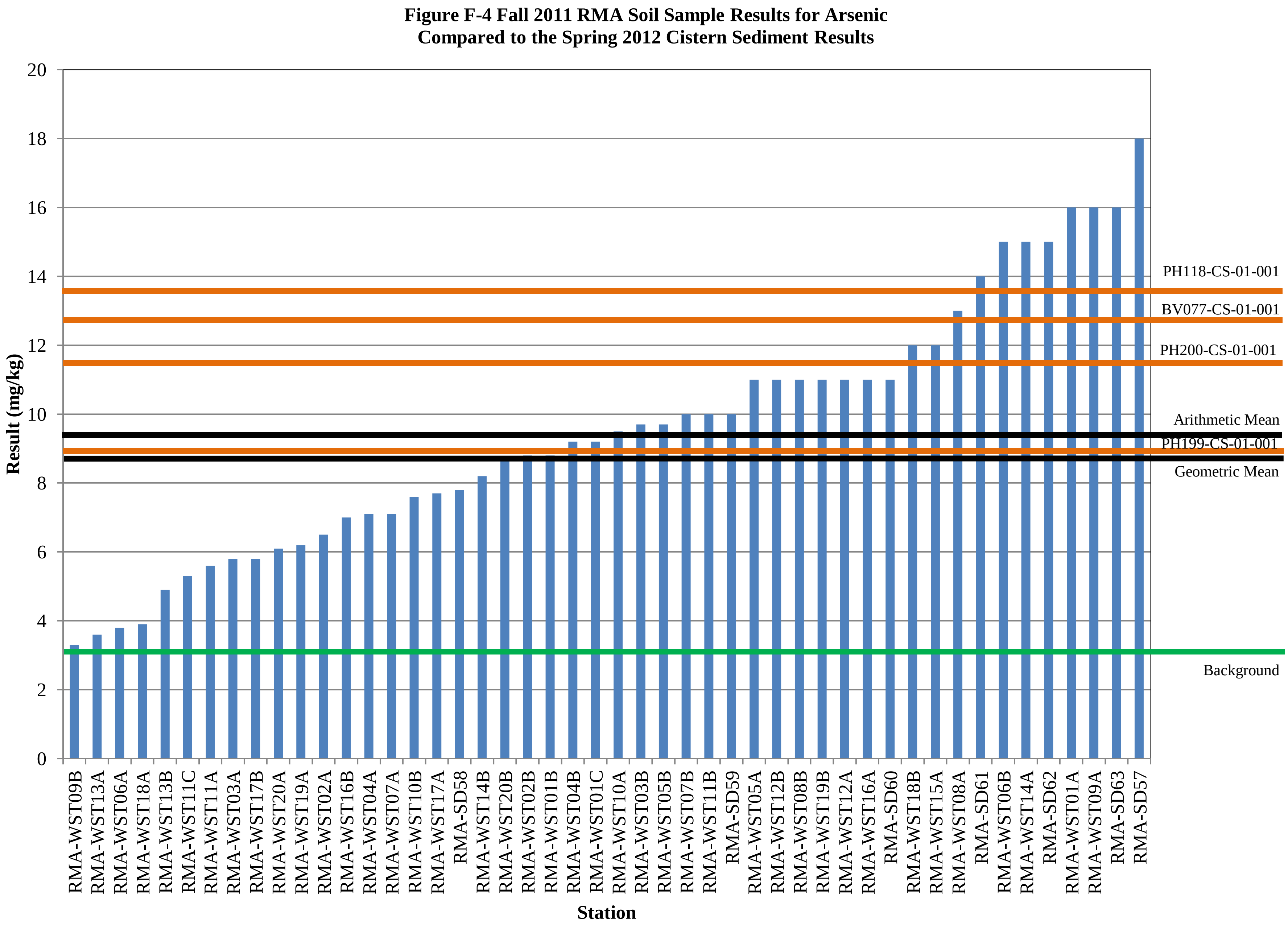
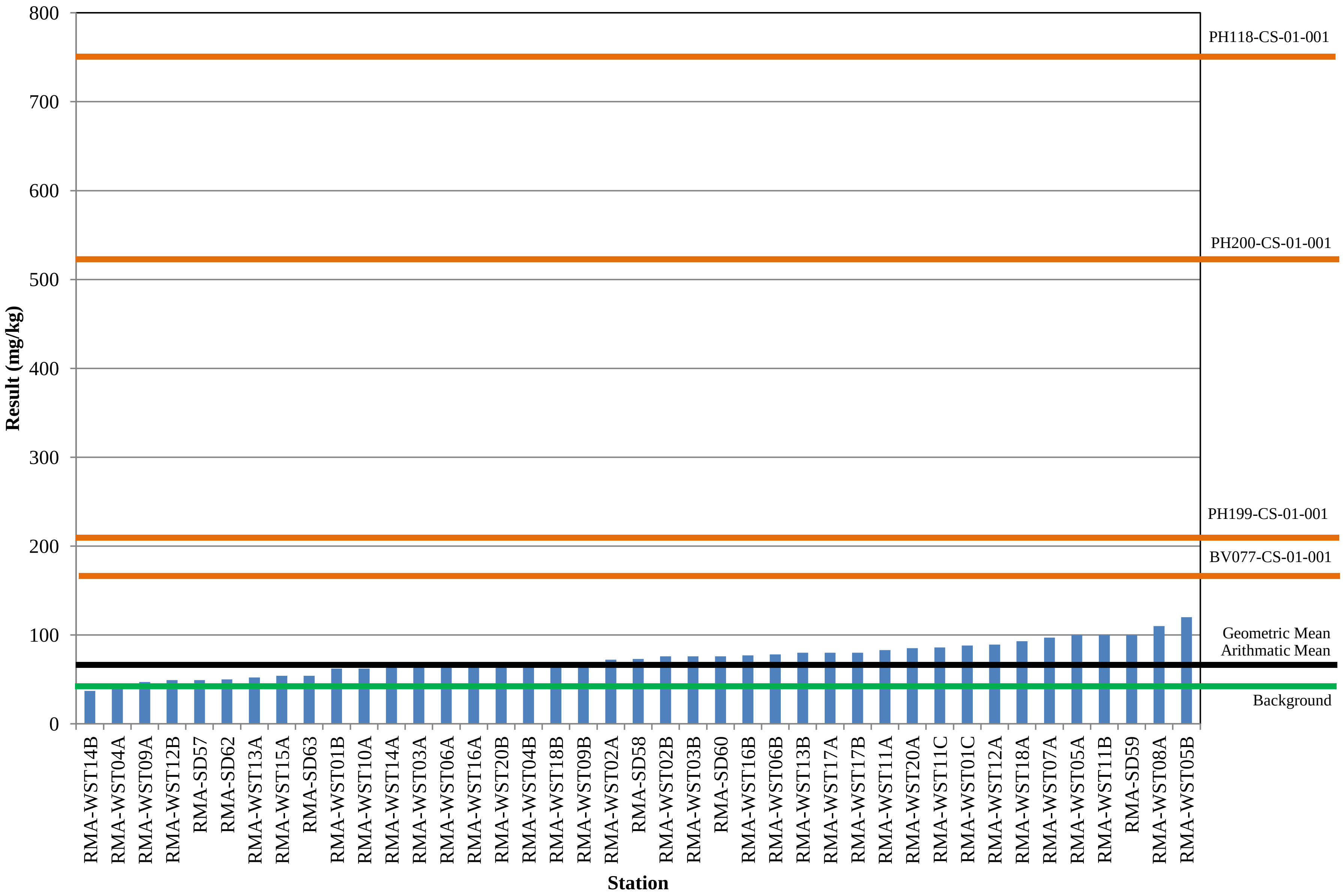


Figure F-4 Fall 2011 RMA Soil Sample Results for Arsenic
Compared to the Spring 2012 Cistern Sediment Results
Result (mg/kg)
Station
PH118-CS-01-001
BV077-CS-01-001
PH200-CS-01-001
Arithmetic Mean
PH199-CS-01-001
Geometric Mean
Background
RMA-WST09B
RMA-WST13A
RMA-WST06A
RMA-WST18A
RMA-WST13B
RMA-WST11C
RMA-WST11A
RMA-WST03A
RMA-WST17B
RMA-WST20A
RMA-WST19A
RMA-WST02A
RMA-WST16B
RMA-WST04A
RMA-WST07A
RMA-WST10B
RMA-WST17A
RMA-SD58
RMA-WST14B
RMA-WST20B
RMA-WST02B
RMA-WST01B
RMA-WST04B
RMA-WST01C
RMA-WST10A
RMA-WST03B
RMA-WST05B
RMA-WST07B
RMA-WST11B
RMA-SD59
RMA-WST05A
RMA-WST12B
RMA-WST08B
RMA-WST19B
RMA-WST12A
RMA-WST16A
RMA-SD60
RMA-WST18B
RMA-WST15A
RMA-WST08A
RMA-SD61
RMA-WST06B
RMA-WST14A
RMA-SD62
RMA-WST01A
RMA-WST09A
RMA-SD63
RMA-SD57

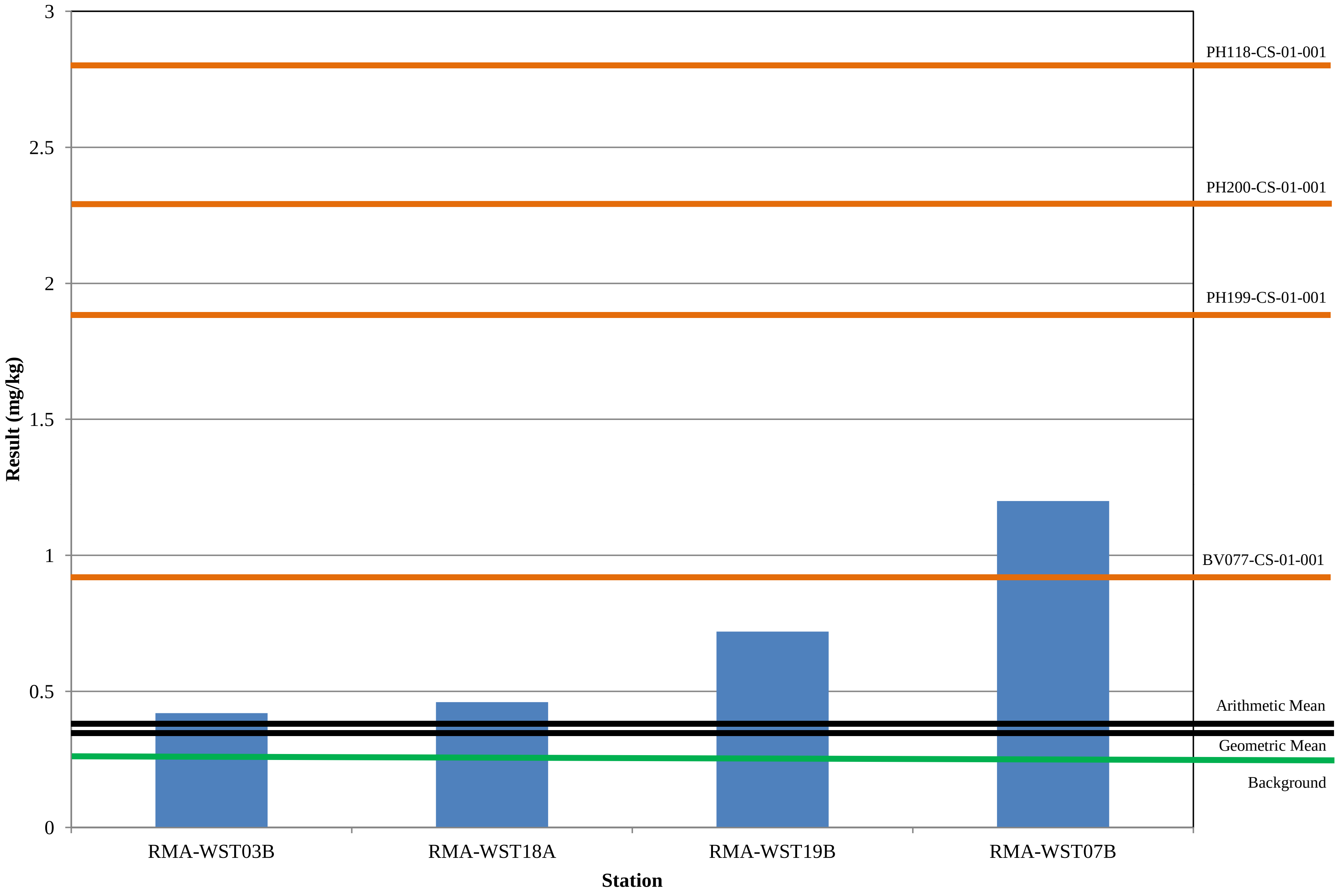
SCRG141121

Figure F-5, Fall 2011 RMA Soil Sample Results for Barium Compared to the Spring 2012 Cistern Sediment Results



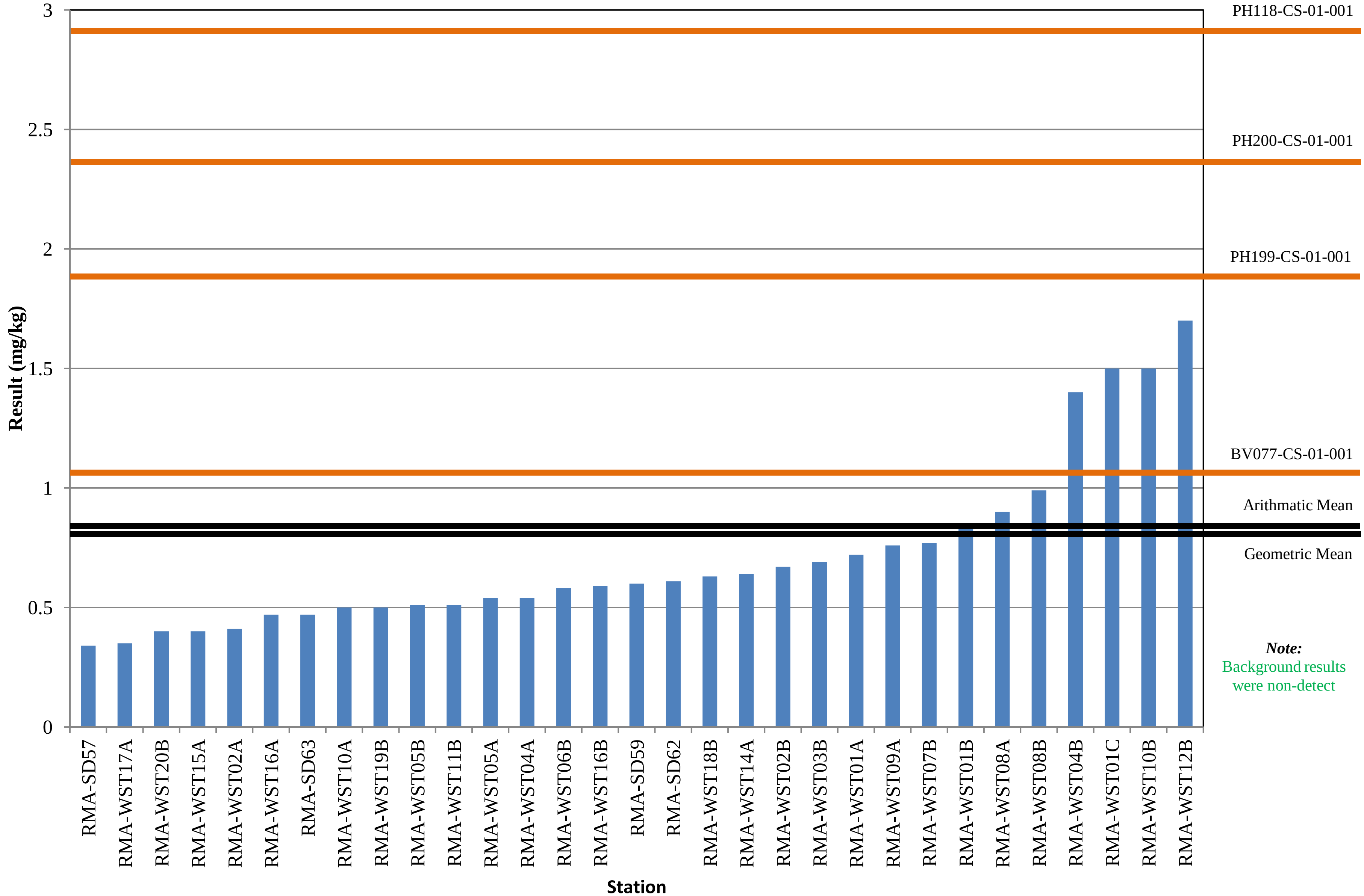
SCRG141122

Figure F-6, Fall 2011 RMA Soil Sample Results for Beryllium Compared to the Spring 2012 Cistern Sediment Results



SCRG141123

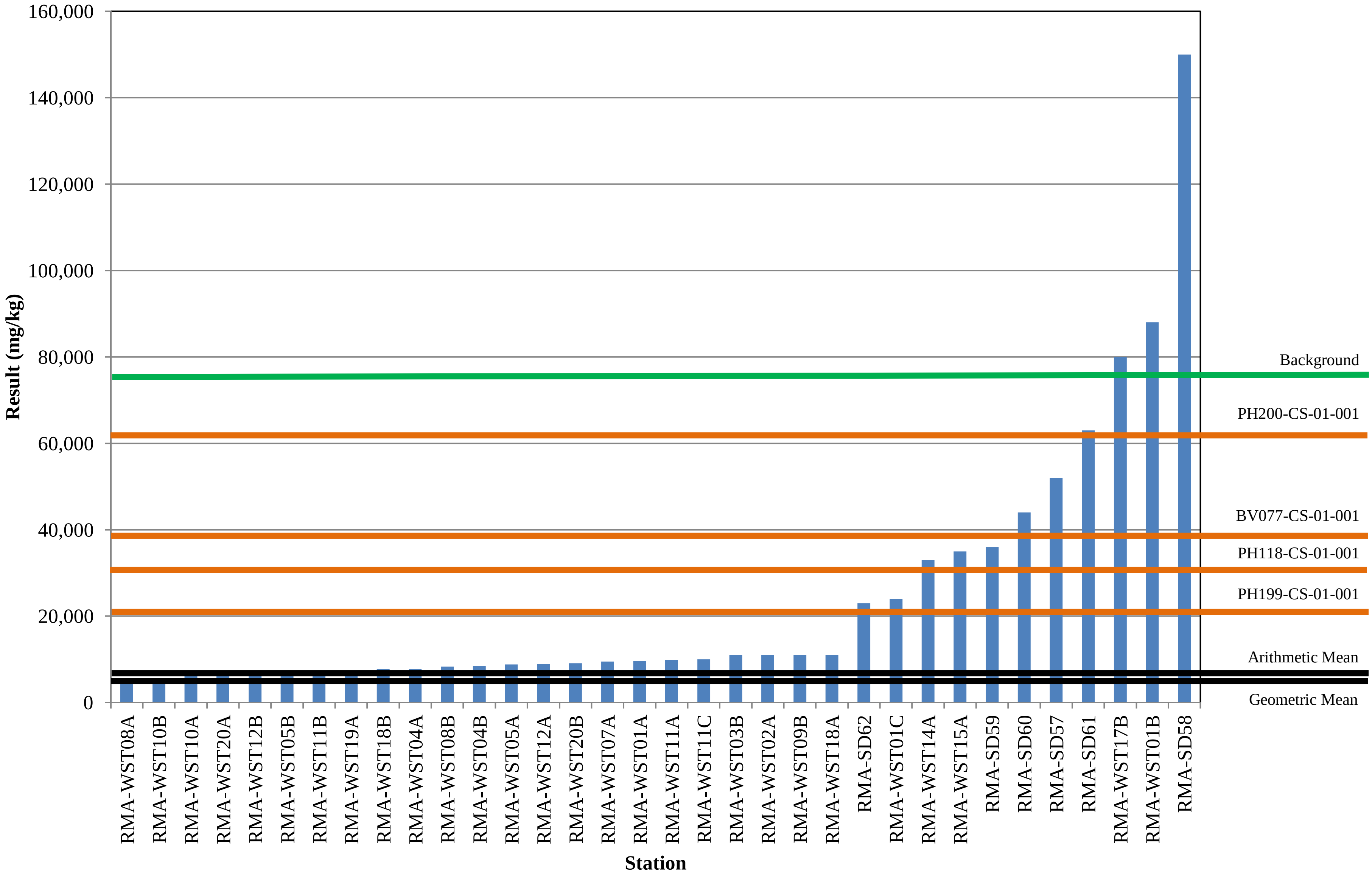
Figure F-7, Fall 2011 RMA Soil Sample Results for Cadmium Compared to the Spring 2012 Cistern Sediment Results



Note:
Background results
were non-detect

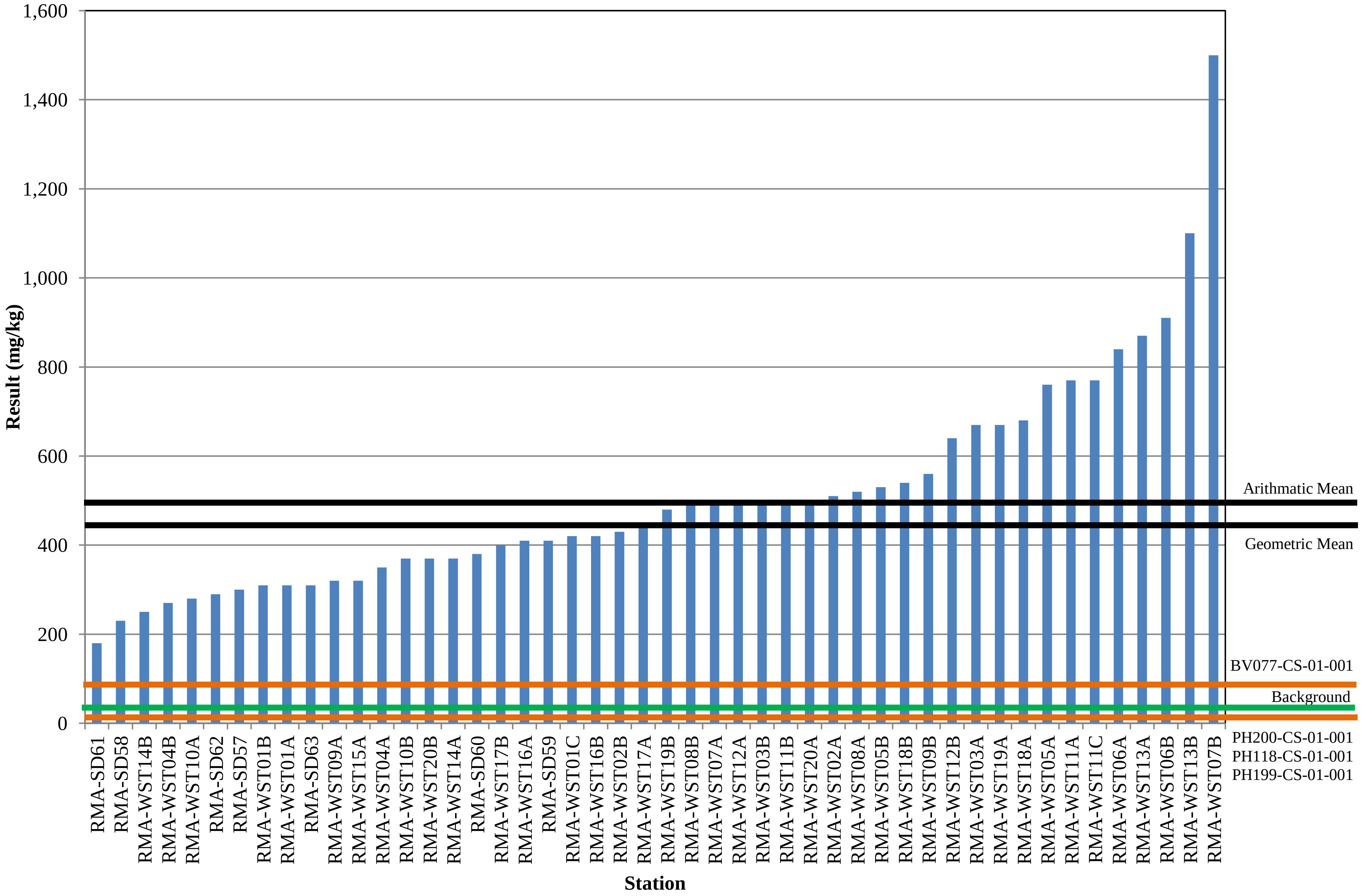
SCRG141124

Figure F-8, Fall 2011 RMA Soil Sample Results for Calcium Compared to the Spring 2012 Cistern Sediment Results



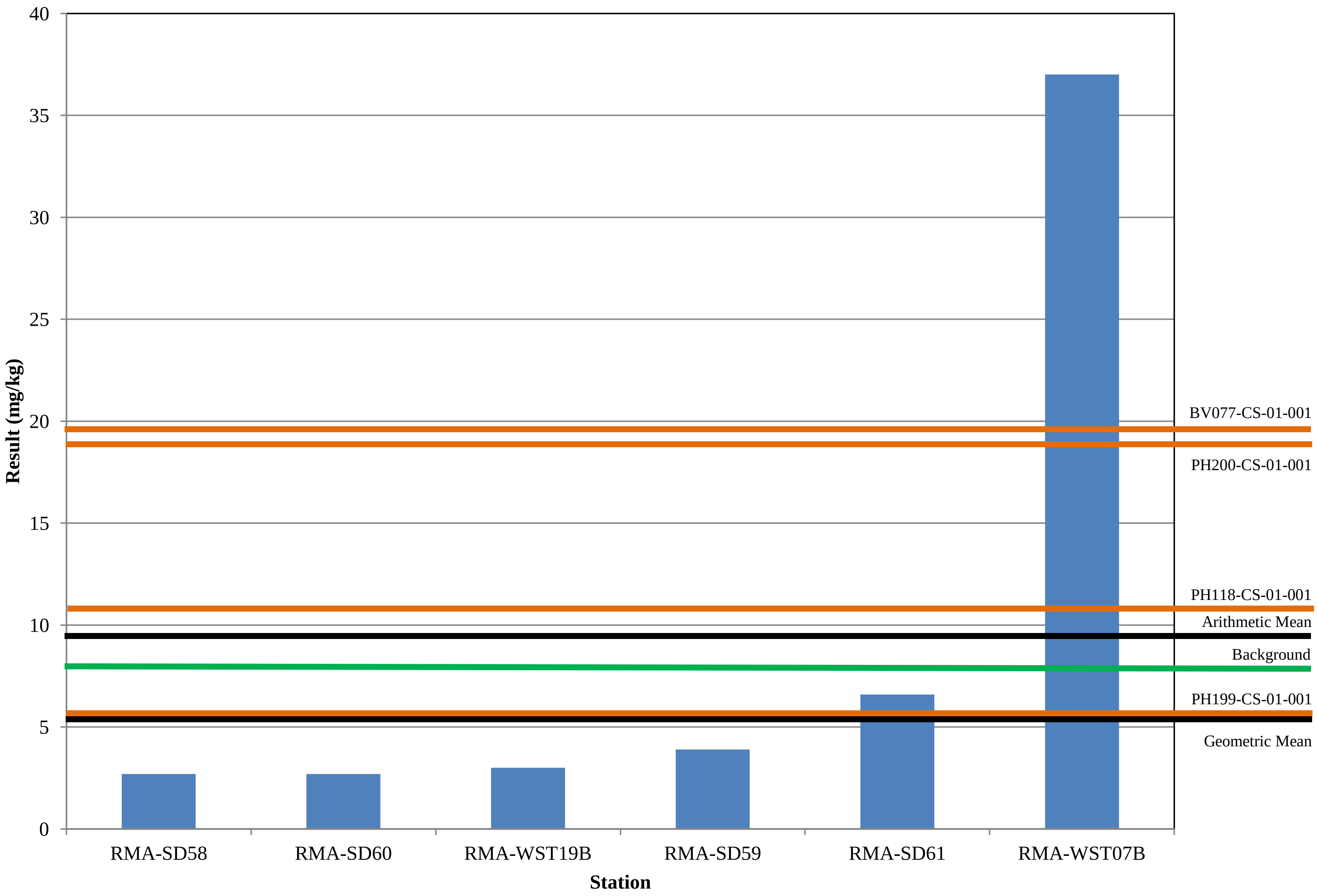
SCRG141125

Figure F-9, Fall 2011 RMA Soil Sample Results for Chromium Compared to the Spring 2012 Cistern Sediment Results



SCRG141126

Figure F-10, Fall 2011 RMA Soil Sample Results for Cobalt
Compared to the Spring 2012 Cistern Sediment Results



SCRG141127

Figure F-11, Fall 2011 RMA Soil Sample Results for Copper Compared to the Spring 2012 Cistern Sediment Results

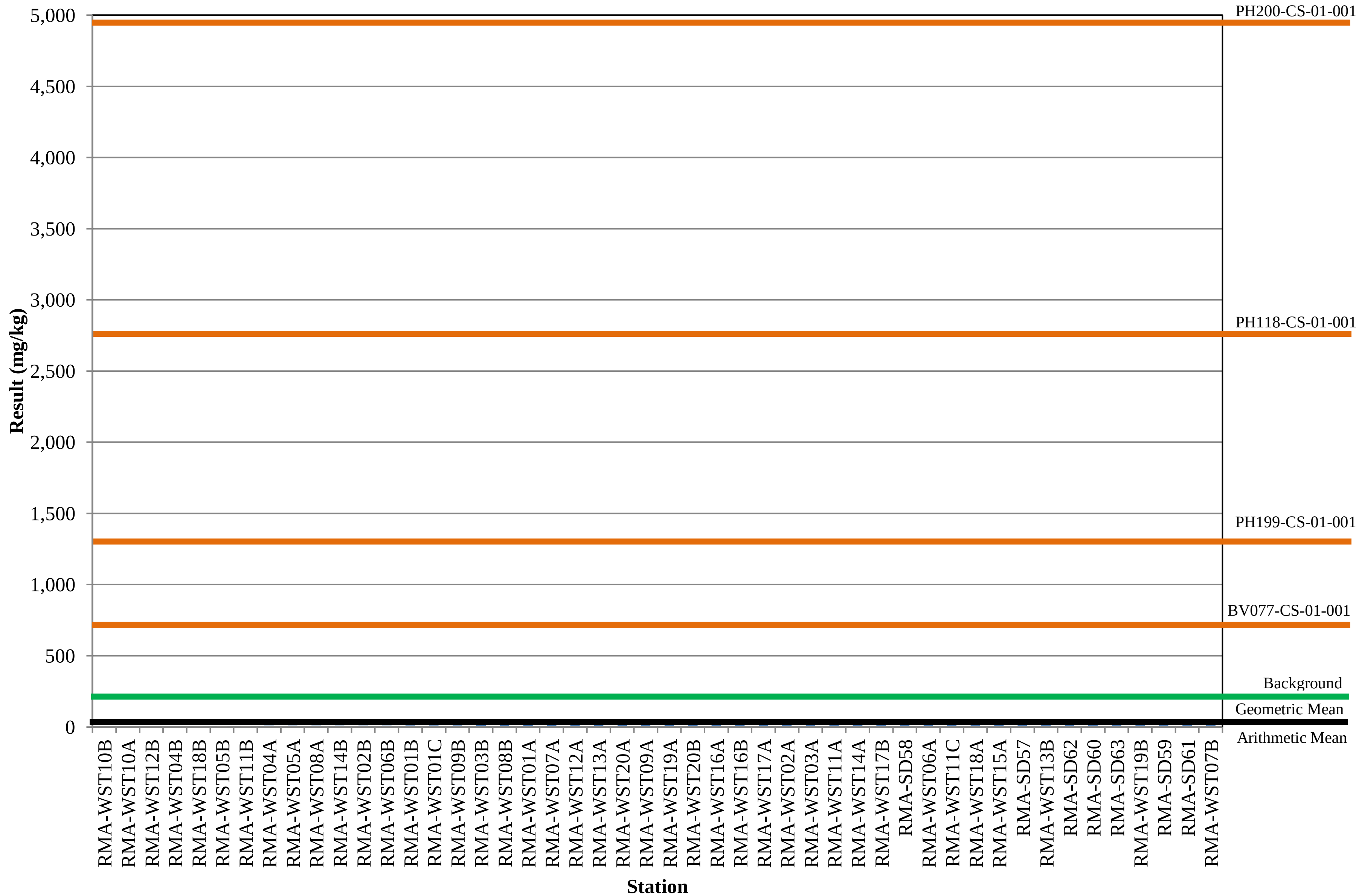
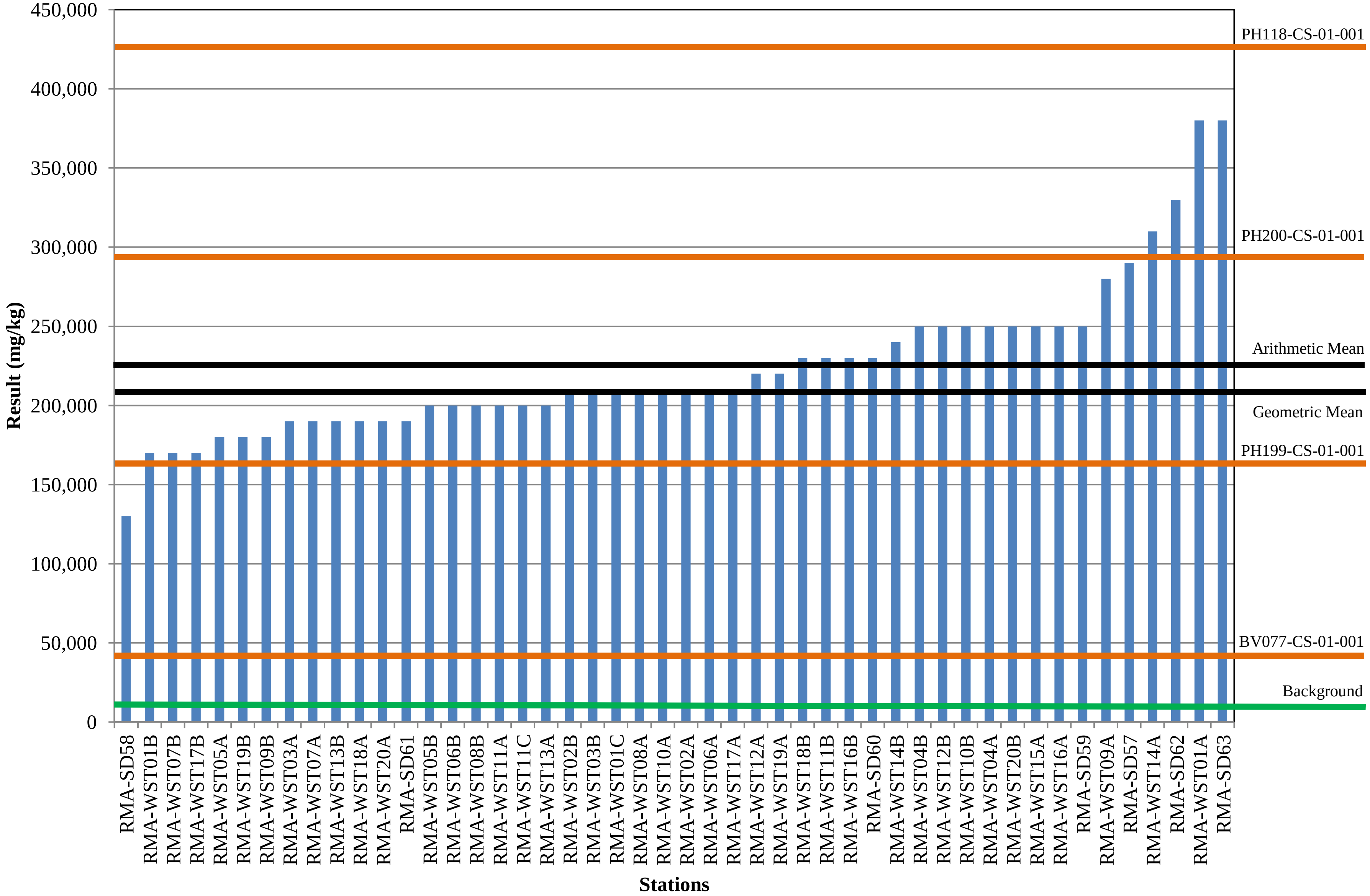
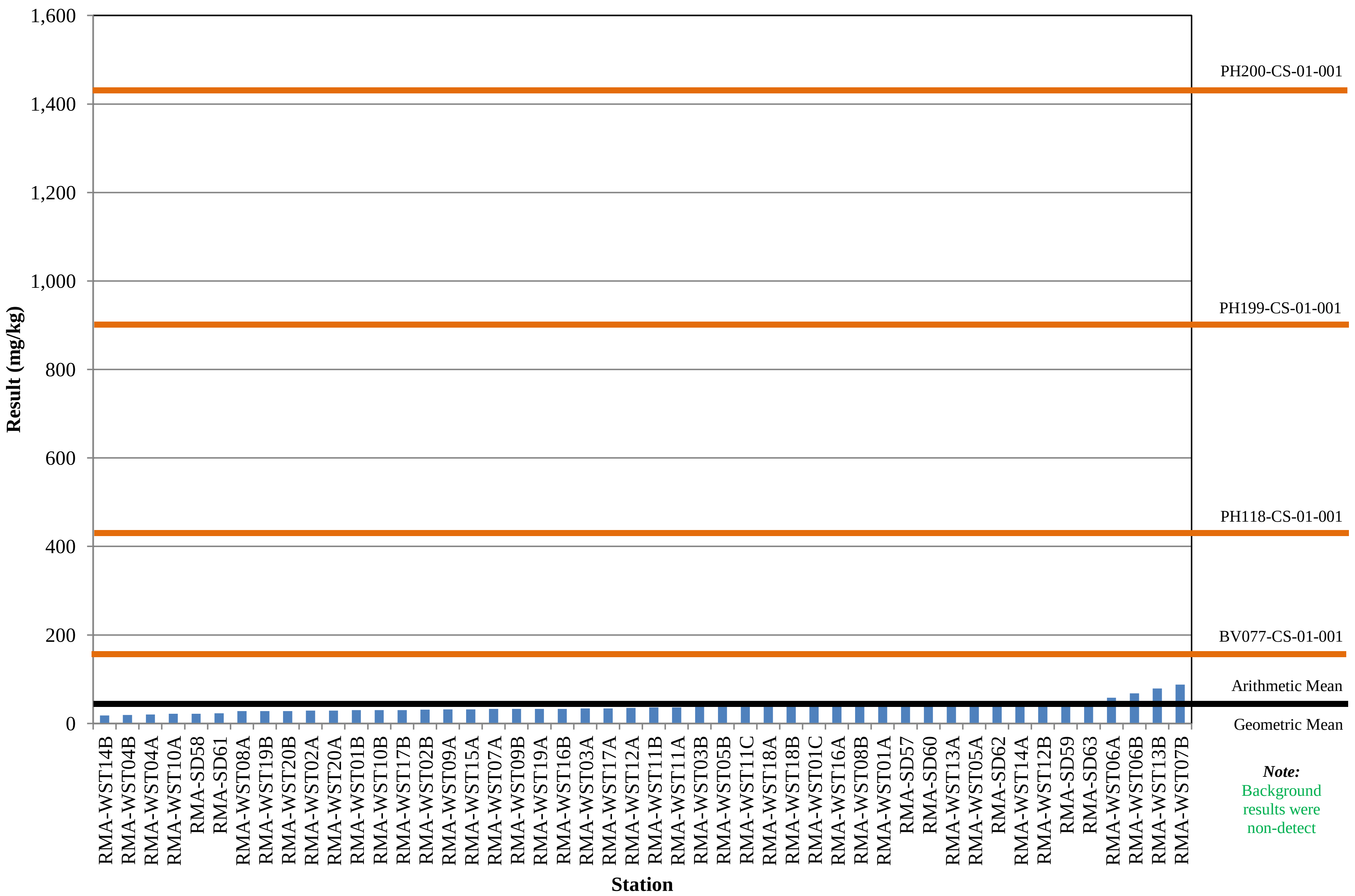


Figure F-12, Fall 2011 RMA Soil Sample Results for Iron
Compared to the Spring 2012 Cistern Sediment Results



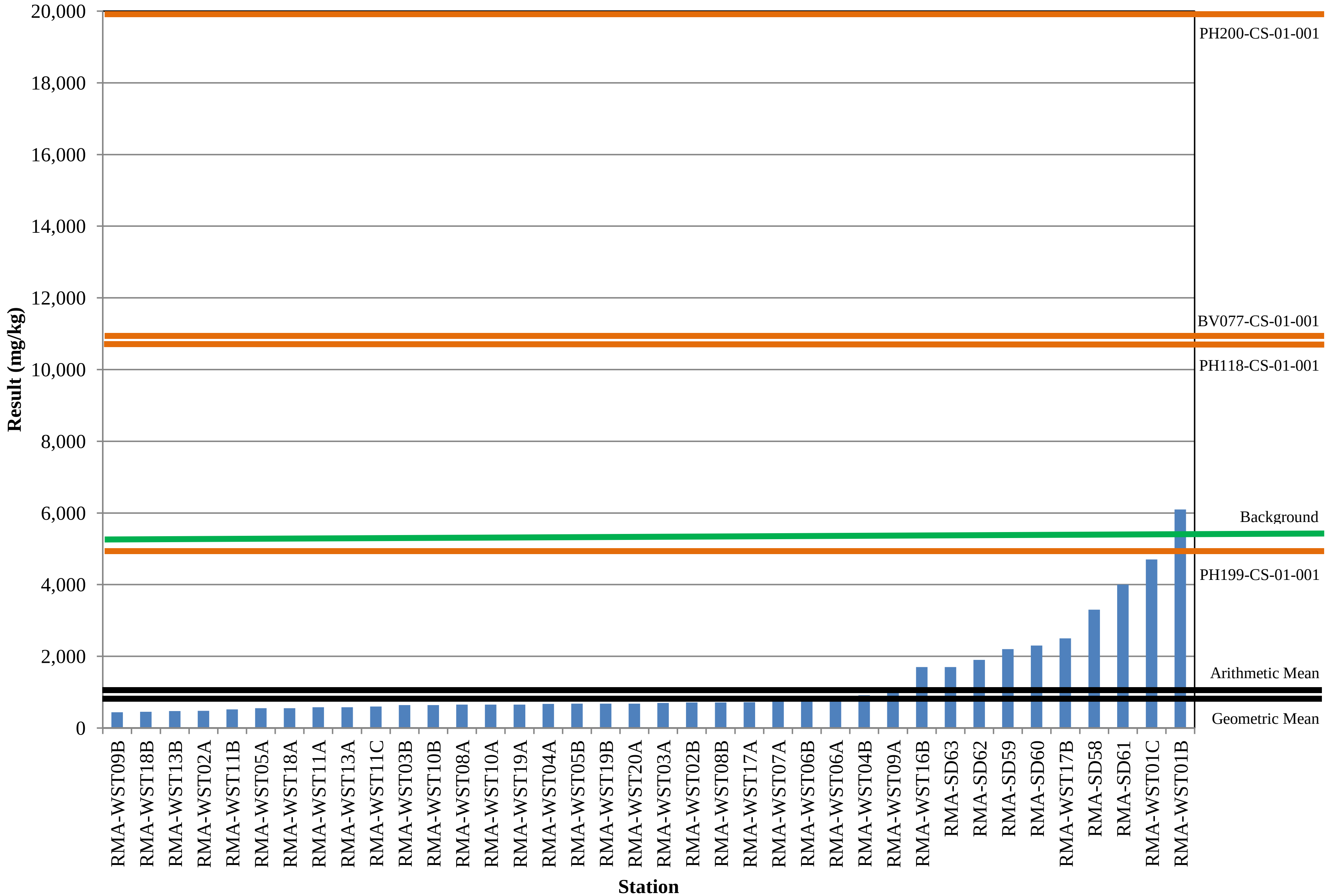
SCRG141129

Figure F-13, Fall 2011 RMA Soil Sample Results for Lead Compared to the Spring 2012 Cistern Sediment Results



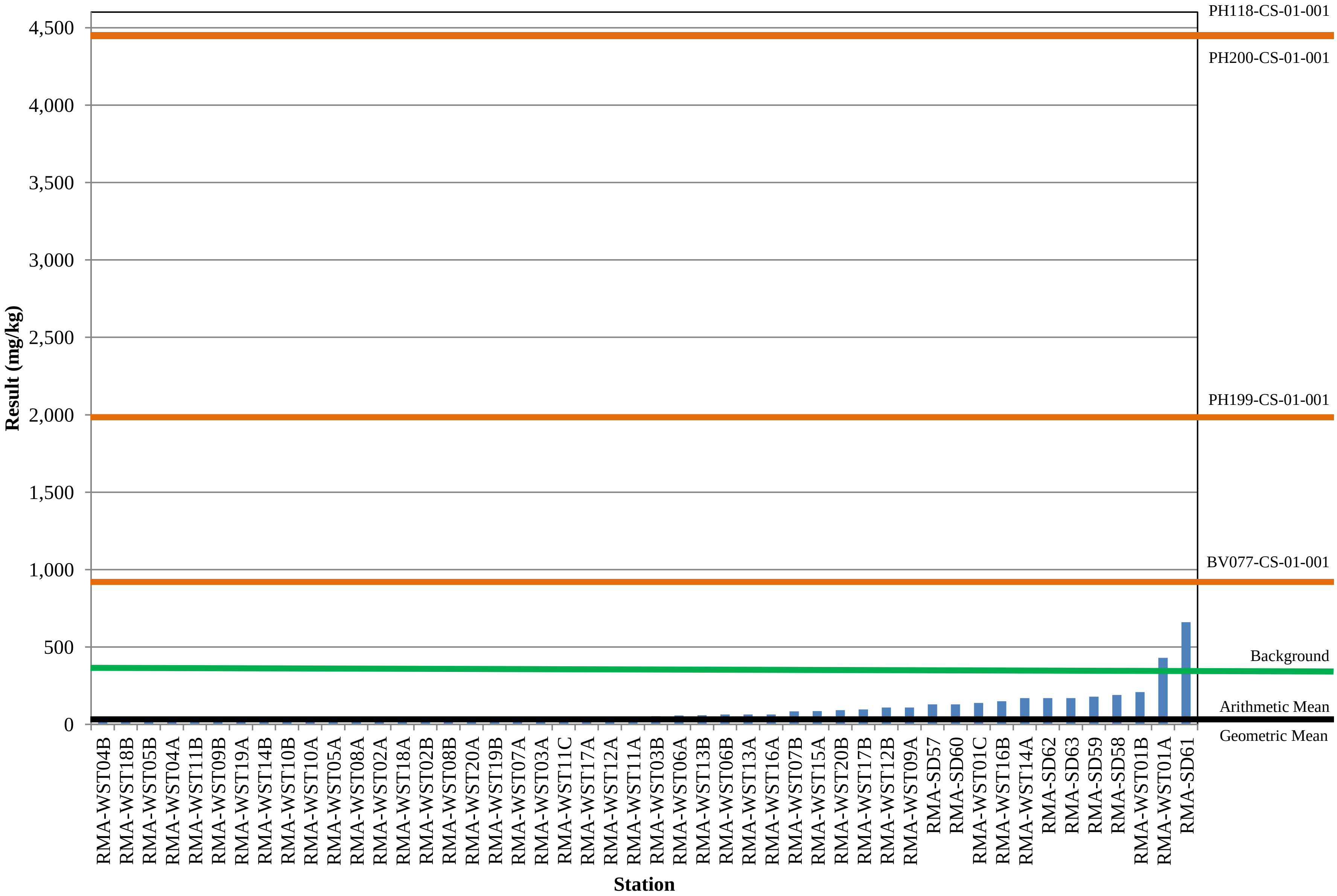
SCRG141130

Figure F-14, Fall 2011 RMA Soil Sample Results for Magnesium Compared to the Spring 2012 Cistern Sediment Results



SCRG141131

Figure F-15, Fall 2011 RMA Soil Sample Results for Manganese Compared to the Spring 2012 Cistern Sediment Results



SCRG141132

Figure F-16, Fall 2011 RMA Soil Sample Results for Nickel Compared to the Spring 2012 Cistern Sediment Results

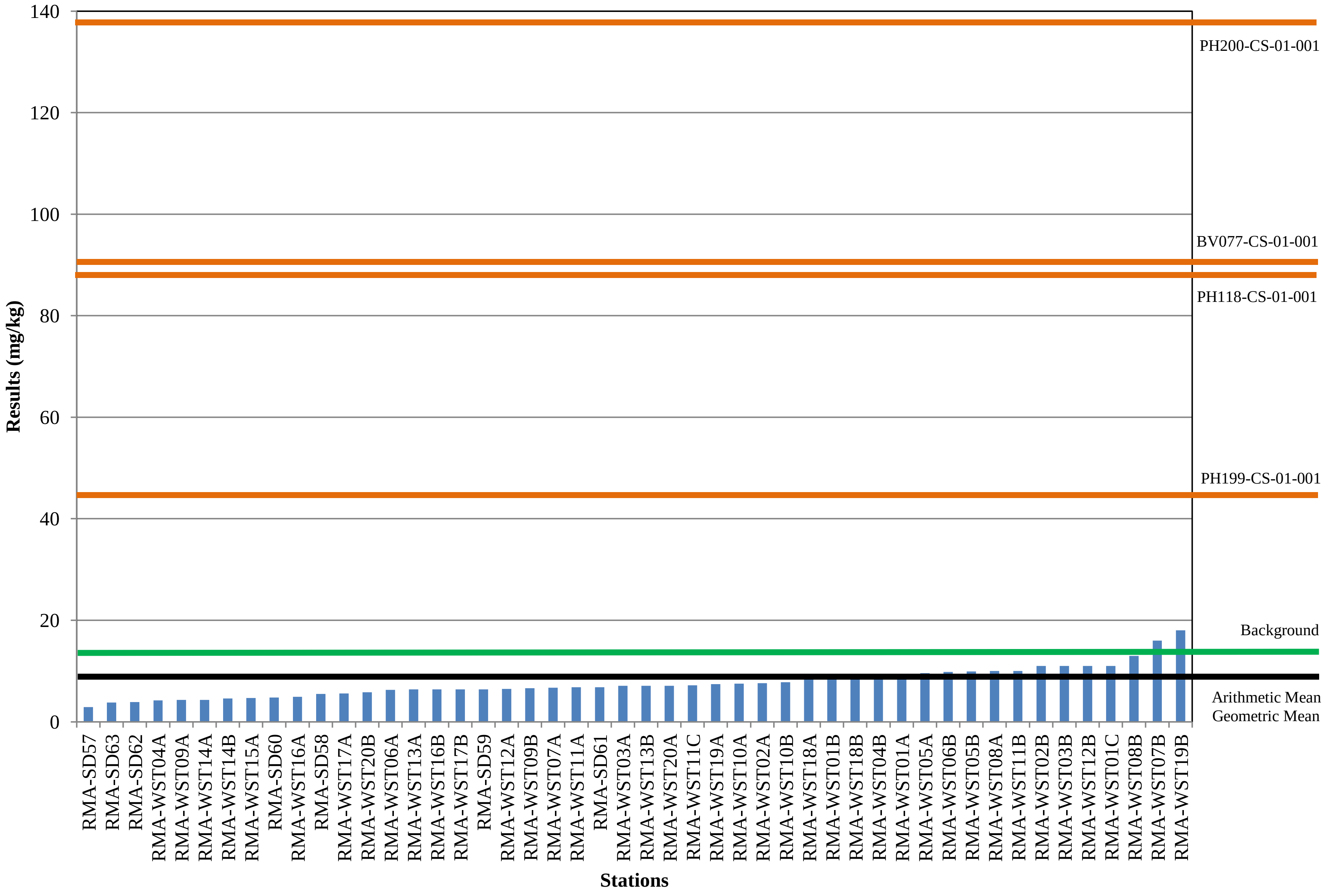
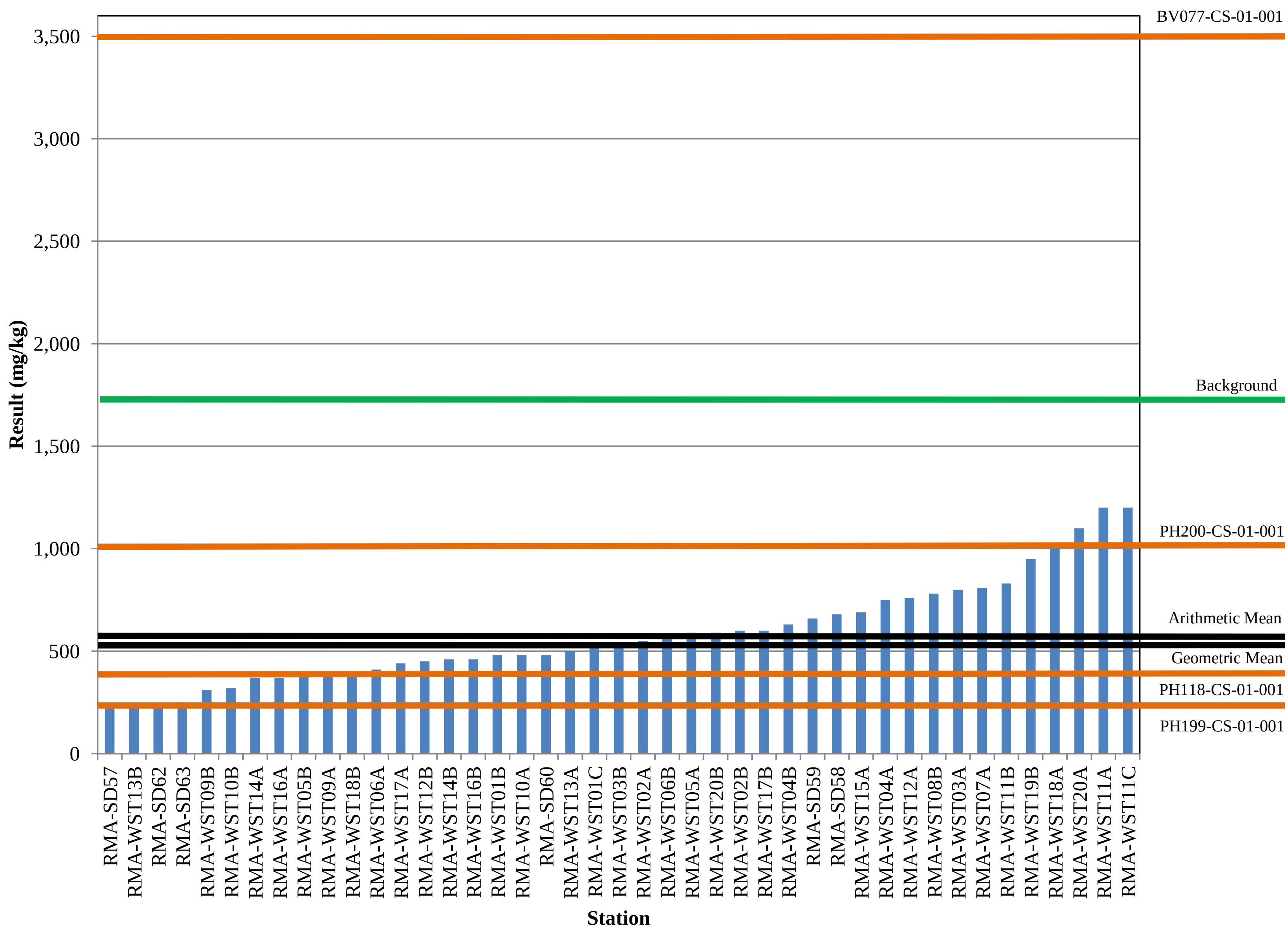
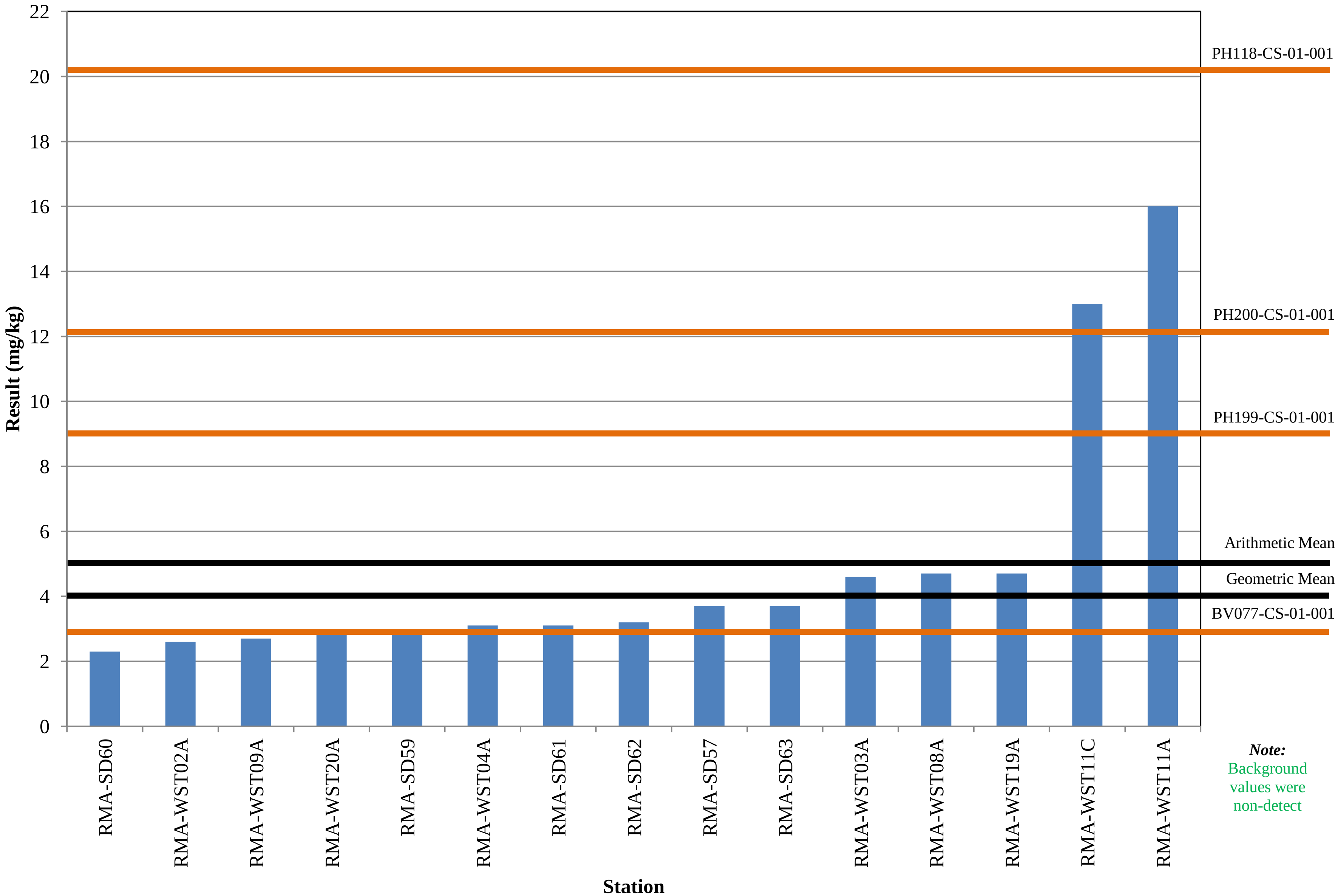


Figure F-17, Fall 2011 RMA Soil Sample Results for Potassium Compared to the Spring 2012 Cistern Sediment Results



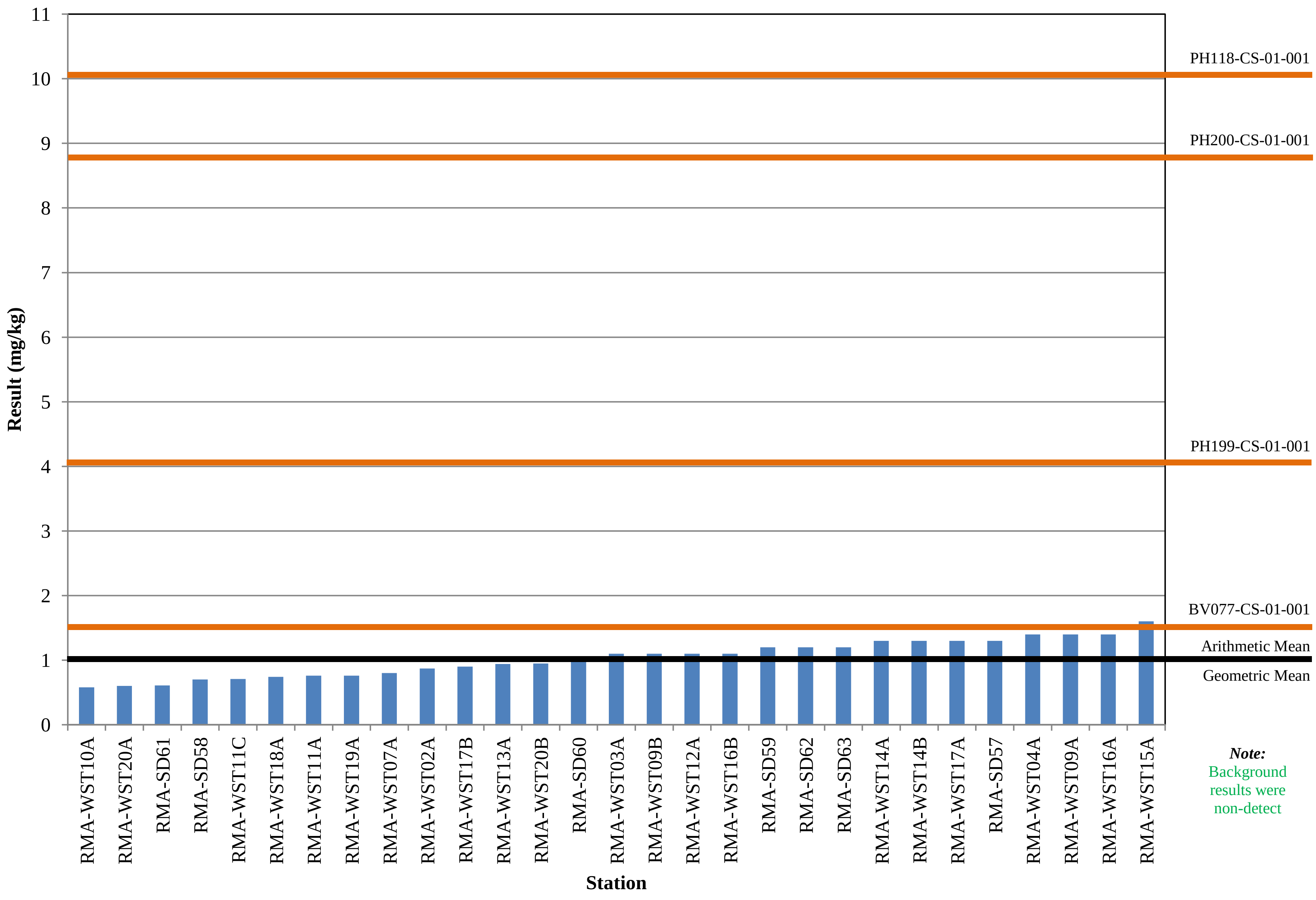
SCRG141134

Figure F-18, Fall 2011 RMA Soil Sample Results for Selenium Compared to the Spring 2012 Cistern Sediment Results



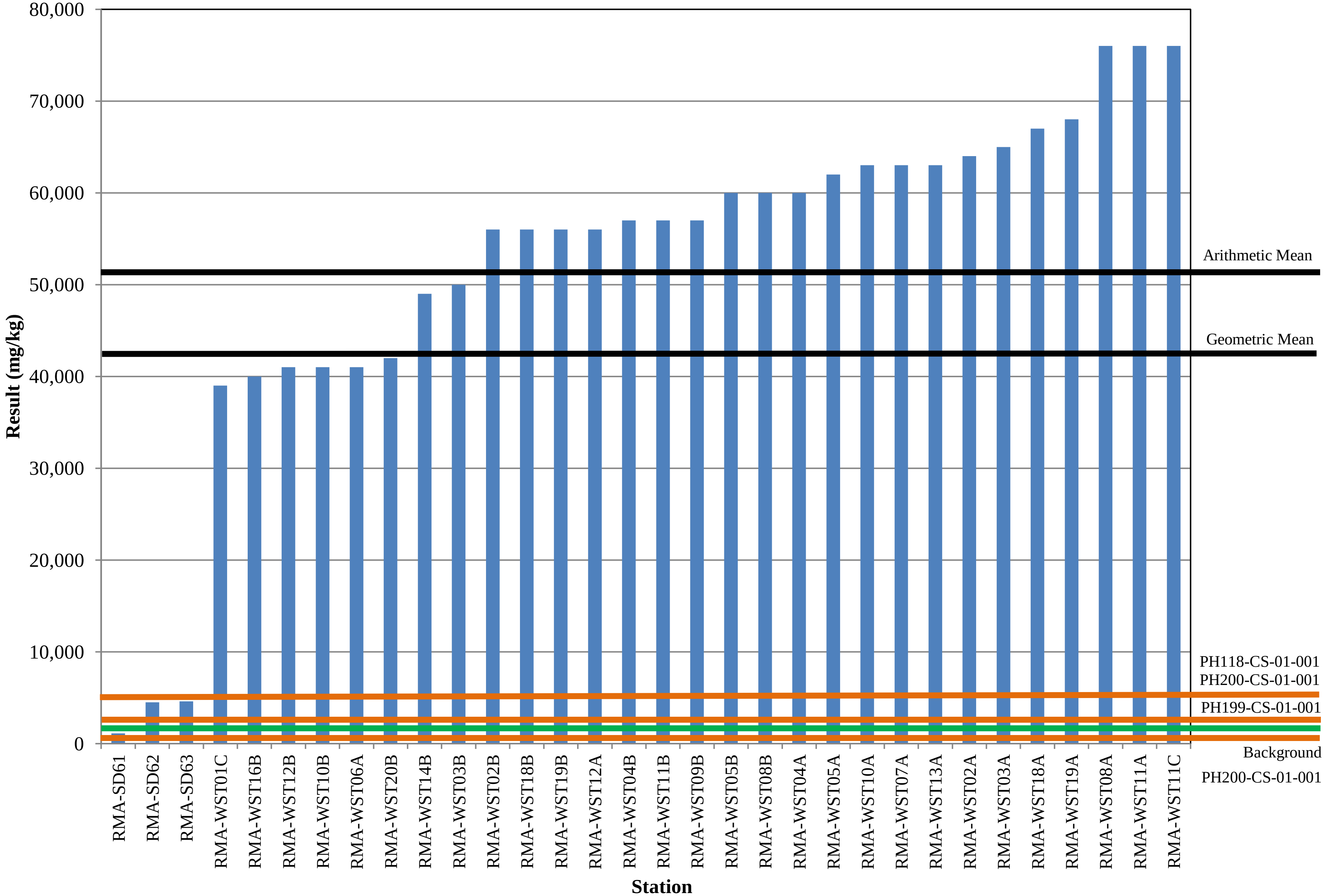
SCRG141135

Figure F-19, Fall 2011 RMA Soil Sample Results for Silver Compared to the Spring 2012 Cistern Sediment Results



SCRG141136

Figure F-20, Fall 2011 RMA Soil Sample Results for Sodium Compared to the Spring 2012 Cistern Sediment Results



SCRG141137

Figure F-21, Fall 2011 RMA Soil Sample Results for Vanadium Compared to the Spring 2012 Cistern Sediment Results

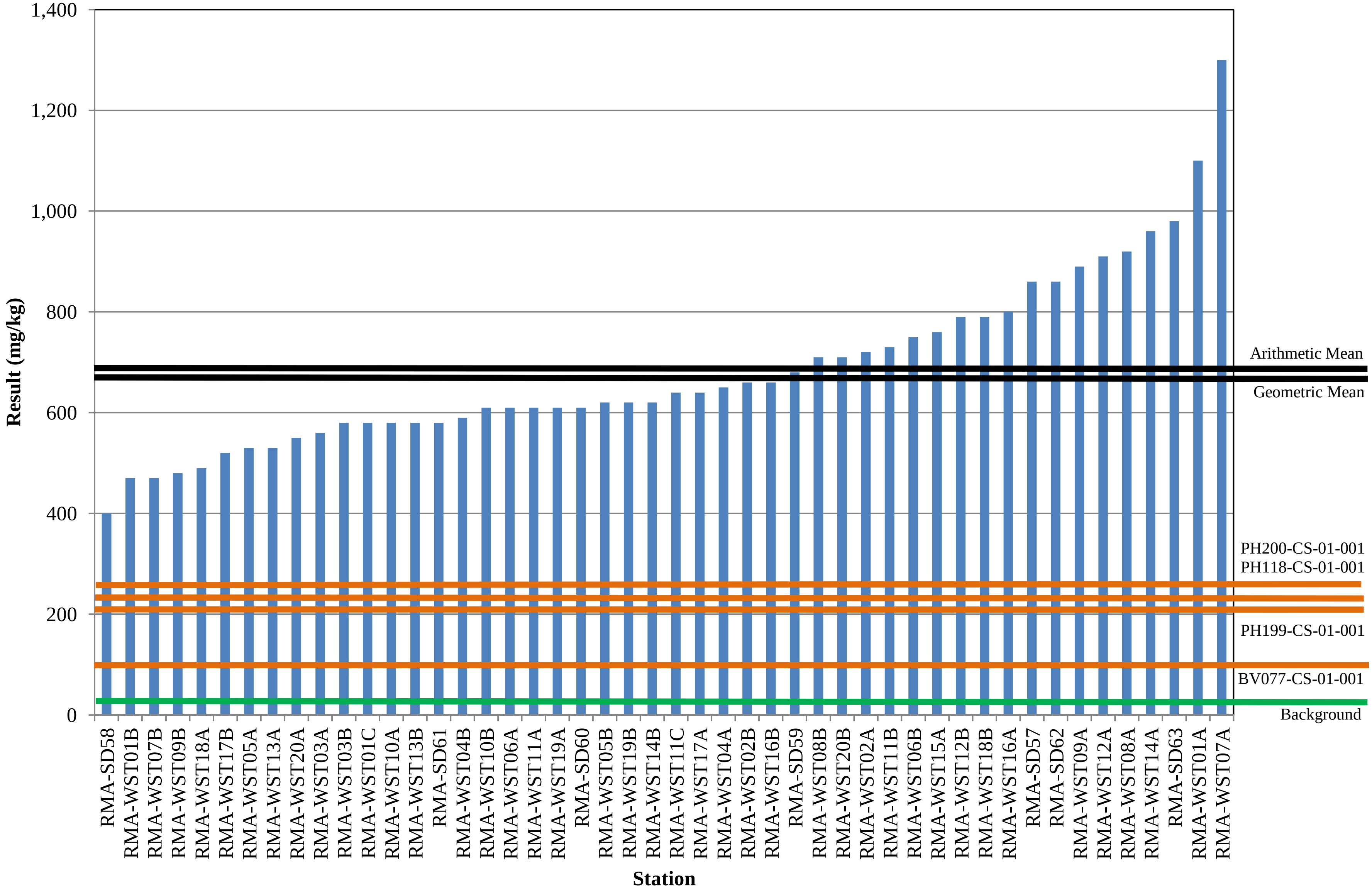
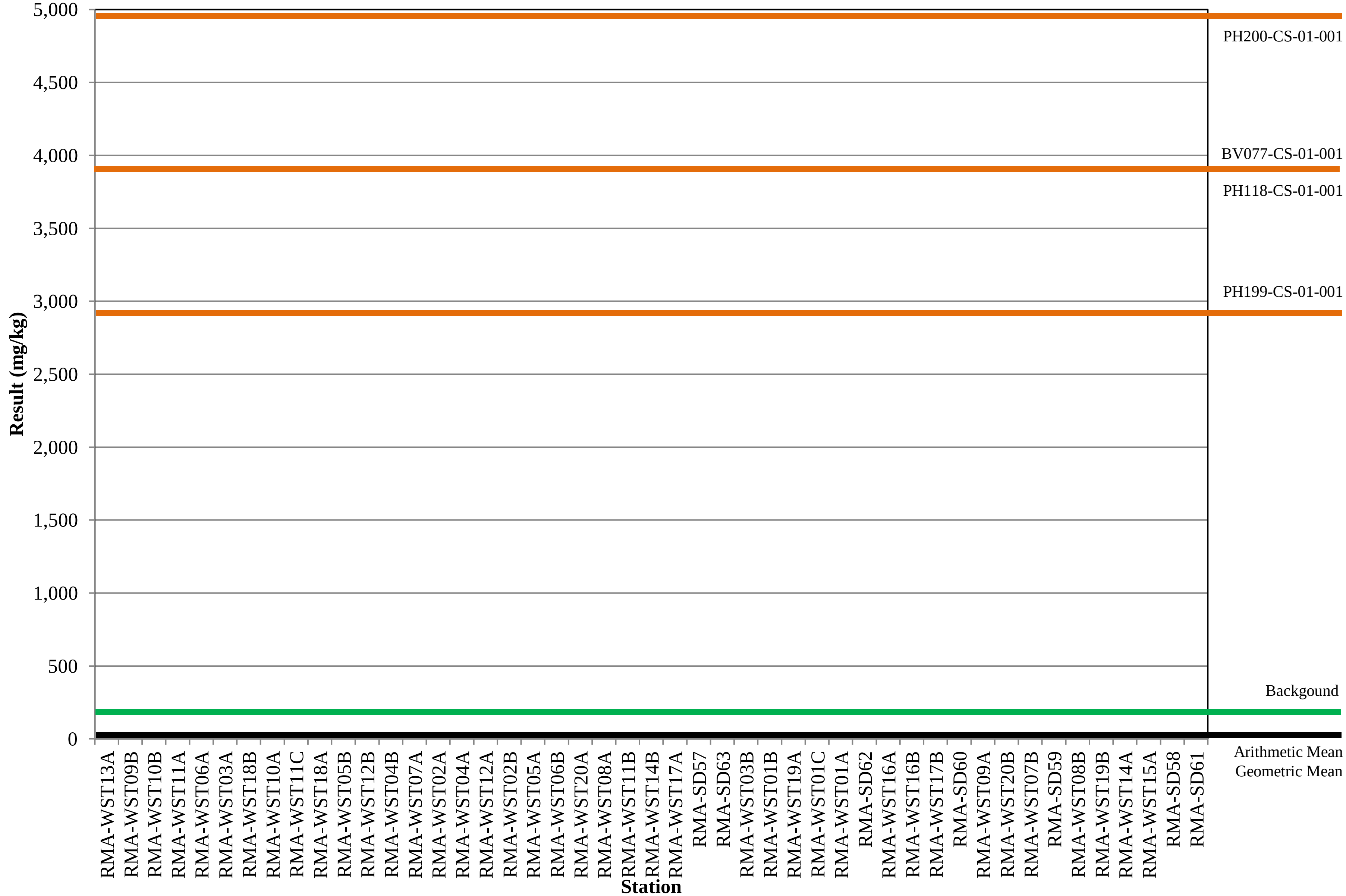


Figure F-22, Fall 2011 RMA Soil Sample Results for Zinc Compared to the Spring 2012 Cistern Sediment Results



SCRG141139

Appendix G: Photographic Documentation Log

Photograph 1: **R7001-001, RF001-001**.

Photograph 2: **RF001-002**.

Photograph 3: **RF001-003**.

Photograph 4: **RF001-004**.

Photograph 5: **R7001-005, RF001-005**.

Photograph 6: **RF001-006**.

Photograph 7: **RF001-007**.

Photograph 8: **RF001-008**.

Photograph 9: **R7001-009, RF001-009**.

Photograph 10: **R7001-010, RF001-010**.

Photograph 11: **R7001-011, RF001-011**.

Photograph 12: **R7001-012, RF001-012**.

Photograph 13: **R7001-013**.

Photograph 14: **R7001-014**.

Photograph 15: **R7001-015**.

Photograph 16: **R7002-001, RF002-001**.

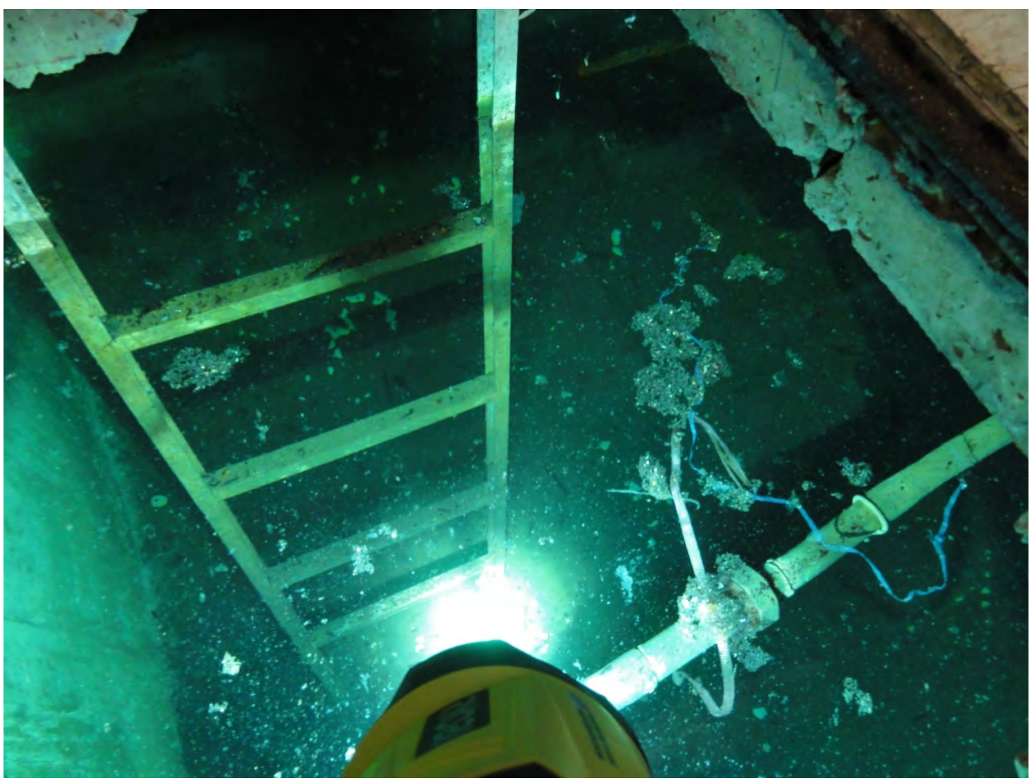
Photograph 17: **R7002-003**.

Photograph 18: **R7003-001, RF003-001**.

Photograph 19: **R7004-001**.

Photograph 20: **R7005-004**.

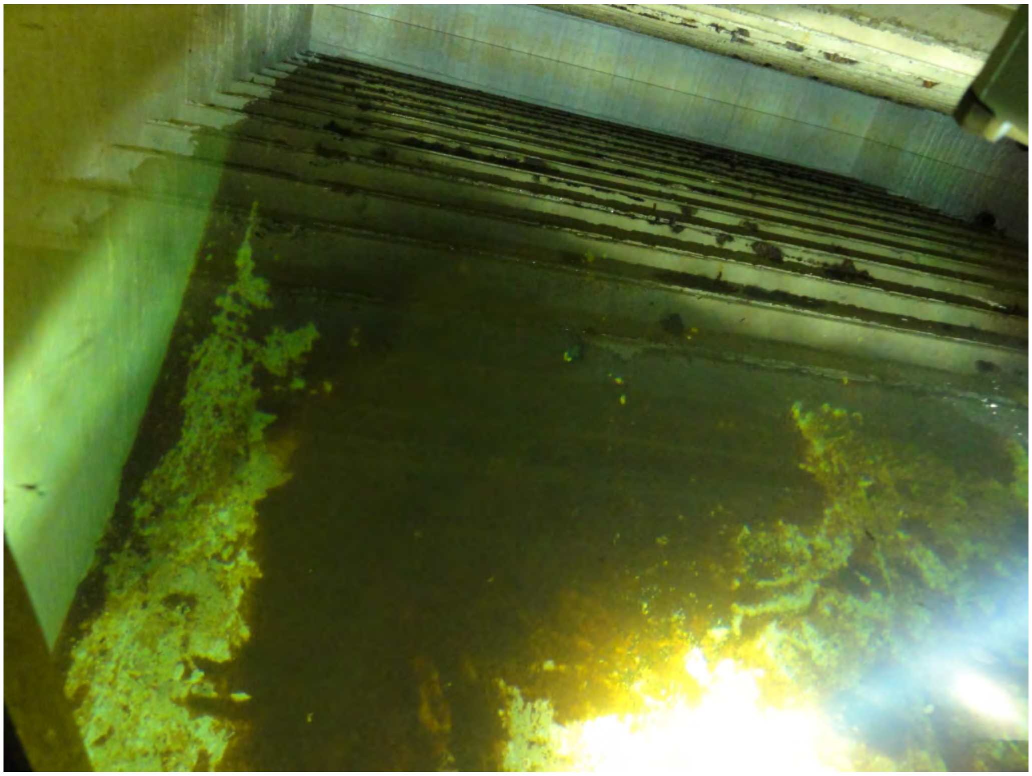
Photograph 21: **BV077 – Cistern Photo 1**.



Photograph 22: **BV077 – Cistern Photo 2**.

Photograph 23: **R7005-001**.

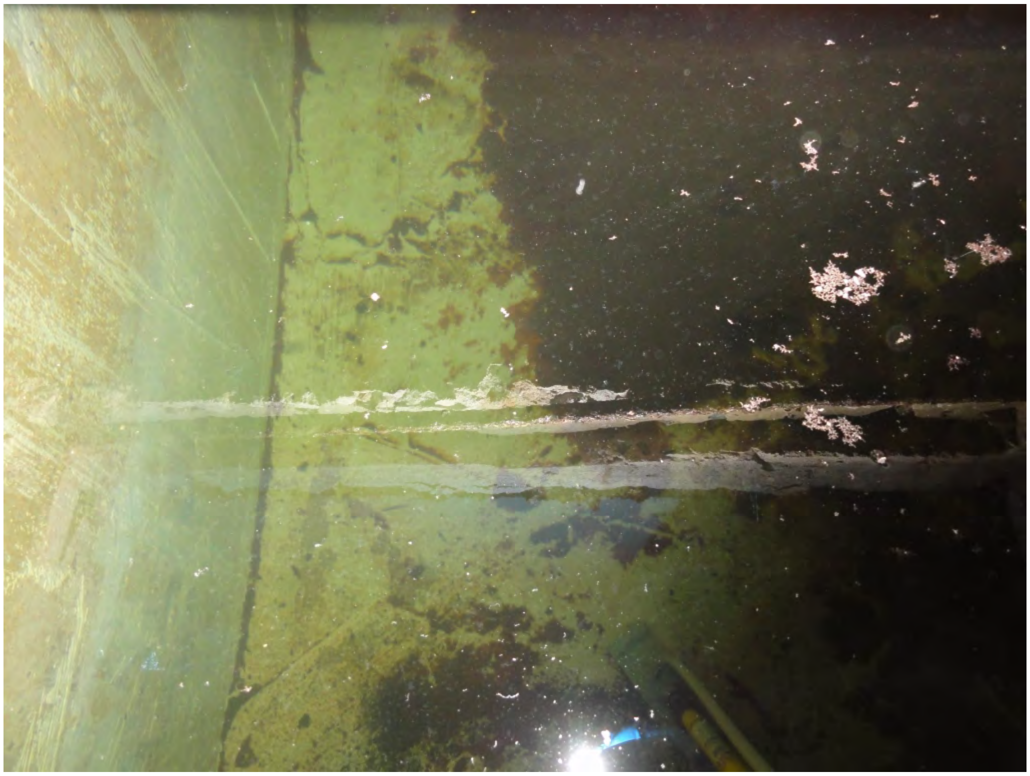
Photograph 24: **PH200 – Cistern Photo 1**.


Photograph 25: **PH200 – Cistern Photo 2**.


Photograph 26: **PH118 – Cistern Photo 1**.

Photograph 27: **PH118 – Cistern Photo 2**.

Photograph 28: **PH200 – Cistern Photo 1**.



Photograph 29: **PH200 – Cistern Photo 2**.

Photograph 30: Modified sander head.

Photograph 31: Extension rod and sander head.

Photograph 32: Sediment vacuumed were discharged to 5-gallon buckets.

Photograph 33: Peristaltic Pump and battery pack used to vacuum the sediment.

Photograph 34: Sediment extracted from PH200.