Data Usability Report 1
Cleanup Verification Sampling Data
Krejci Dump Site

Cuyahoga Valley National Park
Summit County, Ohio
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The National Park Service

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LIST OF ACRONYMS

AOC	Area of Concern
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CVS	Cleanup Verification Sampling
CV	Coefficient of Variation
CVSP	Cleanup Verification Sampling Plan
DOT	Department of Transportation
DQE	Data Quality Evaluation
DQO	Data Quality Objective
DUR	Data Usability Report
EQIS	EQ Industrial Services, Inc.
FSP	Field Sampling Plan
FQAO	Field Quality Assurance Officer
Ford	Ford Motor Company
LPC	Laboratory Performance Criteria
LOQ	Limit of Quantitation
MQO	Measurement Quality Objective
OSR	National Park Service On-Site Representative
OU	Operable Unit
Park	Cuyahoga Valley National Park
PID	Photoionization Detector
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RI	Remedial Investigation
RAWP	Remedial Action Work Plan
RD	Remedial Design
RG	Remediation Goal
RL	Reliance Level
RPD	Relative Percent Difference
ROD	Record of Decision
Site	Krejci Dump Site
SOW	Statement of Work
TEQ	2,3,7,8 TCDD Toxicity Equivalent
VOC	Volatile Organic Compound
WCP	Waste Characterization Plan

Section 1. Introduction

This Krejci Dump Site (Site) Data Usability Report (DUR) 1 was commissioned by the National Park Service (NPS) to enable NPS's independent evaluation and determination of: (1) whether the Cleanup Verification Sampling (CVS) data for the Site are of sufficient quality for use in determining achievement of Site Remediation Goals (RGs); and (2) whether the usable data establish that the RGs have been achieved. The usability evaluation of CVS data is set forth in three DURs. This DUR 1 evaluates CVS data for soil samples collected at the end of the first round of excavation and that were reported in the September 11, 2009 CVS database. DUR 2 evaluates CVS data first reported in the December 16, 2010 CVS database (excluding data related to dioxins and furans), and DUR 3 evaluates CVS data first reported in the October 7, 2011 CVS database as well as all dioxin and furan test results (including dioxin and furan test results preliminarily addressed in DUR 1).

The data usability assessment proceeds as follows: (1) all CVS measurements are compared to project measurement quality objectives (MQOs), since measurements that attain all MQOs are usable; (2) all CVS measurements are then compared to a derived reliance level (RL), which is a calculated concentration that sets a limit on how close a CVS measurement can be to the RG without undue concern that noncompliance with MQOs might impact decisionmaking; and (3) CVS measurements that exceed the reliance level and do not achieve all MQOs are then individually evaluated using other contextual factors such as other related CVS data (e.g., other CVS results for same analyte in the same grid, CVS results for other analytes in the same analyte group in the same grid, CVS results for linked or associated analytes in the same grid), field and laboratory batch-specific data quality indicators, and qualitative data collection proficiency measures, to determine if the acquired measurement quality is sufficient to support the RG achievement decision.

This document is organized as follows: Section 2 provides a Site overview; Section 3 presents the Site CVS process; Section 4 discusses the data quality objectives (DQOs) and the quality assurance (QA) program; Section 5 discusses laboratory performance criteria (LPCs); Section 6 discusses MQOs and RGs; Section 7 develops a procedure for identifying qualified CVS measurements; Section 8 discusses the data usability of qualified measurements; Section 9 compares usable data to RGs; and Section 10 presents a summary and conclusion. Appendix A contains summaries of all quality control (QC) sample analyses and CVS test results organized by parameter group and analyte and discusses data usability for each analyte. Appendix B contains all CVS test results organized by location and date (sample identifier) and compares them to RGs.

Section 2. Site Overview

The roughly 47-acre Site is a former municipal and industrial dump and salvage located within the Cuyahoga Valley National Park (Park) in Summit County, Ohio. During the years of operation from approximately 1950 to 1980, large volumes of solid and liquid waste materials were brought to the dump, where significant quantities of hazardous substances were released to the environment as a result of open dumping, spills, leaking containers, and burning.

The United States purchased the land in 1980 for management by the Department of the Interior National Park Service (NPS). In 1987, it was determined that the Site may constitute a threat to human health and the environment. In response to this determination, the U.S. Environmental Protection Agency (EPA) initiated an emergency removal action in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in June 1987. In November 1988, NPS completed the removal of wastes staged during the initial EPA activity, as well as the removal of unconsolidated wastes remaining on the West Site. Large quantities of debris and contaminated soil remained.

Following extensive Site investigations and completion of the CERCLA Remedial Investigation and Feasibility Study (RI/FS), the Site Remedial Action (RA) was selected and set forth in the 2002 Record of Decision (ROD) issued by NPS. The ROD requires, among other things, that all debris and soils containing unacceptable levels of contaminants will be excavated and disposed off-site at appropriately licensed or permitted facilities. The ROD also established RGs for each identified Site contaminant. The ROD was incorporated into the Consent Decree (CD) negotiated with Ford Motor Company (Ford) and other Site responsible parties and entered by the U.S. District Court for the Northern District of Ohio (April 22, 2002). Under the terms of the Ford CD, Ford is implementing the RA, subject to NPS oversight, and in accordance with the Statement of Work (SOW) (CD Appendix B), which sets forth additional RA implementation requirements.

Ford retained Environmental Quality Industrial Services, Inc. (EQIS) as its contractor to conduct the cleanup. The Remedial Design (RD) Report and Remedial Action Work Plan (RAWP) detailing the RA design and implementation plans, respectively, were prepared on Ford's behalf and approved by NPS in 2005.[1] Initial excavation began in October 2005.

The Site comprises two areas referred to the West Site (approximately 19 acres) and East Site (approximately 28 acres), located as shown on Figure 2.1.[2] For the RI, the Site was divided into fourteen Areas of Concern (AOCs). RI data is reported in relation to these AOCs. Later, for the purposes of the Feasibility Study (FS) and Remedial Action (RA) design, the Site was divided into nine Operable Units (OUs). RA data is reported in relation to OUs. Both RI and RA sample collection locations are related to State plane coordinates in data reports. Of most significance now for the purpose of RA implementation, the Site was divided into 186 grids (76 on the West Site and 110 on the East Site) that are generally ¼-acre in size, located and identified as shown on Figures 2.2 and 2.3.[3] All CVS test results

[1] Various amendments have been made to the RA documents. The only amendment to the Field Sampling Plan (FSP) was made on June 8, 2009.

[2] The West Site consists of approximately 19 acres and is bounded by property managed by Metro Parks Serving Summit County to the west, Boston Township right-of-way for Hines Hill Road to the southwest, Ohio Department of Transportation right-of-way for Interstate 271 to the southeast, and NPS-managed Park land to the north and northwest. The East Site consists of an estimated 28 acres and is bounded by NPS-managed Park land on an all sides; note that it is divided by and does not include the Boston Township right-of-way for Hines Hill Road.

[3] Grid locations were established in final format on April 18, 2008. Prior to this date some East Site and West Site grids were located and labeled differently. The data evaluated by this report uses the grid locations identifiers presented on maps

and decisions regarding RG achievements are made for each contaminant that has an RG as specified in the SOW and each individual grid.[4]

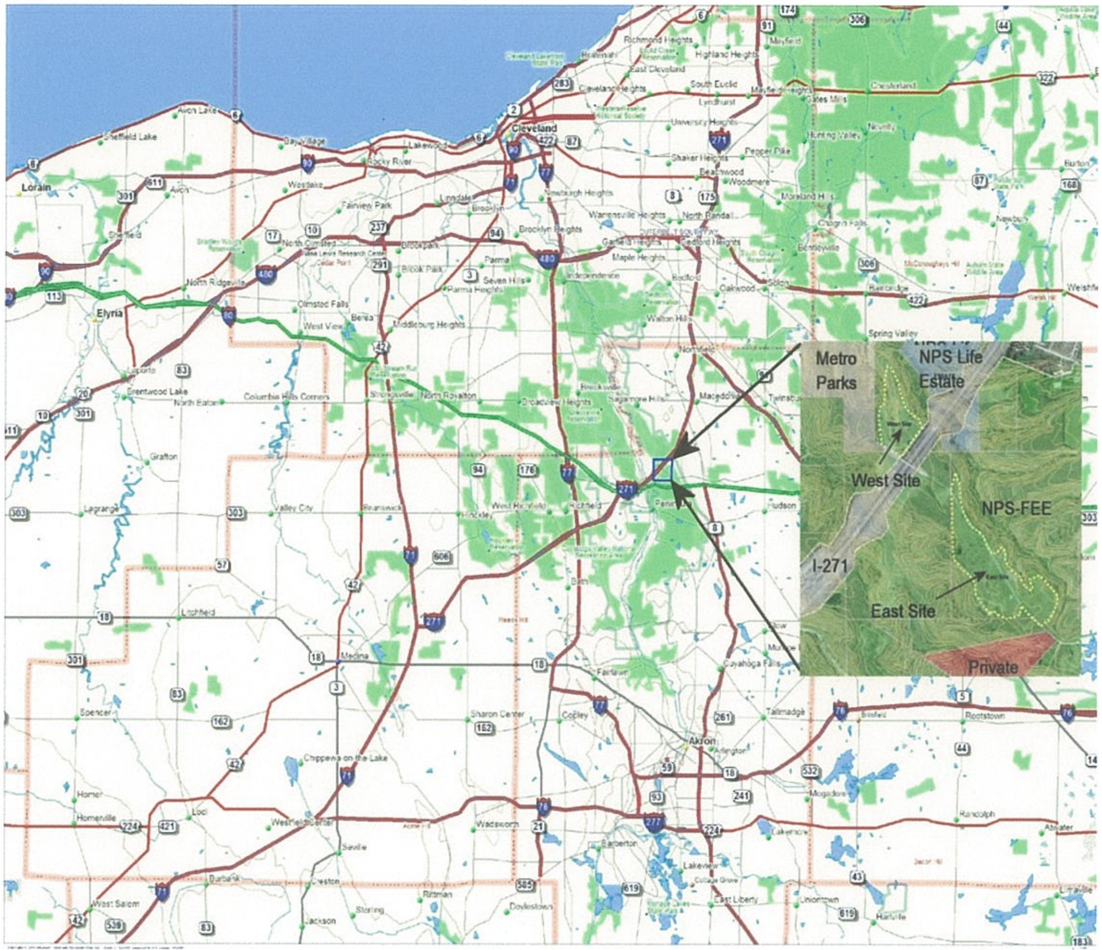

Figure 2.1 Krejci Site Location and Property Map

conveyed by email to Mark Gemperline, Margaret Lake and Wendy Block from Bernd Rehm on April 18, 2008 and included in the June 8, 2008 QAPP amendment. Subsequently, the area of East Site grid G03 was added to East Site grid G02 and grid was G03 eliminated. All data presented and discussed herein is related to these final grid locations.

[4] Twelve acres of the Site (48 grids) are subject to the dioxin/furan RG. The SOW prescribed initial CVS of the 1-acre dioxin/furan areas (the bolded areas on Figures 2.2 and 2.3), and allowed that if the dioxin/furan CVS results for a 1-acre area indicated RG failure, then re-sampling in each of the four ¼-acre grids in the area is permitted prior to additional excavation, following which RG achievement would be measured by individual grid rather than 1-acre area.

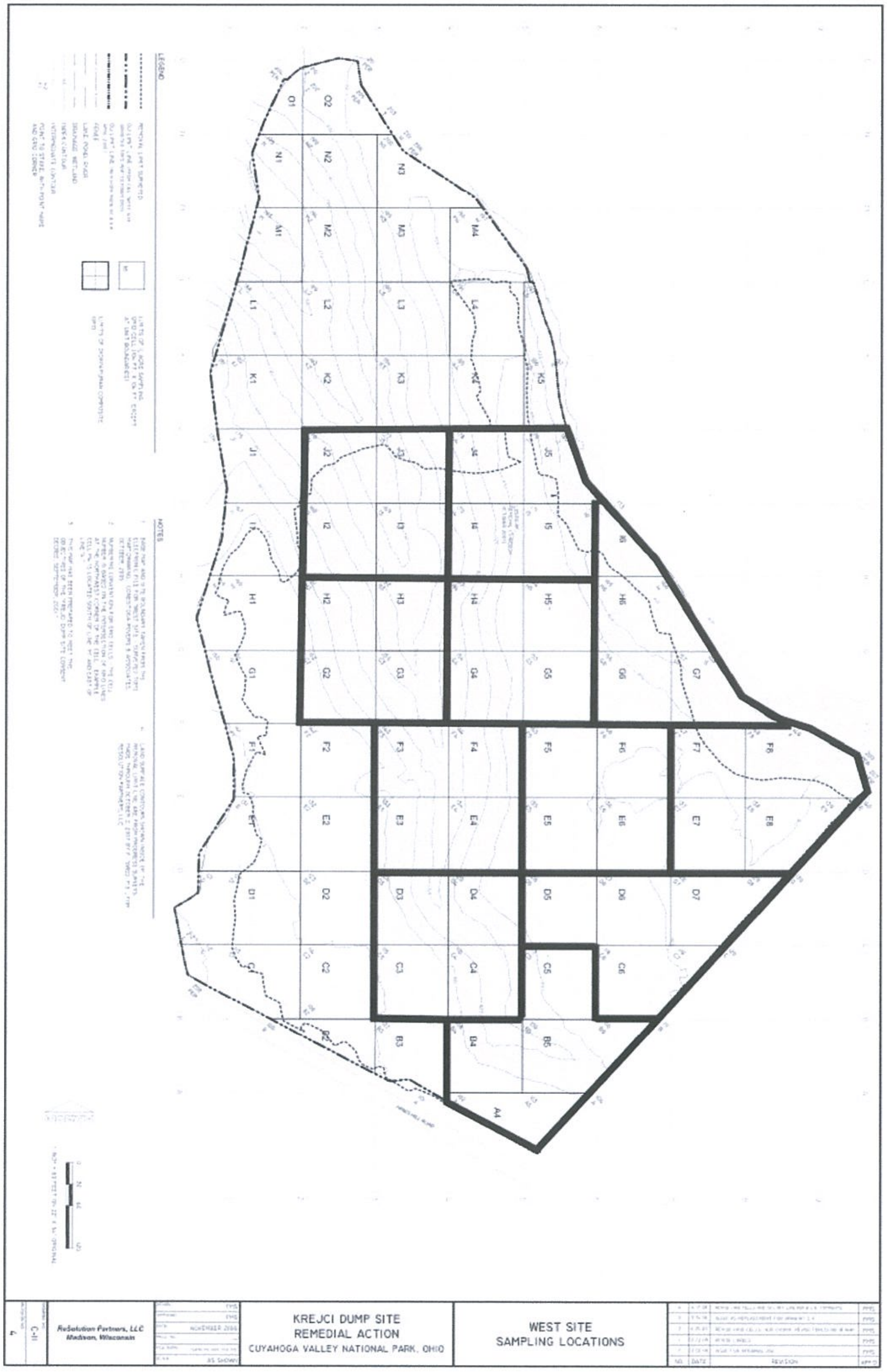

Figure 2.2 Krejci West Site Grids and Dioxin Sampling Areas (bold)

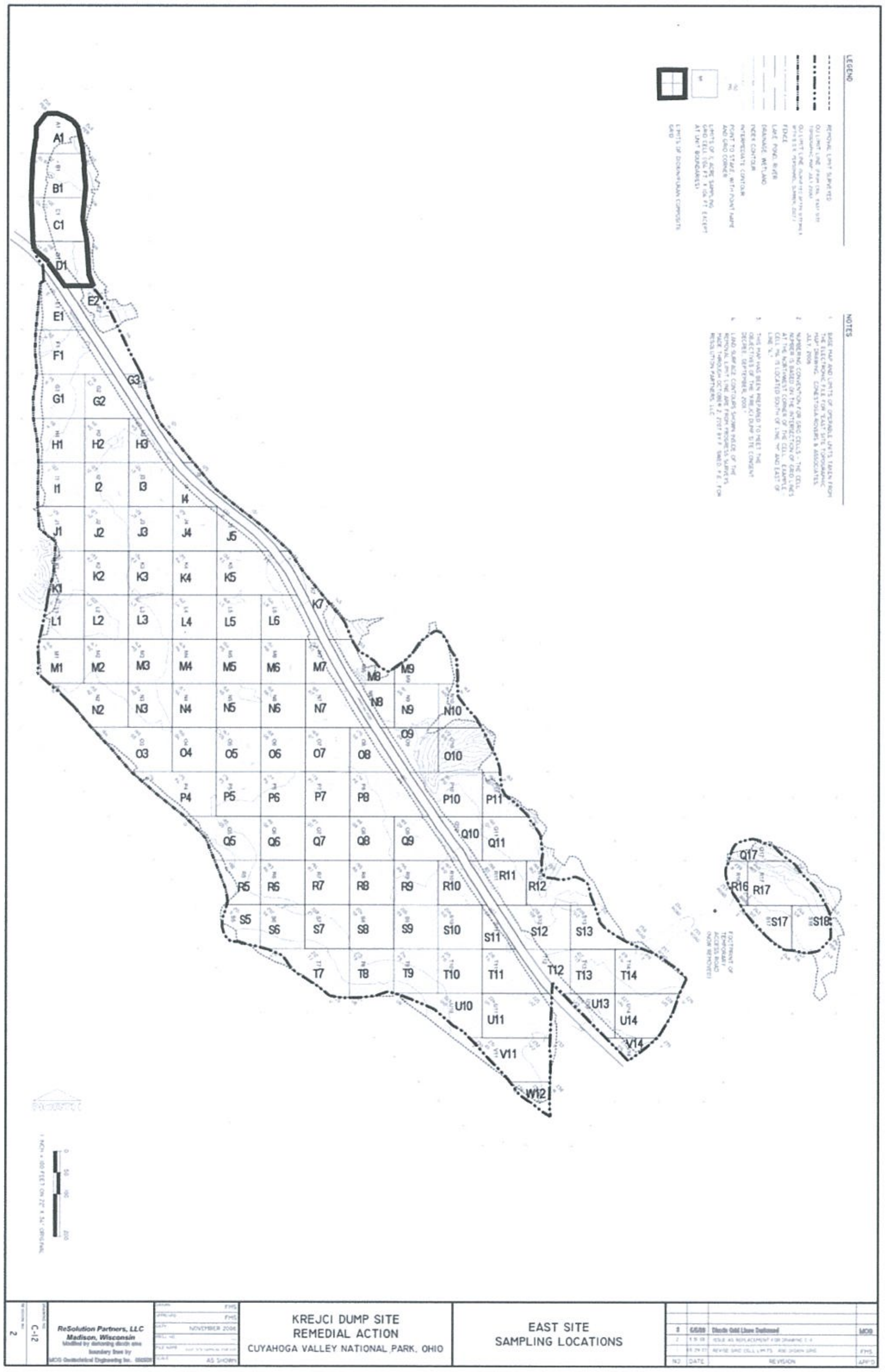

Figure 2.3 Krejci East Site Grids and Dioxin Sampling Area (bold)

Section 3. Site Cleanup Verification Process

3.1 Overview of Soil Data Collection and Usability Analysis

The selected Site remedy requires that all debris and soils containing unacceptable levels of contaminants will be excavated and properly disposed off-site. The Site governing documents (e.g., ROD, CD, and SOW) define the terms by which this remedy is achieved, as well as the process to verify that this remedy has been achieved.

Site RGs as set forth in the ROD and incorporated into the CD establish the maximum concentration level of each identified Site contaminant that may remain in the soil to achieve the standard of cleanup required by the ROD. The soil sample collection process is set forth in the SOW. Detailed procedures for processing and analyzing soil samples for determining soil contaminant concentrations and achievement of RGs are established in the 2005 Remedial Design (RD) Report, which includes the Cleanup Verification Sampling Plan (CVS Plan), Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP).

The CVS Plan provides that one sample comprised of approximately 40 increments of soil is collected to represent the surface of each ¼-acre grid. These samples are analyzed to determine the concentration of the Site contaminants listed in Appendix D, SOW, except for benzene and dioxins/furans. Samples for benzene analyses are collected from a single discrete location within each ¼-acre grid. Dioxin/furan samples (2,3,7,8-TCDD TEQ) are collected to represent the 12 identified one-acre dioxin/furan areas (or, alternatively, the individual ¼-acre grids within some of the 12 areas). Soils samples are submitted for laboratory analyses pursuant to QAPP protocols, and the resulting data is validated and entered into the Site database, also pursuant to established QAPP protocols.

To ensure that soil sampling analyses are of the quality needed to limit the risk of erroneous decisions regarding attainment of RGs, the QAPP sets forth criteria for evaluating the quality and usability of CVS data.[5] More specifically, the QAPP establishes ten (10) measurement quality objectives (MQOs) by which the quality of CVS data can be evaluated. When CVS data routinely achieve applicable MQOs, these data are of sufficient quality to be used to verify whether Site grids have achieved the RGs; when CVS data fails to achieve MQOs, these data are assigned data qualifiers and are subject to additional evaluation to determine usability. Finally, usable data are compared with the RG for each applicable contaminant to verify that all RGs have been achieved in each grid. Once all grids have achieved all RGs, all unacceptable levels of contaminants have been excavated and removed from the Site as set forth in the ROD and CD.

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[5] The RD Report and Remedial Action (RA) Work Plan (RAWP) set forth remediation protocols in addition to the MQOs that further ensured a quality process resulted in quality data. For example, a representative of the NPS was on Site at all times during periods of sampling and remediation to assure that field procedures and remedial actions were implemented in a manner consistent with the RD and RAWP. In addition, the QAPP was prepared in accordance with "EPA Requirements for Quality Assurance Project Plan", EPA QA/R-5 (March 2001) and "Guidance for Quality Assurance Project Plans," EPA QA/G-5 (December 2002). The QAPP addresses cleanup verification, sampling, and analysis required to ensure that soil containing unacceptable levels of contaminants has been removed. This data usability report fulfills the QAPP Section 5.3 requirement that an evaluation of the validated data be performed to assess data usability relative to project DQOs.

The initial RA excavation began in October, 2005 and was completed in June, 2007 and consisted of removal of all debris and some soil. Surface soil samples were collected and tested after the initial excavation in an effort to determine whether the remaining Site soil in the various Site areas achieved the RGs. CVS analyses related to the initial excavation were completed, in large part, in August, 2009 and the resulting data is contained in the database provided by EQIS to NPS on September 11, 2009. In the "Data Quality Evaluation 1 (DQE 1)," EQIS evaluated this CVS data, identified the data that routinely achieved the MQOs related to laboratory testing, and assigned qualifiers to data that failed to achieve these MQOs. The DQE 1 report does not include presentation and evaluation of NPS quality control or quality assurance measures. Such presentation and evaluation, which is relevant to evaluating MQO attainment and evaluating data quality, is included herein.

In this report, NPS first introduces the data quality needs and evaluates and confirms the validity of the analyses and conclusions made in DQE 1 with respect to the identification of data that routinely achieved the MQOs related to testing. Next, this report evaluates the qualified data to decide whether these measurements have sufficient quality for use in RG determinations. Finally, this report compares all usable September 2009 database measurements (identified in DQE 1 and this report) to the RGs, for each contaminant in each grid, to verify which RGs were attained following initial excavation.

In Site grids for which CVS data is both usable and indicates achievement of all applicable RGs, this report concludes that the materials removal component of the project (i.e., excavation) in that grid is complete. There are a number of grids in which soil samples achieved some but not all RGs. These grids have been subject to additional excavation and CVS sampling; however, some of the CVS data from the initial excavation may be usable and determinative of RG achievement for the following reason. Once a grid has achieved the RG for every contaminant within a single parameter group, the achievement of the RGs for those contaminants is established and is not re-tested in future CVS events. This report, therefore, evaluates the CVS data for the contaminants in the completed parameter groups in these partially completed grids. Subsequent excavation and CVS sampling has since been conducted in these grids, and this newer CVS data will be the subject of other DQE and DUR reports, for the contaminants in the incomplete parameter groups only. More detail on this process is provided below.

3.2 Overview of Cleanup Verification Analysis

The Site RGs are set forth in SOW Appendix D, which is reproduced as Table 3.1 herein. Each of the thirty-nine listed Site contaminants has a Tier 1 or Tier 2 RG as explained below. Dioxin/furans congeners collectively have a single RG, which is also explained below. The contaminants are divided into six parameter groups: metals, pesticides and PCBs, volatile organic compounds, polycyclic aromatic hydrocarbons, phthalate esters, and dioxins/furans. The contaminants are also divided into six "cases," which serve a different purpose and do not correlate with the parameter groups.

Table3.1 Remediation Goals

Parameter Group	Analyte	RG		Case
		Tier 1 RG (mg/kg)	Tier 2 RG (mg/kg)	
Metals	ALUMINUM	21000	24000	1
	ANTIMONY	1.9		2
	ARSENIC	13	30	2
	BARIUM	210	220	1
	BERYLLIUM	2.1		1
	BORON	31	35	2
	CADMIUM	0.57	1.3	2
	CHROMIUM	31	35	1
	COBALT	21	30	1
	COPPER	34		5
	LEAD	100		1
	MANGANESE	3650		1
	MOLYBDENUM	14	16	2
	NICKEL	190		5
	SELENIUM	1.9	14	2
	SILVER	17	17	5
	VANADIUM	37	44	1
	ZINC	140		1
	MERCURY	1.7	2.4	2
PCBs	AROCLOR 1232	0.075		4
	AROCLOR 1242	0.075		4
	AROCLOR 1248	0.075		4
	AROCLOR 1254	0.075		4
	AROCLOR 1260	0.075		4
Pesticides	4,4'-DDE	0.16		4
	ALDRIN	0.01		4
	ALPHA-BHC	0.003		5
	GAMMA-CHLORDANE	0.083		4
	HEPTACHLOR EPOXIDE	0.011		5
Semivolatile Organics	BENZO(A)ANTHRACENE	0.55		4
	BENZO(A)PYRENE	0.55		4
	BENZO(B)FLUORANTHENE	0.55		4
	BENZO(K)FLUORANTHENE	0.55		4
	BIS(2-ETHYLHEXYL) PHTHALATE	0.55		4
	CHRYSENE	0.55		4
	DIBENZ(A,H)ANTHRACENE	0.55		4
	INDENO(1,2,3-CD)PYRENE	0.55		4
Volatile Organics	BENZENE	0.0060		6

Significance of parameter designation: Once all contaminants within a parameter group have achieved their respective RGs in a specific grid, CVS need not be conducted again for those contaminants following subsequent excavation. If, however, there is an RG failure of any contaminant within a parameter group in a specific grid, CVS must be conducted and the RG achieved for all contaminants within that parameter group following the subsequent excavation in that grid. The dioxin/furan parameter group is unique, in that there is one RG for the entire group of dioxins/furans, and the dioxins/furans are considered collectively in determining achievement of the RG. The dioxin/furan RG Toxicity Equivalent (TEQ) is calculated as the sum of the products of the concentration of each of 14 dioxin/furan congeners and their respective toxicity equivalency factor, which adjusts each congener's toxicity in relation to 2,3,7,8-TCDD, the most toxic dioxin/furan congener. The TEQ calculation is applied to CVS results for 14 congeners as described in Section 9.

Significance of case designation: In the ROD and CD, analytes are grouped according to the method used to establish their respective RGs, and each group is identified by a case number designation. Each of the Case 4 - 6 contaminants has a single "Tier 1" RG listed in parts per million (ppm). For these contaminants, the usable CVS data representing the soil concentration for each contaminant in each grid (or area, in the case of dioxins/furans) is compared to the RG, and is deemed to achieve the RG when the CVS measurements do not exceed the RG. For these contaminants without Tier-2 RGs, an exceedance of the Tier-1 RG within the measurement area constitutes a failure. Most of the Case 1 and 2 contaminants have a two-tiered RG, with the Tier 2 RG being higher than the Tier 1 RG. For these contaminants, the RG is achieved whenever the usable CVS data representing the soil concentration for each contaminant in each grid does not exceed the Tier 1 remediation goal (RG); or alternatively, up to two exceedances of the Tier-1 RG are permitted for each grid as long as the Tier-2 RG is met for those contaminants.

As a general rule, following a CVS result indicating failure of one or more RGs within a grid, a six inch excavation of that grid must be completed prior to another CVS event to test achievement of RGs in that grid. In some instances, the SOW allows for an additional CVS sampling event in a failing grid prior to additional excavation. In addition, the SOW sets forth a separate and unique CVS procedure for dioxins/furans. CVS for dioxins/furans was to occur after all other contaminants had met RGs, and then only in twelve (12) designated dioxin/furan acres. The SOW prescribed initial CVS of each 1-acre dioxin/furan area, and allowed that if the dioxin/furan CVS results for a 1-acre area indicated RG failure, then re-sampling in each of the four ¼-acre grids in the area is permitted prior to additional excavation. Following this, RG achievement would be measured by individual grid rather than the 1-acre area.

In order to achieve efficiency in mobilization and progress in excavation, it was often desirable to make decisions to conduct additional excavation using validated data that had not yet undergone all usability evaluations. Such decisions were permitted when the validated data was deemed to be sufficiently reliable for use in determining when additional excavation was necessary, even if the analyses had not yet been performed to establish that the data was sufficiently reliable for determining RG achievement.

This choice theoretically could have resulted in more excavation than necessary, but likely did not. In any case, there was no possibility of impacting confidence in RG achievement, since all final comparisons to RGs utilize only validated and usable data.

Section 4. Quality Assurance

4.1 Overview of Quality Assurance Program

The RA Quality Assurance (QA) program is comprehensive and detailed at length in the QAPP. The program includes procedures for each step of the cleanup verification process, including sampling, labeling, shipping, homogenizing, splitting, laboratory analyses, and populating a database, all of which are designed to improve data quality and ensure that CVS results can be relied upon and used for determining RG achievement. The program includes a comprehensive auditing program (including, for example, field audits, laboratory audits, readiness reviews and database checks) designed to ensure that program procedures have been followed as intended.

The quality of field activities was monitored and assured by processes and procedures that included training, audits, documentation and diligent oversight by the project team. The NPS On-Site Representative (OSR) was on Site at all times when field activity took place, to observe and report field operations. The OSR documented Site activities in daily reports and assured that Site activities were compliant with the RD and RAWP.

The quality of laboratory activities was monitored and assured by use of standard operating procedures that were implemented according to the laboratory Quality Assurance Plan (QAP) and evaluated by both internal and NPS-attended laboratory audits. Data reported by the laboratory was reviewed and verified by laboratory personnel before it was presented as a finished product, and this effort is documented in a series of laboratory reports. To assure an unbiased evaluation of the laboratory measurements, a chemist working independently of the laboratory performed rigorous data validation using the National Functional Guidelines or more stringent requirements, and this effort is documented in a series of validation reports. Laboratory attainment of performance criteria for individual laboratory sample batches is discussed in these reports. In addition, NPS periodically submitted quality control (QC) samples to the project laboratory to support evaluation of laboratory performance. These included blind certified reference materials (a CRM is a soil sample containing a known quantity of one or more contaminants) and blind splits of select samples (these are CVS samples previously homogenized and tested by the laboratory and returned to the OSR who resubmitted them to the laboratory after relabeling them using a new sample identifier)[6]. Moreover, in addition to the project QA program, a laboratory internal QA program was implemented to assure that laboratory performance achieves common, as well as project specific, standards of practice.

[6] This document reports and interprets the results of NPS quality control (QC) sample analyses as well as QC samples inserted into the sample stream by the Field QA Officer.

The procedural and auditing requirements of the laboratory QAP, taken together, are essentially self-correcting. These requirements have been routinely followed throughout project implementation and are not the subject of this report. The quality assurance program set forth in the QAPP, however, includes specific performance objectives for data quality designed to assure that data is sufficiently reliable for use in verifying achievement of Site RGs. There are ten (10) measurement quality objectives (MQOs), discussed in greater detail below, that place limits on process errors to control precision, accuracy, representativeness, comparability, completeness and sensitivity of measurements (PARCCS). Project compliance with MQOs related to testing is addressed in a Data Quality Evaluation Report 1 (DQE 1) (May 2012). The report herein, in significant part, evaluates data that has not complied with all MQOs, to determine the reliability, and consequently the usability of such data for determining RG achievement.

4.2 Data and Measurement Quality Objectives

Data quality objectives (DQOs) for the project that are presented in the QAPP were developed from a series of planning steps based on the scientific method designed to ensure that the type, quantity, and quality of environmental data used in decisionmaking are appropriate for the intended application[7]. The DQOs articulate project specific decision goals that guided the development of the Site sampling and analysis plan. Measurement performance criteria (MPC) were derived from the DQOs and consist of Laboratory Performance Criteria (LPCs) and Measurement Quality Objectives (MQOs), which are discussed in Sections 5 and 6 respectively.

The following critical DQO establishes the level of data quality needed to determine if the requirements of the ROD and CD have been met:

> *No ¼-acre area (or 1-acre area in the case of dioxin/furan) will be declared to have met the Site remediation goals when the sample used for decision-making contains contamination in excess of the Site remediation goals.*

In furtherance of the above objective, the QAPP sets forth ten (10) Measurement Quality Objectives (MQOs) designed to evaluate precision, accuracy, representativeness, comparability, completeness and sensitivity of measurements (PARCCS). The MQOs are presented in Figure 4.1. Taken together, these performance-based MQOs are designed to indirectly limit the frequency of instances when data indicates that a grid is contaminated when it is not, or indicates that a grid is clean when it is not. The program is designed so that when data achieves all MQOs, it is: 1) sufficiently reliable for use in determining RG achievement; and 2) when data does not achieve all MQOs, it may also be sufficiently reliable for use in RG decisionmaking, but additional evaluation of the data is required to make this determination.

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[7] The seven steps are: stating the problem, identifying the decision, identifying inputs to the decision, defining the boundaries of the study, developing a decision rule, specifying limits on decision errors, and optimizing the design for obtaining data.

This additional data usability evaluation is the chief objective of this report. It is conducted herein using a statistical, outcome-based approach, which supplements the performance-based MQOs. In other words, instead of looking to the performance-based MQOs, this report uses statistical quantities to evaluates whether the precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCCS) of the data is sufficient to allow confident decisionmaking. The following rule has been devised for this remedial effort to articulate, in statistical terms, the acceptable limits of decision error, applied to the evaluation of data for usability:

> *When a sample measurement is to be used for decisionmaking and it did not routinely achieve one or more MQOs, the sample measurement must be less than the Site RG, and there must be less than a 20 percent chance the sample true concentration exceeds the RG by 20 percent or more.*

In Section 6 of this report, usability analyses evaluate compliance of the non-MQO-compliant CVS data against this objective. The rule is a statement of the approximate data quality capable of being achieved by MQO-compliant CVS data. The sections below provide a brief description of precision and accuracy, followed by definitions, procedures and statistical measures used for PARCCS evaluations herein.

4.3 Precision and Accuracy Described

The evaluation of data quality relies most heavily on estimating the accuracy and precision of contaminant concentration measurements. The following discussion explains these concepts.

"Accuracy" refers to how similar a measurement is to the true value. "Precision" refers to repeatability, or how similar repeated measurements are to each other. The terms "bias" and "error" are often used synonymously for accuracy and precision respectively.

Figure 4.1 Traditional description of accuracy and precision.

The limits on decision errors stated in the previous section necessitate that limits be placed on inaccuracy and imprecision in order to ensure acceptable decisionmaking confidence. Accuracy is the tendency of the measurements to come close to the intended value. Precision is the tendency to have the measurements cluster. Figure 4.1 portrays traditional concepts of accuracy and precision while Figures 4.2 and 4.3 uses target shooting as an example. The cluster of holes to the right of the target on Figure 4.2 represents poor accuracy since the intended target was routinely missed. The large spread of the cluster suggests poor precision. In contrast, good precision and accuracy are suggested by the tight cluster of holes centered on the bulls-eye on Figure 4.3. The analogous relationship between the target shooting example and CVS contaminant measurement is derived by associating the targets bulls-eye to the true CVS chemical concentration and associating each shot at the target to a chemical measurement intended to represent the true CVS concentration.

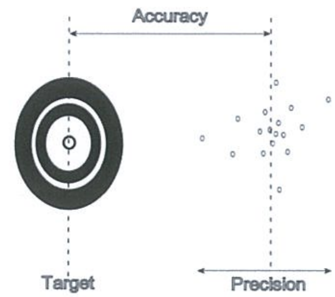

Figure 4.2 Target shooting demonstration of poor accuracy and poor precision.

4.4 Precision

Two measures of precision are used in subsequent discussion: the relative percent difference and the standard deviation of a data set.

The relative percent difference (RPD) is commonly calculated for paired data sets representing duplicate measurements. Different types of duplicate measurements were used in the QA program to evaluate precision associated with different processes e.g. duplicate CRMs, laboratory duplicates, field duplicates, etc. These are discussed in subsequent sections. The RPD between two

Figure 4.3 Target shooting demonstration of good accuracy and good precision.

measurements is calculated using the following formula:

$$RPD = \left(\frac{|R_1 - R_2|}{R_1 + R_2} \right) \cdot 200$$

where:

R_1=value of first result

R_2=value of second result

Standard deviation (SD) is the most widely used measure of the precision of a data set. A value of zero represents perfect precision while larger values represent increasingly less precise measurement. Standard deviation (SD) has utility in calculations that estimate confidence in decisionmaking. Methods used to calculate SD are beyond the scope of this report. SD is observed to vary with the estimated mean (average) of the data sets. For example, SD of analytical measurements in the ug/kg range are typically in the ug/kg range while those in the mg/kg range are typically in the mg/kg range. This relationship diminishes the value of using SD for comparing precision of two data sets that have significantly different mean analyte concentrations. The standard deviation can be "normalized" with respect to the mean to provide for comparison of precision for such data sets. Dividing the SD by the sample mean (x) gives a "relative standard deviation" also called "coefficient of variation" (CV). These values are commonly expressed as percentages. Standard deviation is used in Section 6 to estimate expected confidence in decisionmaking when concentrations are near the RG. The coefficient of variation is used to demonstrate differences in precision, relative to the mean, between data sets that have varying mean concentrations e.g. CRMs from different vendors.

4.5 Accuracy (Bias)

Accuracy is evaluated by measuring the concentration of a contaminant in a sample that has a known concentration and comparing the measurement to the known value (true value). Percent recovery (R) is a measure used to quantify accuracy and is calculated by one of the following two methods depending on the situation.

1) The following equation is used when accuracy is evaluated using a certified reference material (i.e. a soil sample made to have a prescribed concentration of the contaminant).

$$R = \frac{100x\text{Measured\_Value}}{\text{True\_Value}}$$

2) The following equation is used when accuracy is evaluated by spiking a sample that may already contain some of the contaminant.

$$R = \frac{(SSR - SR)\cdot 100}{SA}$$

where:

SSR = Spiked Sample Result

SR = Sample Result or Background

SA = Spike Added

Bias (inaccuracy) is a systematic error occurring in a chemical measurement. A calculated value of R equal to 100 percent suggests there is no bias: whereas numbers consistently less than or consistently greater than 100 percent indicate bias. Greater bias is indicated by greater deviation of R from 100 percent. Values of R greater than 100 percent indicate a bias favoring high measurements while values less than 100 percent indicate a bias favoring low measurements.

The different types of bias that may be present and the different times when those biases may occur complicate quantitative assessments of accuracy. For example, a few types of potential biasing errors are listed below:

- Consistent additive biasing error (e.g., the data handling algorithm might add a constant to all measurements as they are entered into the database; or mixing samples with a metal spoon may routinely add metals to the sample).

- Consistent multiplicative biasing error (e.g., application of an unduly high or inadequately low multiplicative factor to correct for loss of semi-volatile organic compounds during sample processing or an incorrect instrument calibration).
- Intermittent biasing errors of the additive and multiplicative types (e.g., misplaced decimal, poor recovery of contaminant due to equipment problem, random sample contamination, and transcription errors). Intermittent errors are very difficult to detect and quantify because they occur infrequently and unpredictably.

Generally the best that can be done to safeguard data quality is to limit the chance that these errors will occur by applying well defined laboratory and field procedures, training, audits and diligent oversight.

The QAPP was designed to reduce the risks of intermittent errors by requiring diligent, routine checks to be performed on the procedures and by assuring correct and consistent implementation of appropriate and well-defined laboratory and field practices. For example, QAPP requirements are in place to check one in ten entries in the database, and if any errors are discovered then all the data is checked; readiness reviews are performed before the first implementation of each task, when there is a change in personnel, and otherwise periodically to assure that the staff involved in implementing a procedure understand it well; and laboratory and field audits are routinely conducted to ensure procedures are implemented correctly.

Laboratory and project QC samples are used to detect and quantify consistent bias and occasionally detect intermittent bias and imprecision. Section 6 discusses measured errors in CVS data and associated impacts on decisionmaking.

4.6 Representativeness

Composite samples are intended to provide unbiased representations of average chemical concentration in the top two inches of undisturbed soil in ¼-acre areas (one-acre areas in the case of dioxin/furan)[8]. This requires that: 1) field sub-samples are collected in the correct locations and represent the surface two inches of undisturbed soil; 2) the mass of each sub-sample combined to form the composite is large enough to include representation of the largest particle sizes; 3) the mass of each sub-sample is the same; 4) composite samples are completely homogenized and properly split so each test aliquot has the same chemical composition; and 5) holding times and other variables that might hamper sample representativeness are controlled. Project-specific concerns and measures of success related to these requirements are discussed in the remainder of this section.

<u>Procedures ensured correct sampling locations, representation of particles sizes, and sample mass</u>

The SOW established CVS procedures that provide for a 40-part composite sample (of approximately equal soil mass in each part) to represent the surface two inches of soil in ¼-acre areas (grids). Site grids

[8] The degree of representation depends significantly on the distribution chemical concentrations on the ground surface. Detailed discussion is beyond the scope of this report. Suffice it to say here, the degree of representation is established by the SOW specification to use 40 soil increments.

are shown on Figures 2.2 and 2.3. Due to the irregular shape of the Site boundary, boundary grids were not precisely ¼-acre; accordingly, the number of soil increments collected within each grid varied in proportion to the size of these grids, with 40 increments collected in ¼-acre grids. Grid sizes varying between approximately 1/6 and 3/8 acre resulted in minor inequalities in the degree of representativeness between grids and slightly different grid representations than those specified by the SOW. The magnitude of the deviations from desired conditions is small resulting in only minor effects on grid representations. Therefore the use of varying grid sizes around the perimeter of the Site is acceptable.

Field oversight of well-defined sampling procedures by the Project Site Manager, the Field Quality Assurance Officer, and the NPS On-Site Representative provided several layers of checks that reasonably assured that field sub-samples were collected in the correct locations and represented the surface two inches of undisturbed soil. Furthermore, careful inspection and measurement of sub-samples as they were collected assured that the volume of each sub-sample was approximately 50 ml and excluded gravel particles larger than ¼-inch.

Homogenization Procedures

A sample collected by the procedure briefly described in the previous paragraph (a composite of soil specimens from various locations within a grid) is heterogeneous and must be homogenized prior to testing. Generally, it is desired to limit CVS measurement variance caused by inhomogeneity to less than the measurement variance due to other causes. To effectuate uniformity in the homogenization process, the field sampling plan contains a site specific sample homogenization procedure that was performed on all CVS samples. The efficiency of the homogenization process is judged by the ability to obtain the same measurement repeatedly from different aliquots (splits) taken from one homogenized sample. To measure homogenization success, samples were spiked with potassium nitrate (KNO_3) prior to homogenization, thereby initially creating a heterogeneous concentration of KNO_3 in the sample. If homogenization is successful, the KNO_3 concentration is approximately the same throughout the sample. Two splits were obtained from the sample following the homogenization and splitting process and the NO_3^- concentration determined for each. It is common laboratory practice to limit the difference in matrix spike duplicate measurements to 35 percent. Consequently, an RPD less than or equal to 35 percent is considered indicative of successful homogenization and is listed as a project specific MQO (See Section 6). The results of these checks are presented in Section 7.4.

Control of holding times and other variables that could impact sample representativeness

The chemical concentration of certain analytes in soil stored in a jar may change significantly over time. This is most significant for soil containing volatile and/or biodegradable substances such as organic compounds and mercury; it is less a concern for soil containing only inorganic analytes. Therefore, to assure true measurements of soil concentration, specific holding time restrictions were placed on the analyses for various analytes. Section 7.4 evaluates representativeness of samples by comparing sample extraction and analysis holding times to criteria specified in QAPP Table 3.2. Representativeness requires that prescribed sample holding-time periods are met for organic compounds and mercury.

<u>Audits and oversight ensured correct application of procedures</u>

In addition to the above described QC measures used to evaluate representativeness, the QAPP specifies that representativeness is to be assured by strict adherence to SOPs and specific protocols. Field audits were performed by the EQIS Field Quality Assurance Officer (FQAO) as follows: 1) at the time of the first sampling event; 2) once every 100 sampling events thereafter; and 3) when a change in field personnel or a major change in procedure occurred. Additionally, the conduct of field activities was scrutinized by NPS On-Site Representatives and audited by EQIS. Audits included documentation of compliance. The effectiveness of field and laboratory oversight is discussed in Sections 7.1 and 7.2 respectively.

4.7 Completeness

The decision regarding attainment of all the RGs is to be made for each grid based on the results of analyses performed on a single 40-increment sample. To make a valid comparison to the RGs it is critical that this single sample for a grid has a usable measurement of each analytical parameter. Hence, a complete set of usable data is needed for each grid, i.e. completeness must be 100 percent. The equation used to calculate percent completeness is:

$$\%\text{Completeness} = \left(\frac{\text{Number\_of\_usable\_measurements}}{\text{Number\_of\_measurements\_planned}}\right)\cdot 100$$

4.8 Comparability

It is imperative that analyses produce measurements that are comparable to those used to develop the Site RGs. For instance, many metal contaminant RGs were based upon background concentrations measured during the Site RI. For new metal contaminant data to be comparable, the same metals extraction efficiency achieved in the RI must be achieved for CVS testing. To determine this, the same extraction and analysis procedures used during the RI were applied to CVS. Initially, when representative background samples were tested under current conditions (e.g., new lab, new machines) using unchanged procedures, there was a statistically significant departure in comparability between new and old metals data. In general, new measurements were much lower. Procedural adjustments to the extraction procedure (specifically, increased microwave digestion times) were required to achieve the same RI efficiency. Accordingly, suitable digestion time adjustments were investigated, tested, and identified using background samples. These adjustments were effectuated on April 2, 2009 as laboratory corrective actions, modified on April 24, 2009[9], and subsequently included in the June 8, 2009 amendments to the QAPP.[10] For data to be usable it must conform to the adjusted procedure.

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[9] The corrective actions identified and accepted on April 2, 2009 showed arsenic and selenium digested in a solution of nitric acid and HCL acid. This was corrected on April 24, 2009 to a solution of nitric acid only. Digestion times were not further adjusted.

[10] Amendments to the RA documents were made effective June 8, 2009 that, among other things, established metals microwave digestion times to be used when implementing method SW846-3051 with the laboratory's recently purchased microwave, documented grid locations and identifiers associated with CVS sampling, and documented changes to the project

Analyte concentrations are equal to the ratio of the mass of contaminant to the mass of soil. The calculation of concentration can result in two different numbers depending on whether the mass of soil includes water or not. The RGs are based on soil contaminant concentrations that are relative to the dry weight of the soil. Consequently, the SOW requires that CVS concentration measurements be relative to soil dry weight for appropriate comparison to RGs. The laboratory initially reported CVS results relative to soil wet-weight. To convert these results to dry-weight-based concentrations, moisture content (aka percent solids) measurements were determined for preserved splits of the tested CVS samples, and applied to each respective test result. The database includes both the original wet-weight-based concentrations as well as the subsequent dry-weight-based concentrations for organic compounds. However, only the dry-weight based concentrations are used for comparison to RGs.

4.9 Sensitivity

Sensitivity pertains to the lowest concentration of a substance that can be measured as distinguished from the absence of that substance (a blank value) within a stated confidence limit (a statistical term-of-art and generally 1%). This means that no more than 1% of the time would a higher measurement occur in the absence of the substance. When analyzing CVS samples for the purpose of determining whether Site RGs have been achieved, it is critical that detection limits are low enough to enable reliable measurements of contaminants in the concentration ranges of the RGs. Thus, the QAPP requires detection limits for metals that are low enough to routinely quantify concentrations in the Site background range for metals, and detection limits for organic contaminants that are half the respective Site RG. Method detection limits specified in the QAPP are presented in Table 3.1. The sensitivity of the sample data is reviewed herein to ensure that it is sufficient to achieve these detection limits.

By definition, the method detection limit (MDL) is the lowest analyte concentration detectable with reasonable confidence using a particular analytical method (including all steps of preparation and analysis), and it is calculated as a function of the standard deviation of error ("noise") introduced by the method.

Whereas MDL is the minimum concentration level at which there is reasonable assurance that the analyte has indeed been detected, the limit of quantitation (LOQ) is the minimum analyte level that provides reasonable assurance that the analyte concentration has actual significance as a measurement.

The Practical Quantitation Limit (PQL) or Reporting Limit are commonly used to establish the minimum value a laboratory will quantitate and is equal to or higher than the LOQ. The methods for determining this value varies among laboratories. It is often defined simply as about 5 times the MDL.

MQO's use the MDL as the sensitivity measure. Data sensitivity is compared to the QAPP established limits in Section 7.4.

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team. National Park Service, letter to Jeff Hartlund (EQIS) from Shawn Mulligan (NPS), RE: Draft QAPP Amendments, Krejci Dump Site, June 4, 2009.

Section 5. LPCs and Data Qualifiers

The laboratory performance criteria (LPC) set forth in the QAPP include requirements for method blanks, initial calibration standards, calibration verification standards, internal standards, surrogate compound spikes, matrix spike and matrix spike duplicate (MS/MSD) samples, and performance evaluation (PE) samples. The methods that were used to analyze samples along with the type, analysis frequency and acceptance criteria for laboratory QC samples are discussed in QAPP Section 2.8.2 and are summarized in QAPP Table 2.3.

Laboratory performance criteria were routinely evaluated by the laboratory to monitor performance and allow corrections to be made in a timely manner so that valid data would be produced. Internal data and process reviews were performed by laboratory quality control personnel. Data review was also performed by a chemist who is independent of the data collection and analysis process. These reviews ensured the data quality meets laboratory standards and project specific LPCs. Data not achieving these standards were flagged with a "data qualifier." A data qualifier is a one, two or three character notation that is assigned to a piece of data to indicate a specific problem, or a potential problem, with that data. Laboratory data qualifiers are initially added by the laboratory and included in laboratory reports. Additional qualifiers are assigned to data during data validation and these are included in data validation reports. Following data validation, attainment of MQOs related to testing was evaluated and additional qualifiers added as needed. These qualifiers are presented in DQE 1. All qualifiers were considered during preparation of this report. NPS quality control measurements collected during the remedial effort are also used to assess data usability as discussed in subsequent sections.

To facilitate data usability assessment, a select set of data used to evaluate LPCs is included in the database (as required by the SOW), including surrogate, matrix spike and matrix spike duplicate, and laboratory duplicate measurements. This information has been evaluated in data validation reports and DQE 1, is presented in Appendix A of this report, and is discussed in greater detail in Sections 7 and 8.

Section 6. Measurement Quality Objectives

MQOs are project-specific analytical parameters derived from project specific DQOs. MQOs include acceptance criteria for PARCCS that, if achieved, reasonably assure that data will be usable to make confident decisions regarding RG achievement. (Discussion of DQOs and PARCCS is in Section 4.) Less assurance for decisionmaking may be afforded by data of lesser quality. Data that does not achieve MQOs, therefore, require further evaluation to determine if the quality is adequate. The MQOs are listed in the QAPP where they are presented as follows.

> *Data will be usable to determine if the Site remediation goals have been achieved if data assessment measurements suggest the validated data routinely achieves the following MQOs (the respective PARCC is appended):*

1. *detection limits must be low enough to routinely quantify concentrations in the background range for metals and at half the remediation goals for organic contaminants while achieving the subsequent MQOs; (Sensitivity MQO)*

2. *measurement precisions represented by the calculated RPDs between blind composite sample splits are less than 35%; (Precision MQO)*

3. *measurement precisions represented by the calculated RPDs among repeated analyses of blind duplicate CRMs are less than 35%; (Precision MQO)*

4. *the RPD between measured nitrate concentrations of unique splits from a homogenized composite sample is always less than 35%; (Representativeness MQO, June 8, 2009 amendment to QAPP)*

5. *it can be statistically inferred at the 10% significance level that the means of the new background sample results are equal to the means of the RI background sample results for naturally occurring elements (10% significance establishes a limit on the chance of rejecting the equality of new and old measurements when they actually are equal); (Comparability MQO)*

6. *accuracies determined by the measurement of contaminant concentrations in blind CRMs are within manufacturers recommendations; (Accuracy MQO)*

7. *contaminants contained in CRMs are not misidentified; (Representativeness MQO)*

8. *audits are complete, well documented, and confirm that readiness reviews were performed and SOPs were correctly and routinely followed; corrective actions were taken when necessary; (Representativeness MQO)*

9. *excavation depth measurement used to represent the average excavation depth for each ¼-acre area is within 0.1 foot greater or less than the true depth but not uniformly greater or less; (Representativeness MQO) and*

10. *PID calibration gas measurement is within 10 percent of the manufacturers specified calibration gas concentration. (Accuracy MQO)*

Achievement of MQOs related to laboratory analyses is evaluated in the DQE 1 Report. They, and all other MQOs, except MQO number 9 because it is not pertinent to the initial excavation, are also evaluated in Section 7 using the following specific measures and observations.

Precision is evaluated by calculating the RPDs of blind composite sample splits and blind duplicate CRMs, and comparing these values to the MQO of 35 percent. Also, standard deviations are estimated for each analyte to represent measurements near background concentrations for metals and near the remediation goal for organic compounds. Standard deviations are used with estimates of accuracy to evaluate decisionmaking error.

Accuracy is evaluated by comparing measurements of contaminant concentrations in blind CRMs with the manufacturers 95 percent upper and lower acceptance limits and actual spiked concentration ("made to" concentration). Accuracy related to field measurement of benzene involves calculating the percent deviation of the photo ionization detector (PID) calibration gas measurement relative to the calibration gas concentration and comparing these calculated values to the MQO 10 specification.

Representativeness is evaluated in several ways: by comparing the analytes contained in CRMs to the analytes reported by the laboratory to determine correct identification; reviewing audits for completeness; and confirming that readiness reviews were performed and SOPs were correctly and routinely followed. Holding times for samples are compared to requirements in QAPP Table 3.2. To evaluate homogenization efficiency, and thereby the representativeness of test aliquots obtained from CVS samples, duplicate nitrate concentrations RPDs for spiked samples are calculated and compared to the MQO requirement that the RPD be less than 35 percent. The quality of ground surface elevation measurements is not evaluated herein since this data usability report is limited in scope to the initial excavation, and depth of excavation for the initial excavation is inconsequential.

Comparability is evaluated, in part, by assuring that RA analyses were performed using the same methods used during the RI. It is further evaluated by assessing the similarity of measurements for RA background samples and measurements of RI background samples. Determination of comparability also requires establishing that corrective actions were implemented as necessary for achieving comparability of such measurements. This was accomplished during laboratory audits. Comparability is also evaluated by determining that reported concentrations are reported on a dry-weight basis.

Sensitivity is evaluated by comparing the actual laboratory MDLs and Reporting Limits to those identified in Table 3.1 (QAPP Table 2.2).

The evaluation in Section 7 includes the use of NPS quality control samples that were not considered in the MQO evaluation presented in the DQE 1 Report.

Section 7. Data Usability Methods and Results

7.1 Field Oversight

Many tasks performed on Site during RA activities have the potential to significantly influence the quality of the cleanup and the confidence with which decisions may be made regarding attainment of RGs. Procedures for those tasks considered most influential are detailed in the RD Report and RAWP, such that it is likely that a remediation activity was successful when the prescribed procedures were performed as specified. Two general approaches were used to assure that adequate performance of field procedures was achieved. First to the extent practical, measurements were made and compared to project specific acceptable standards of practice, such as MQOs and LPCs. Second, when measurements were not practical, compliance with procedures was assured by close monitoring of activities (field and laboratory oversight). Such monitoring allowed early detection of procedural errors and immediate development and implementation of corrective actions.

The EQIS Project Manager, Quality Assurance Officer (QAO), and Site personnel were responsible for assuring that procedures and practices were implemented according to the RD Report and RAWP. Additionally, NPS's On-Site Representative (OSR) was present during all RA activities and provided an independent level of review. NPS also maintained an off Site group of technical experts with whom the OSR communicated on a regular basis, and who were available for consultation whenever questions arose. The EQIS Field Quality Assurance Officer and the OSR prepared independent daily reports of activities and observations. These reports documented problems encountered and corrective actions taken. The OSR reports were reviewed by the NPS technical experts to evaluate compliance with the RA and RAWP; identify potential problems and propose corrective actions; and evaluate the impact of corrective actions on the quality of the RA and related decisions. By this process field problems were identified and corrected immediately, thereby reasonably assuring procedures were implemented as expected and a high quality cleanup resulted. Furthermore, the process assured that CVS collection activities were in accordance with the Field Sampling Plan (RD, Appendix C) thereby assuring that errors did not occur during this effort and that CVS of acceptable quality were collected for testing.

7.2 Laboratory Oversight

Compliance with industry accepted standards of practice with regard to specified analytical procedures was assured by evaluating the laboratory quality assurance plan and ensuring its implementation. For some methods this project required attainment of data quality that exceeded common practice because decisions regarding attainment of RGs for a grid are based on analyses of one representative multi-incremental sample. Project specific standards are presented as LPCs in the QAPP Table 3.2 and are the focus of comparisons and discussions in Appendix A and Section 7.4.

NPS technical experts audited testing laboratories and reviewed and approved the quality assurance plans (QAPs) and operating procedures prior to the start of laboratory analyses of CVS. A laboratory quality assurance officer monitored day-to-day operations within the laboratory and immediately corrected problems that could adversely impact data quality. The EQIS quality assurance officer (QAO) operated independently of the laboratory and provided oversight that included laboratory audits and data validation in accordance with QAPP specified procedures. Data validation reports and audits were documented by the EQIS QAO and reviewed by NPS technical experts. Additionally, the NPS provided a technical expert to provide independent oversight of laboratory audits and to spot check laboratory and validation reports. Problems identified by the EQIS QAO and/or the NPS technical experts were corrected immediately. By this process, laboratory problems were identified and immediately corrected, thereby reasonably assuring that procedures were implemented as expected and that CVS measurements of acceptable quality were made.

7.3 QC Measurements

Quality control (QC) measurements were made during the RA to evaluate attainment of MQOs and LPCs. Samples were submitted by NPS, EQIS and the laboratory for this purpose. QC protocols and criteria were implemented with various methods and procedures to demonstrate that data of known quality were generated. QC protocols and criteria and their interpretation to evaluate decision rules are included in the QAPP. Consistent with the CD, a CVS measurement that meets QAPP-specified LPCs and MQOs is acceptable for making project related decisions without qualification. A measurement that does not meet QAPP-specified LPCs or MQOs may be used with qualification if, by subsequent data usability evaluation, it is demonstrated to be of sufficient quality to permit decisions to be made with acceptable confidence. [Acceptable decisionmaking confidence is discussed in Sections 3 and 7.7.]

QC measurements needed to evaluate achievement of MQOs and some of the QC measurements needed to evaluate achievement of LPCs are included in the September 11, 2009 database. These are presented in Appendix A tables for each inorganic analyte and organic compound having an RG. Tables in Appendix A also compare QC measurements to MQOs and LPCs and provide relevant discussion specific to each analyte and organic compound.

A study conducted by EQIS to test volatilization during sample processing of semi-volatile compounds concluded that there was a possible loss of semi-volatile organic compounds during processing. Semi-volatile concentration measurements contained in the database were, therefore, adjusted to be 4/3 of the laboratory reported measurements, to correct for possible loss of semi-volatile organic compounds during sample processing. The 4/3 correction was applied to all semi-volatile organic data because all samples, including QC samples, underwent the same, or nearly the same sample processing steps. QC measurements presented in Appendix A demonstrate that the 4/3 correction generally results in high, environmentally conservative estimates of semi-volatile organic compound concentrations. Laboratory and field QC are described and presented in the next two sections.

7.4 Laboratory QC

Many different types of tests and checks were made by the laboratory to assure data quality. The database contains the laboratory QC results of NO_3^- analyses used to evaluate homogenization, laboratory duplicate, laboratory control sample, surrogate spike, and matrix spike samples. Also, the sample collection dates, sample extraction dates, and sample test dates are included and allow the calculation of sample holding times. This data is presented graphically below or in Appendix A, Tables 5 through 10 with data listed above the plots. For surrogate results presented in Appendix A, only data demonstrating exceedance of the LPC is tabularized. Each data type is discussed in the following paragraphs.

<u>Homogenization Success Determination by KNO_3 Spiking</u>

Potassium Nitrate (KNO_3) was added to CVS samples (aka "spiking" the sample) as they were received in the laboratory prior to homogenization. This was done to create a heterogeneous condition that successful homogenization was expected to remove. The MQO in the QAPP was to assure the RPD of duplicate NO_3^{-2} measurements was always less than 35 percent following homogenization. Duplicate NO_3^{-2} measurements were made using SW 846 Method 9056 for every homogenized sample and the MQO was achieved with one exception. The data is plotted in Figure 7.1. The observed RPD measurement distribution is approximately the same or narrower than the RPD distributions observed for many sets of replicate certified reference material (CRM) analyses, duplicate analyses, matrix spike and surrogate analyses (respective plots for all analytes are included in Appendix A). Based on this information, it is concluded that the homogenization process was successful and did not greatly influence measurement quality.

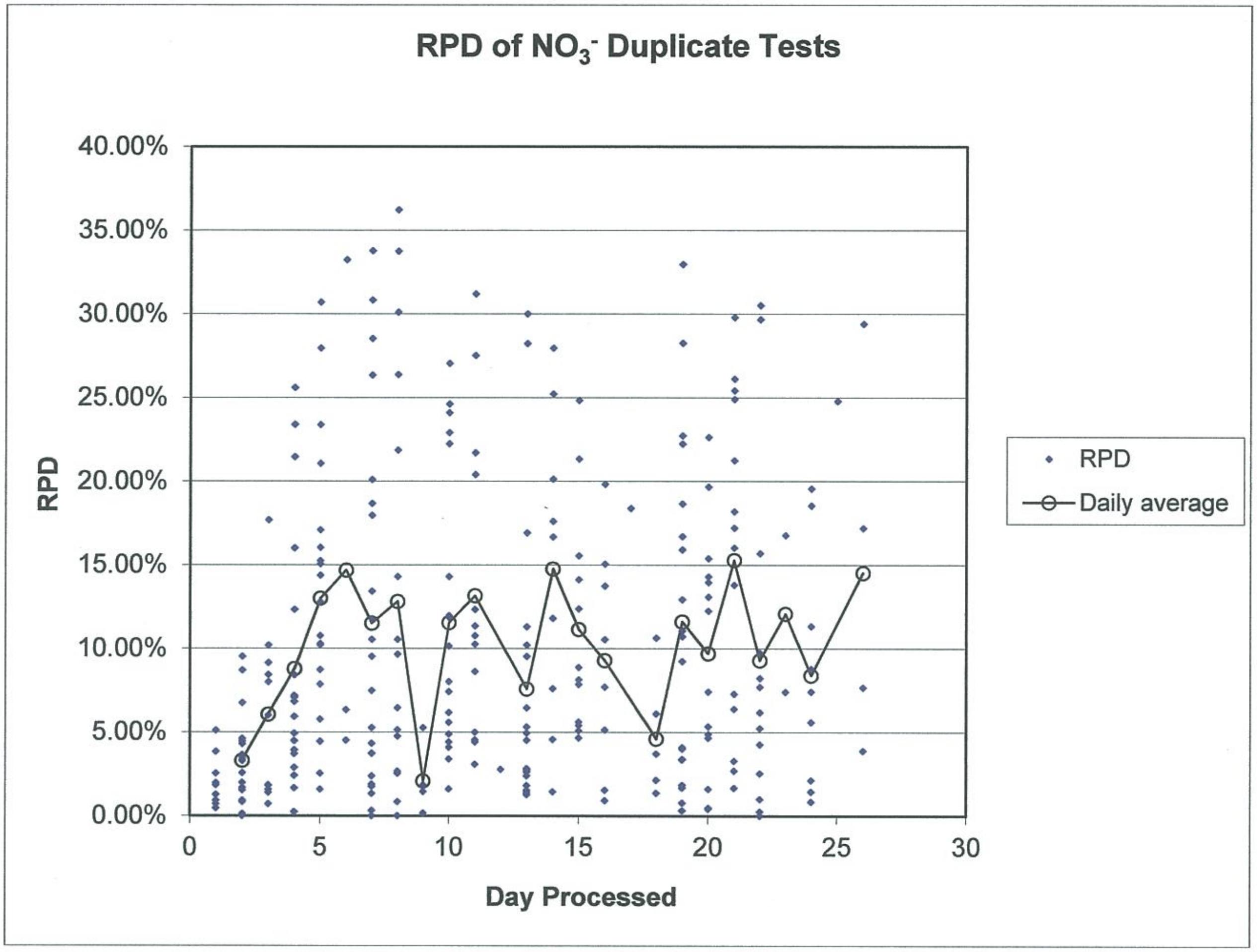

Figure 7.1 RPD of Potassium Nitrate Spiked Samples.

Holding Times

Sample holding times have importance to data quality in that the risk of concentration-altering events, such as chemical reactions, biodegradation, volatilization, chemical adsorption to glass, loss due to leaky seals, etc., increases with time. QAPP Table 3.2 establishes project specific holding times for analyte groups. Compliance with holding times is discussed in the following paragraphs.

For metals other than mercury, the QAPP Table 3.2 -specified holding time is 180 days. Due to program difficulties, CVS samples for metals other than mercury, selenium, arsenic, and antimony were held between 297 and 447 days prior to digestion and then analyzed within 14 days. Selenium, arsenic and antimony were held 316 to 447 days prior to digestion and then analyzed 14 to 37 days later. The metals samples were held in refrigerated storage prior to digestion and analysis, and it is unlikely their quality was adversely impacted by the extended holding time. Also, since all field QC was held for the same period of time with the CVS sample, it is expected that any problems experienced by the metals samples due to the extended holding time would also be manifested in the QC samples and thereby be considered in subsequent data usability analysis. Such problems were not manifested.

The QAPP-specified holding time for mercury is 28 days. Initial CVS samples significantly exceeded this holding time, and it was likely that the quality of these samples for mercury analyses would be adversely impacted by the extended holding time. Accordingly, new CVS samples were collected for mercury analyses, and these samples were held for only 6 to 24 days prior to digestion and analyzed 1 to 3 days later. Consequently, samples collected for mercury analyses were analyzed within the prescribed holding times.

For PCBs, semi-volatile organic compounds and pesticides, the QAPP-specified maximum holding time to extraction analyses is 14 days, with an additional 40 days after extraction allowed for analysis. Other than as detailed in the following paragraphs, all analyses for PCBs, semi-volatile organic compounds, and pesticides occurred within these holding times.

PCB analyses in 18 grids were conducted using samples extracted beyond the holding time. These were analyzed within the allowable holding time following extraction. PCB CVS samples collected between May 1 and May 15 2008 for 14 West Site grids (ES-H02,-I03,-J03,-K03,-L06,-M04,-P05,-P06 and WS-E06,-H01,-I01,-K02,-K03,-K04) were held between 15 and 21 days before extraction. These short exceedances of PCBs holding times will not likely have a significant impact on data quality and, because occasionally QC samples were also held excessive periods, the effect on recovery and precision was considered in subsequent analyses (and found to be insignificant). PCB CVS samples for four East Site grids (O06, I02, O04, and P07) collected November 11, and May 14, 15, and 19 respectively, were held more than 50 days before extraction. These samples were used for conducting repeat analyses, and the results of these analyses were not used in decisionmaking and will, therefore, not impact decision quality. No PCB CVS was extracted in the interval 22 and 50 days following sample collection. A recent change to the SW846 Method 8082 PBCs testing procedure has extended the recommended holding time for extraction from 14 days to one year. By this new standard, the PCBs holding time exceedances are considered inconsequential.

Pesticides analyses in 34 grids were conducted using samples extracted beyond the holding time for pesticides, but analyzed within the allowable holding time following extraction. The pesticide CVS samples for 31 West Site grids (ES -H02-080515, -I02-080514, -I03-080513, -J03-080513, -K03-080514, -M02-080519, -M04-080515, -M09-080611, -N09-080610, O04-080515, -P05-080513, -P06-080515, -R08-080519, -T07-080612 and WS- -B02-080502, -B03-080502, -E06-080613, -H01-080501,-I01-080501, -J01-080505, -K01-080505, -K02-080509, -K03-080509, -K04-080513, -K05-080509, -L01-080505, -M01-080505, -N01-080506, -N02-080506, -O01-080506, -O02-080506) were held between 15 and 31 days before extraction. These short exceedances of pesticides holding times will not likely have a significant impact on data quality and, because occasionally QC samples were also held excessive periods, the effect on recovery and precision was considered in subsequent analyses (and found to be insignificant). Pesticide CVS samples for East Site ES-N07-080530, ES-M04-080515 and West Site WS-K02-080509 were held more than 50 days before extraction. These samples were used for conducting repeat analyses, and the results of these analyses were not used in decisionmaking and will, therefore, not impact decision quality. No pesticide CVS was extracted in the interval 32 and 50 days following sample collection.

Semi-volatile organic compound (SVOC) analyses in 38 grids were conducted using samples extracted beyond the holding time for SVOCs, but analyzed within the allowable holding time following extraction. Semi-volatile organic CVS samples for 31 West Site grids (ES-F01-080529, -G01-080529, -I01-080529, -I03-080513, -I04-080602, -J01-080529, -J03-080513, -J04-080530, -J05-080602, -K01-080602, -K02-080602, -M07-080612, -N07-080530, -O06-080529, -O07-080530, -O08-080530, -P05-080513, -P07-080519, -P08-080530, -R09-080520, -R10-080602, -T11-080530, -U11-080602, -V11-080529 and WS-D04-080623, -E06-080613, -H01-080501, -I01-080501, -K02-080509, -K03-080509, WS-K04-080513) were held between 15 and 31 days before extraction. These exceedances of SVOC holding times will not likely have a significant impact on data quality and, because occasionally QC samples were also held excessive periods, the effect on recovery and precision was considered in subsequent analyses (and found to be insignificant). Semivolatile CVS samples for six East Site and one West Site grids (ES-E02-080611, -T11-080530, -R06-080521, -Q05-080520, -P07-080519, -N04-080519 and WS-K04-080513) were held between 34 and 72 days before extraction. These samples were used for conducting repeat analyses, and the results of these analyses were not used in decisionmaking and will, therefore, not impact decision quality. No SVOC CVS was extracted in the interval 32 and 34 days following sample collection.

The QAPP Table 3.2-designated holding times for benzene CVS is 14 days to extraction and testing and for dioxin/furan CVS it is 30 days to extraction and 45 days following extraction to testing, All CVS were tested for benzene and dioxin/furan within these holding times except that West Site 1-acre dioxin/furan grids containing ¼-acre grids labeled H4 and F5 exceeded the holding time to extraction by 1 and 5 days respectively. These slight exceedances of the holding time are not expected to have a significant adverse effect on data quality. With regard to dioxin/furan quantitation, dioxin/furans are very persistent and a few days extra holding days prior to extraction, limited to only two samples, is likely not to result in a measureable loss and therefore be inconsequential to decisionmaking. With regard to benzene, this is because following excavation the Site surface was exposed to the atmosphere for several months prior to sample collection and such exposure would be expected to have a much greater impact on benzene measurement than a slightly exceeded holding time.

PID screening is not reported in the September 11, 2010 database and field screening for benzene using a photoionization detector (PID) is not a laboratory procedure. However, the timing of this activity is expected to have significance with regard to its intended use, which was to locate hot spots to allow conservative selection of samples for laboratory benzene analyses. The RD provided that PID screening was to occur shortly after excavation so that benzene exposed at the surface by the excavation would not have sufficient time to volatilize significantly before screening. This would provide the best opportunity to find benzene and thereby permit conservative selection of discrete samples for laboratory analyses. The PID screening was delayed for nearly a year following excavation and therefore its value with regard to directing sampling was significantly diminished.

Laboratory instrument accuracy

Laboratory control samples (LCS) are samples of known concentration analyzed with each test batch (of about 20 samples) to provide a measure of extraction and instrument accuracy. LCS duplicate (LCSD) analyses were performed with inorganic analyses test batches and the calculated RPD provides, among other things, a measurement of precision without influence of the soil matrix. LCS were monitored closely by the laboratory and procedural or instrument corrections made as needed to assure LPC limits were not exceeded. Never-the-less, occasionally they were. LCS recovery and RPDs are tabularized and graphically presented for each organic parameter in Appendix A, Table 6 and generally reflect the good LCS performance. The occasional exceedance is likely the result of an intermittent laboratory procedural error (intermittent error is defined in Section 4.5).

Laboratory within-batch measurement precision

Laboratory Duplicates (aka Method Duplicates) are analyses performed on separate aliquots of the same CVS sample. Each aliquot undergoes the digestion and analysis processes and is tested in the same analytical batch. Laboratory Duplicate analyses were performed for inorganic parameters and the calculated RPD is an indication of measurement precision. The calculated RPDs are tabularized and graphically presented in Appendix A, Table 7 for each inorganic analyte. Most analytes had one or more exceedance of the LPC. Frequent LPC exceedance is observed in data presented for antimony, cadmium, and boron and to a significant extent in data presented for lead and selenium.

Matrix Spike analyses accuracy and within-batch measurement precision

A Matrix spike (MS) is a CVS sample to which a known quantity of a target parameter is added. A matrix spike sample was analyzed with every batch of samples tested. Matrix spike duplicate (MSD) samples were also analyzed with each batch of organic analyses and are used to calculate percent recoveries in the extraction process. The MS and MSD results are used, among other things, to evaluate precision and the degree to which matrix interferences affect the overall identification and quantification of the parameters. Recovery and RPDs are tabularized and graphically presented in Appendix A, Tables 5 and 6. Measurements generally reflect the good performance with a tendency for slightly low bias and an occasional exceedance of the LPCs. Antimony and selenium MS recoveries generally exceeded the lower LPC limit, and the RPDs also frequently exceeded the LPC limit.

Surrogate Spike analyses

Surrogate Spike samples are CVS samples to which a surrogate compound (surrogate) is added. This type of sample is designed to detect potential quantitative errors in the actual analyses of each sample. Surrogates are non-target compounds spiked into each sample prior to analysis that elute at different times throughout the analysis and are selected so that they not interfere with analysis of the target compounds. Surrogates provide a measure of accuracy and aid in the determination of matrix interference. Only samples intended for organic analyses were spiked with a surrogate. The laboratory tracked surrogate behavior closely and made procedural and/or equipment adjustments as necessary to generally maintain recovery within acceptable ranges. Although infrequent, LPC exceedances occurred for every organic parameter. These are listed in the Appendix A, Tables 7 and 8, and LPC exceedances appear as peaks on the graphs. On these figures laboratory batches are presented in the order in which they were performed. Note that the sawtooth shape to the graphs is a consequence of sorting each of the surrogate recoveries by value within each batch and should not be interpreted as a progressive change during a batch run.

Laboratory QC summary

In summary, the calculated recoveries and RPDs for laboratory duplicates, LCS, LCSD, MS, MSD and surrogate measurements are tabularized and plotted relative to batch testing order in Appendix A. The plots include lines representing the LPC limits. LPC exceedances are readily distinguished by data that appear above or below the horizontal LPC limit lines. For many parameters, one or more LPC criteria were exceeded during CVS testing. Data qualifiers were assigned to data associated with LPC exceedances as discussed in DQE 1 and data validation reports. Data qualifiers are to be included in the final database.

Field QC is discussed in the next section. Measurements of precision and accuracy made using Field QC exhibit MQO exceedances that are often analogous the LPC exceedances. LPC recovery data suggests that many analytes and organic compound analyses are biased low. Likewise, it will be seen that field QC data generally leads to this conclusion. The effect on RG achievement and decisionmaking confidence is evaluated using reliance levels in Section 7.7 and 7.8.

7.5 Field QC

Data quality was routinely evaluated using quality control samples transmitted to the laboratory with CVS samples. Such samples submitted by EQIS were evaluated throughout the CVS testing effort and when necessary following modifications to procedures that were made to correct deficiencies. However, NPS field QC submittals were blind to both EQIS and the laboratory and provide a means to measure the overall measurement process performance. The September 11, 2009 database contains field QC results for the following: 1) NPS-purchased certified reference materials (NPS CRMs), 2) repeated tests on splits of a single homogenized sample obtained from either the background Site (NPS Background Replicates) or from the West Site (NPS West Site Replicates), 3) splits of laboratory homogenized CVS that were returned to the field and submitted independently by either NPS or EQIS (NPS and EQIS CVS Splits), and 4) EQIS-purchased certified reference materials (EQIS CRMs). Data are tabularized and presented with statistical summaries for each parameter in Appendix A, Tables 2 through 5. A discussion and summary is contained in Appendix A, Table 1. The following two paragraphs describe the contents and nomenclature used in Appendix A.

Nomenclature

The identifier for NPS field QC samples is prefixed with the letters "BOR." A cross-reference to vendor supplied identifiers was maintained by the NPS On-Site Representative in field notes. NPS field QC samples were given to the Field Quality Assurance Officer (FQAO) for submittal with CVS sample delivery groups. NPS QC was "blind" to EQIS and the laboratory with respect to chemical composition. However, CRMs and CVS Splits were easy to distinguish from other samples due to their small bottle size and pre-processed character.

The sample identifier for splits of CRM samples submitted by EQIS contains the letter "-Z" as the third character position. The character string "DUP" prefixes all EQIS splits of homogenized CVS samples. The results of tests on CRM samples and "DUP" samples are presented in Appendix A for each analyte and organic compound.

NPS and EQIS CRM Analyses

CRMs (see Appendix A, Table 4) are commercially prepared and purchased soil samples containing a measured quantity of contaminant. CRMs were submitted to the laboratory with CVS and tested to evaluate measurement accuracy. Analyses of duplicate sets of CRMs provide data to calculate RPD for precision evaluation. NPS and EQIS purchased their respective CRMs from different vendors. Only NPS technical experts knew the type and quantity of contaminants in CRMs that were purchased and submitted for testing. The NPS's vendor supplied certificates stating the "Made to" concentrations and the 95 percent acceptance limits for recovery for each parameter. The EQIS vendor supplied 99 percent acceptance limits for recovery for each included parameter. These 99 percent limits were used to back-calculate the 95 percent acceptance limits that are presented in Appendix A, Table 1 for comparison with laboratory measurements. Appendix A, Tables 2 and 5 present analyses in the order tested. Generally, two or more EQIS CRM samples were analyzed per laboratory batch, while only one NPS CRM was analyzed per laboratory batch. EQIS CRMs contained only 4 analytes per parameter group while NPS CRMS contained most parameters. Duplicate CRM analyses provide the only consistent measures of precision for organic analyses because splits of CVS samples seldom contain organic compounds in quantifiable quantity (methods of measuring precision for organic compounds are discussed in the next section, Section 4.4 and Section 6 and QAPP Sections 2.8.1 and 2.8.2). NPS CRM recovery is treated herein as an unbiased representation of accuracy and indicative of the overall bias. Accuracy demonstrated by NPS CRMs is presented for each parameter in Appendix A, Table 2.

NPS and EQIS Duplicate Analyses (between-batch analytical precision)

Duplicate analyses were performed on splits of CVS samples. The laboratory returned three splits of each CVS sample to the FQAO who, in turn gave two of those splits to the NPS OSR. The FQAO and NPS OSR each independently returned splits blind to the laboratory for analysis at a frequency of approximately one for every twenty CVS samples. The samples that were returned were randomly selected. By chance, in no instance, was the same sample used as a field duplicate by both NPS and EQIS. Each duplicate underwent the same digestion and analysis processes as the original sample split. Because the duplicates were submitted for testing later than the original sample, they were tested in different analytical batches. Therefore, the calculated RPD is an indication of between-batch measurement precision, as opposed to within-batch measurement precision measured by laboratory duplicates. Calculated RPDs for NPS and EQIS duplicate analyses are presented in Appendix A, Table 4.

NPS Background Replicate Test

NPS collected a soil sample from the Site background area in 2005 and had this sample homogenized by the NPS CRM vendor in the same rigorous manner used by the vendor to process soils for CRMs. The NPS OSR periodically submitted splits from the homogenized sample to the FQAO for inorganic analyte analysis. These measurements provide a method to evaluate trends and a measure of analytical precision at concentrations representing background concentration. Measurement error for repeated tests on this sample includes laboratory analytical imprecision as well as imprecision due to incomplete homogenization. For evaluation of data usability, it is presumed the rigorous CRM vendor's homogenization process has approximately the same efficiency as the project laboratory homogenization process. This assumption is supported by comparison of the coefficient of variation (CV) between background replicate tests and the CV estimated from RPDs for NPS and EQIS duplicate analyses. Twelve of sixteen possible comparisons result in the calculated CV for the replicate tests on the background sample exceeding the CV of the duplicate analyses. Therefore, the standard deviation of this data set is used conservatively as the primary representation of precision in subsequent data usability analyses. The results of replicate tests on a single background sample are presented for each inorganic analyte in Appendix A, Table 3.

NPS West Site Replicate Tests

NPS collected a single soil sample from the West Site in 2007 and had this sample homogenized by the NPS CRM vendor in the same rigorous manner the vendor used to process soils for CRMs. The NPS OSR periodically submitted splits from the homogenized sample to the FQAO for PCBs analyses. These measurements provide a method to evaluate trends in PCB analysis and a measure of analytical precision representing concentrations near the RG concentration. Measurement error for repeated tests on this sample includes laboratory analytical imprecision as well as imprecision due to incomplete homogenization. In subsequent evaluation of data usability, it is presumed the CRM vendor's homogenization process has approximately the same efficiency as the project laboratory homogenization process.. The results of replicate tests on a single West Site sample are presented with PCBs data in Appendix A, Table 3.

7.6 Data Qualifiers

Data qualifiers are one, two or three character notations assigned to a piece of data to indicate a specific problem with that data. For the Krejci Site, upon completion of a round of CVS testing, the CVS analytical results underwent a laboratory data verification process during which the laboratory assigned data qualifiers, as appropriate and required by the laboratory quality assurance plan. This process was followed by an independent data validation performed by the EQIS Quality Assurance Officer (QAO) which included the detailed comparison of laboratory QC information to procedural standards and project LPCs. The validation procedures were in accordance with National Functional Guidelines or more stringent requirements as identified in the QAPP. Measurements that did not achieve LPCs or otherwise were of questionable quality were assigned a qualifier that identified the condition resulting in noncompliance. The EQIS QAO then compared the validated data to QAPP-specified MQOs and, when a noncompliance was observed, assigned appropriate descriptive qualifiers to the data. All qualifiers are associated with respective measurements in associated laboratory reports, data validation reports and a data evaluation report (DQE1) as previously discussed.

The qualifiers created by the steps just described are not included in the September 11, 2009 database. They are discussed in DQE 1 and will be included in the final database. DQE 1 identifies and discusses the QC measurements that do not attain the LPCs and MQOs and are hence qualified. Most CVS measurements are assigned one or more qualifiers, because identification of intermittent measurement errors results in a single qualifier being attached to all data for an analyte or compound. These measurements do not have the presumption of reliability for use in making RG achievement decisions. This report provides the additional evaluation of these measurements to determine if they are sufficiently reliable to be used in making RG attainment decisions with acceptable confidence. Section 7.7 discusses how data usability will be evaluated using a statistical approach and Section 8 summarizes the results of the data usability evaluations.

7.7 Reliance Level

Data quality objectives were established for the Krejci Site Remediation that, if routinely achieved, would allow a confident decision to be made. However, as discussed in the previous section and presented in DQE1, seldom were all DQO's routinely achieved. Consequently, there is a need to establish a statistically based analytical procedure to determine if data is sufficient for confident decisionmaking. The Reliance Level (RL) is established for this purpose and is a concentration that, if not exceeded by a CVS measurement, provides a measured and acceptable level of confidence that the RG has been attained.

In other words, when data for a parameter is imprecise, biased low, or both, it is reasonable to be concerned about the quality of decisions related to RG attainment. In such circumstances it is reasonable to question the validity of a decision even when the CVS measurement is less than the RG. The question becomes, how far below the RG concentration must a measurement be before in can be confidently concluded the remediation goal has been achieved?

Definition and Use

The Reliance Level (RL) is a calculated concentration that sets a limit on how close a CVS measurement can be to the RG without undue concern that the true sample concentration exceeds the RG by 20 percent or more. The QC-derived RL is developed and used herein to aid in the evaluation of data usability. The RL is used to evaluate achievement of the project-specific limit on decision error that was discussed in Section 4.2 and is paraphrased below in the form of a hypothesis to be tested for each CVS measurement:

> *When a sample measurement used for decisionmaking is less than the RG, there is less than a 20 percent chance the sample true concentration exceeds the RG by 20 percent or more.*

When the calculated RL for a parameter is equal to or greater than the RG, CVS measurements for that parameter may be compared to the RG with confidence that the previous statement is true.

When the calculated RL is less than the RG the data quality is less than desired for the parameter and the above statement is not guaranteed to be true for CVS measurements between the RL and the RG.

It follows, by definition:

- When a CVS measurement is less than the RL for that parameter, there is less than a 20 percent chance the sample concentration actually exceeds the RG by 20 percent or more, and the CVS measurement is useable for determining RG achievement.
- When a CVS measurement is between the RL and RG for that parameter, there is possibly more than a 20 percent chance the sample concentration actually exceeds the RG by 20 percent or more, and evidence beyond the measurement itself must be evaluated to determine the impact of equivocal data quality on decisionmaking.

As a consequence, measurements below the RL may be used with confidence to conclude the RG has been attained and measurements above the RG may be used with confidence to conclude the RG has not been attained. Otherwise, additional evidence is needed to effect decisionmaking confidence.

A few examples follow:

Example 1: Figure 7.2 presents copper CVS measurements for West Site grids (see map on Figure 2.2 for grid locations). Each radial line on the plot represents a grid. Concentration is represented by dots (connected by lines). Dots farther from the center represent higher concentration. The dashed circle represents the RG (34 mg/kg). For copper, the calculated RL is greater than or equal to the RG, indicating the data has acceptable quality for decisionmaking. Therefore, the data is usable and any dot more distant from the center of the circle than the line representing the RG indicates an RG exceedance. Any measurement less than the RG represents RG achievement. This statement of RG achievement is made with confidence that there is less than a 20 percent chance the sample true concentration exceeds the RG by 20 percent of more. Note that the RL is not shown on the plot (as it is in the next two examples) because it is not used in decisionmaking in this example.

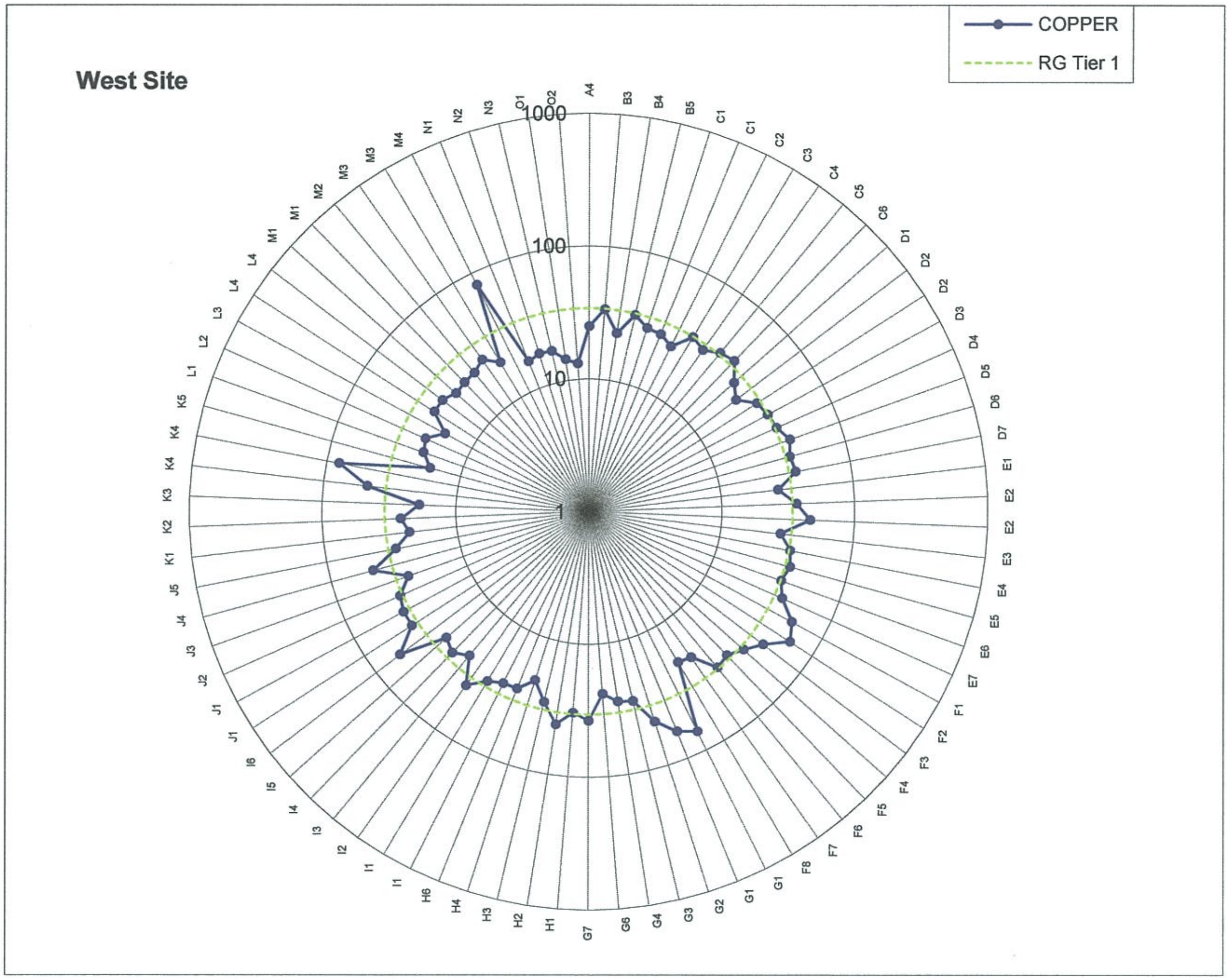

Figure 7.2 Example 1: Demonstration of Data Usability when the RL Equals or Exceeds the RG.

Example 2: Figure 7.3 presents vanadium CVS measurements for East Site girds in rows A through N (see map on Figure 2.3 for grid locations). Note that two dashed circles represent the Tier 1 and Tier 2 RGs. The calculated RL, represented by a solid blue circle, is less than the RGs, indicating that the vanadium measurement data quality was generally less than desired for decision making. However, because all CVS measurements (dots connected by lines) were less than the RL it is reasonable to conclude the RG was always achieved. As with the first example, this statement of RG achievement is made with confidence that there is less than a 20 percent chance the sample true concentration exceeds the RG by 20 percent of more.

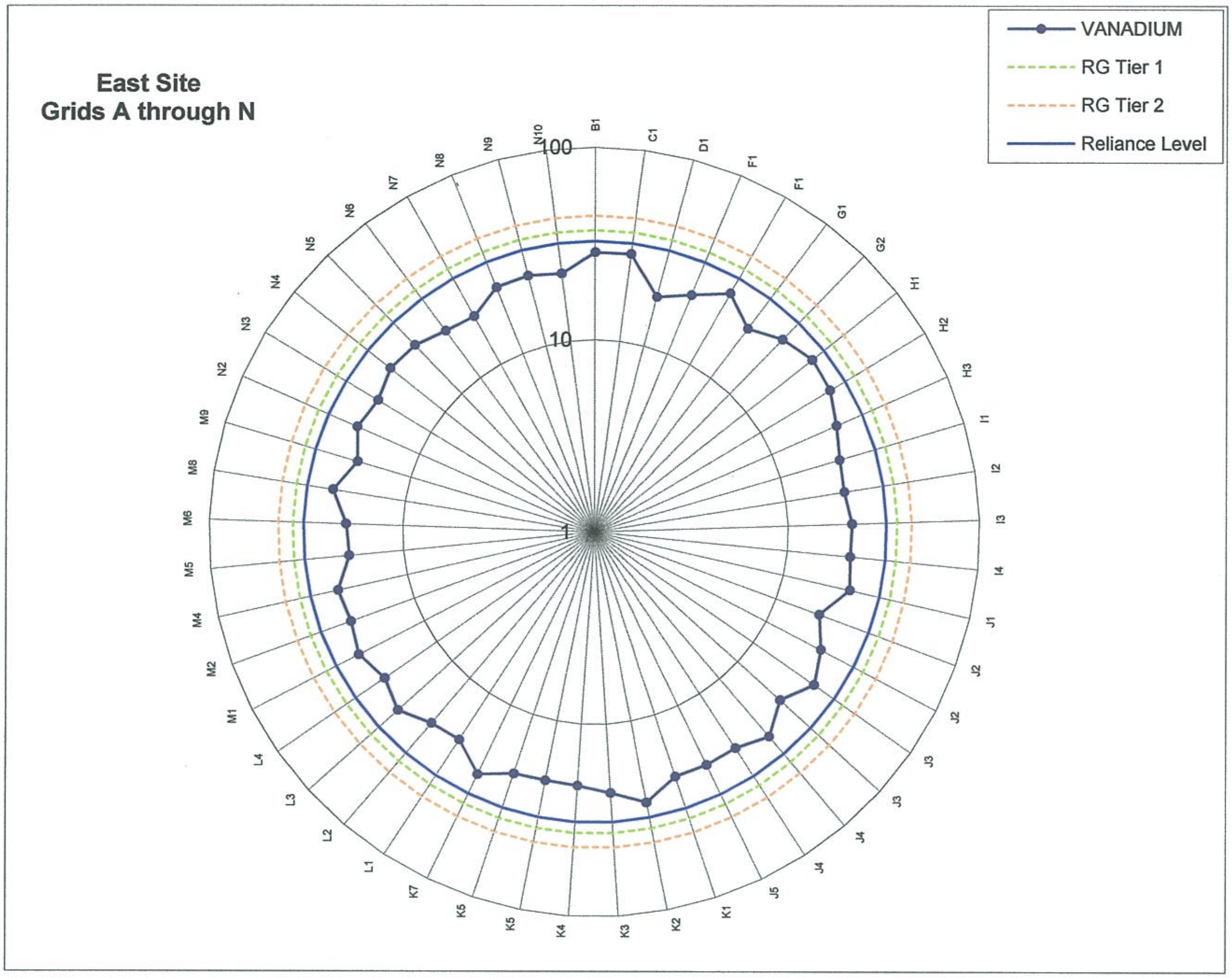

Figure 7.3 Example 2: Demonstration of Data Usability when the RL is less than the RG and Measurements are below the RL.

Example 3: Figure 7.4 presents Aroclor 1254 CVS measurements for West Site grids. Note that the F2 measurement exceeds the RL but is less than the RG. Consequently, it cannot be confidently stated that the Aroclor 1254 concentration in the West Site F2 CVS sample is less than the RG. The same might be said of the E2 measurement. However there is additional evidence to support confidence related to the E2 RG achievement decision. It is by chance that the E2 measurement was duplicated with nearly the same result. This information provides the confidence needed to conclude that the West Site E2 CVS concentration is less than the RG. Please observe on Figure 7.1 that both F2 and E2 exceeded the copper RG and subsequently underwent additional remediation. This additional remediation was likely sufficient to reduced PCBs concentration below the RL therefore provides confidence that the data for F2 is acceptable for Site decisionmaking.

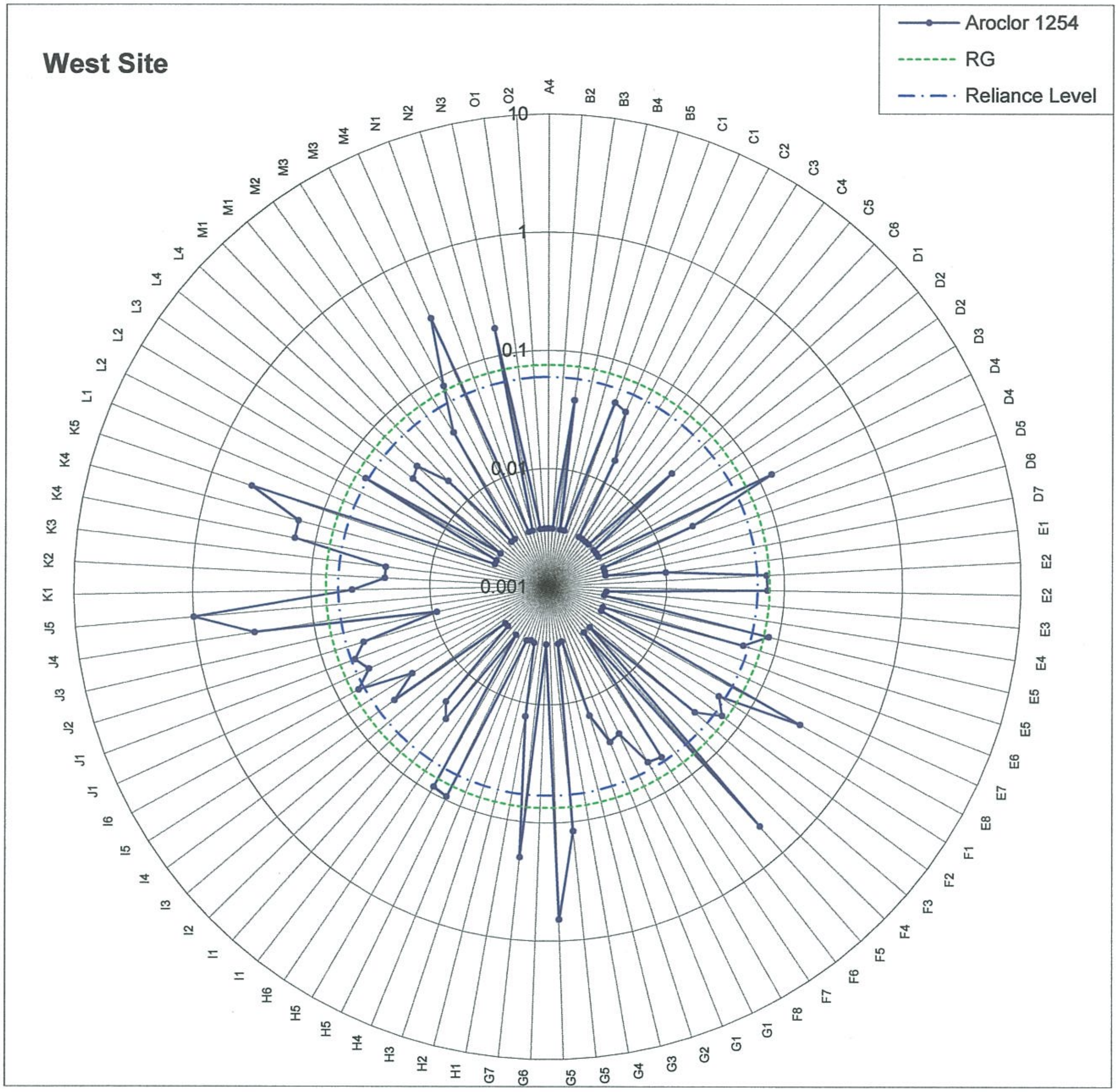

Figure 7.4 Example 3: Demonstration of Data Usability when the RL is less than the RG and Measurements are between the RL and RG.

Radial plots that provide a visual comparison of CVS results to RGs and RLs are presented for each parameter in Appendix A, Figures 1 through 3. Data presented on these plots include all CVS, QC duplicate test results, and the results from repeat CVS performed when previous measurements were slightly greater than the RG. The values plotted are also presented in tabular form in Appendix A.

Reliance Level development

Figures 7.5 and 7.6 (below) are theoretical representations of zinc CVS data. They include vertical lines that represent the RG (140 mg/kg) and calculated RL (139 mg/kg) for zinc along with curves that portray the minimal acceptable data quality and the data quality acquired (based on DOI QC test results). On Figure 7.5, an additional vertical line represents the concentration that is twenty percent greater than the zinc RG (168 mg/kg). The bell-shaped curve labeled "Desired Quality" is a representation of the minimally-acceptable data quality, in that it represents the distribution of analytical results expected from repeated tests on a single sample that actually contains zinc at a concentration twenty percent or greater than the RG (i.e., 168 mg/kg), but which, due to imprecision, the analytical results are less than the RG just under twenty percent of the time.

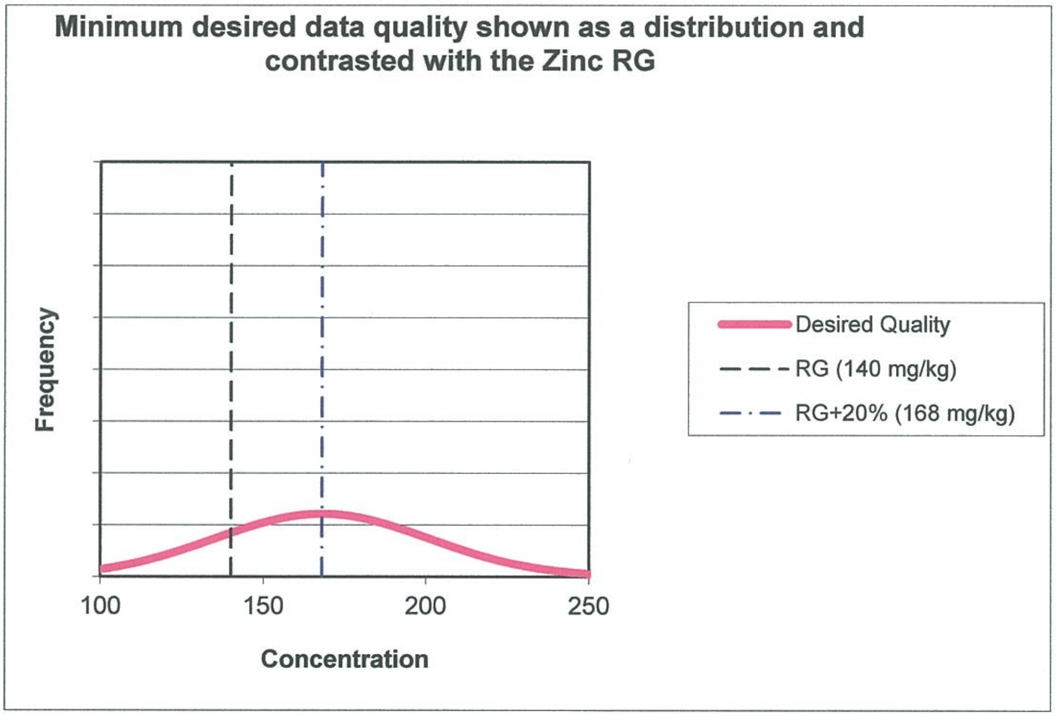

Figure 7.5 Minimum Desired Data Quality Shown as a Distribution and Contrasted with the Zinc RG.

With an average concentration of 168 mg/kg, a measurement from this minimally-acceptable distribution will result in an erroneous declaration of RG achievement 20 percent of the time [visualized on the graph as the ratio of the area below the distribution curve to the left of the remediation goal to the total area below the curve]. This represents the general data quality that can be achieved for zinc measurements when prescribed MQOs are minimally achieved. In other words, it is expected that data that meets all MQOs will also have satisfied this 20/20 rule resulting in no more than a 20 percent chance of erroneously declaring the CVS concentration to be less than the RG when it actually exceeds the RG by 20 percent.

The recovery of zinc from NPS CRMs averaged 85.4 percent. This suggests an approximate 15 percent bias towards low concentrations. The standard deviation of NPS replicate tests on a background sample was a 5.25 mg/kg, indicating good precision. Figure 7.6 presents the theoretical distribution of measurements expected from repeated tests on the same CVS sample that contains zinc at a concentration twenty percent or greater than the RG (i.e., 168 mg/kg), for the condition of an approximately 15 percent low measurement bias and a standard deviation of 5.25. This distribution is labeled "Acquired Quality" in the figure. With an average concentration of 143 mg/kg (approximately 85 percent of 168 mg/kg), a measurement from the Acquired Quality distribution will result in a value equal to or lower than 139 mg/kg less than 20 percent of the time [visualized on the graph as the ratio of the area below the Acquired Quality distribution curve to the left of the RL line (139 mg/kg) to the total area below the curve]. Hence, Figure 7.6 graphically describes how the RL is determined to be 139 mg/kg for zinc. The RL is calculated as follows:

$$RL = (1.2)RGxR - (0.84)SD$$

where:

R = Estimate of Recovery

SD = Standard Deviation

RG = Remediation Goal

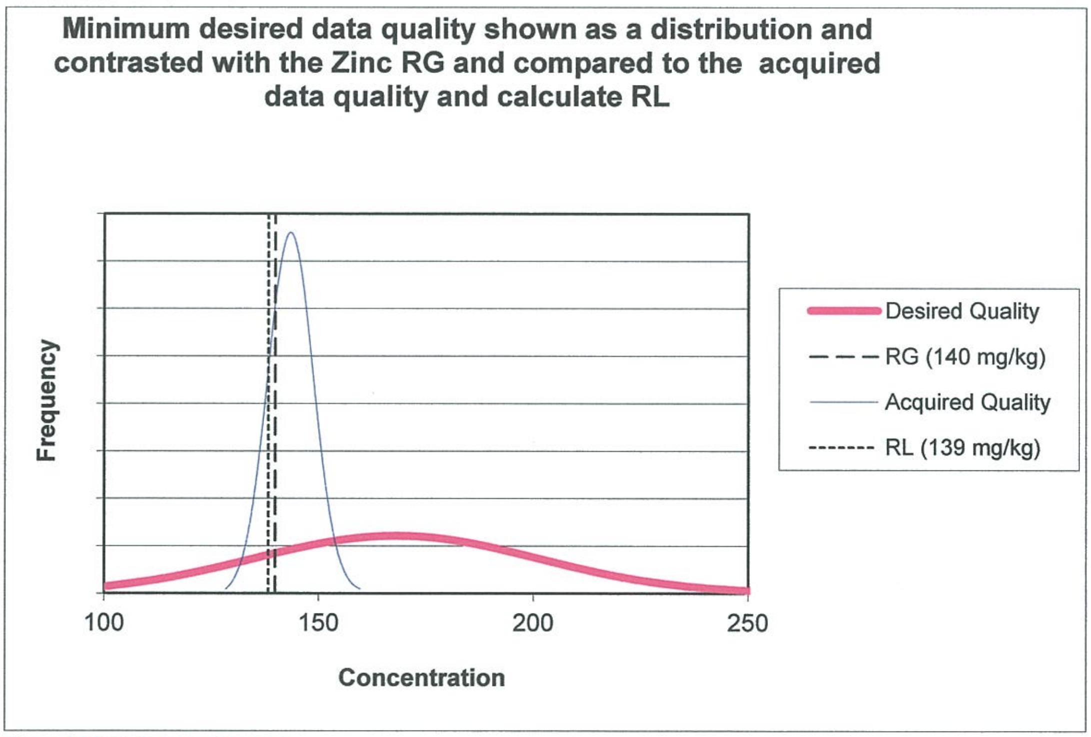

Figure 7.6 RL Determination.

The RL is calculated for all analytes and organic compounds (except as noted below for dioxin/furans) in this manner. There are instances when NPS QC data is insufficient to estimate bias (recovery) and precision (standard deviation). For examples, NPS did not submit CRMs for mercury, boron, or benzene analyses. In these situations, the bias and standard deviation were generally estimated from EQIS CRM results, laboratory internal QC data, and/or recovery of laboratory surrogates and spiked samples. Precision for metals other than mercury was estimated using repeated measurements of a background sample; precision for PCBs was estimated using repeated measurements on a West Site sample; precision for pesticides and semi-volatile organic compounds was estimated using CRM data; and precision for mercury and benzene was estimated using MSD results. An RL was not calculated for dioxin/furan analyses because the amount of QC data was insufficient to allow reliable estimates of precision and accuracy. Appendix A, Table 1 presents the calculation of the RL for each parameter and compares CVS results to RLs.

Derivation of the RL assumes that compromised data quality is the result of multiplicative errors, not additive errors (see Section 4.5 for explanation of these types of errors). Multiplicative errors increase as the concentration increases. When such errors increase linearly with respect to concentration the percent recovery (the ratio of measured to actual contaminant concentrations) is the same regardless of concentration. The assumption of linearity is significant because the calculation of RL uses recovery information for parameters at concentrations different than the RG to establish measurement accuracy. This is considered an acceptable assumption because 1) a review of standard deviation estimates for analytes in CRMs having different concentrations suggests a strong correlation of measurement error to concentration; and 2) the coefficient of variation (standard deviation divided by the mean concentration) calculated for tests performed at different concentrations is relatively constant. Furthermore, the assumption that the error is multiplicative is considered acceptable because NPS CRM parameter recoveries are predominantly used in RL calculations and these CRM concentrations are very near the RG, thereby minimizing an adverse effect that may result if the assumption is incorrect.

Section 8. Data Usability Summary

Much of the data collected is qualified because it did not fully comply with an LPC or an MQO (See Data Quality Report DQE1). Therefore it cannot be universally accepted that measurements near the RG (between the calculated RL and RG) are of adequate quality to decide RG achievement. Additional review is necessary to glean information regarding the quality of such measurements. Data usability evaluation includes review of the laboratory reports, data validation reports, the Data Quality Evaluation Report DQE1, DOI and NPS quality control measurements, and field quality control activities as discussed in previous sections. Quality control measurements and calculated RLs are presented with discussion in Appendix A for each parameter. Appendix A also presents a discussion regarding data usability that is specific to each parameter. The finding is that all data that indicates RG achievement for all analytes in a parameter group for any grid is usable. The usability assessment is summarized in this section

8.1 Application of RLs to Data Usability Evaluation

The QC and data usability for individual parameters are summarized and discussed in Appendix A, Table 1. The following was observed when comparing CVS to RGs and RLs.

- For most of the parameters, the CVS measurements were below the RL and RG indicating RG achievement and acceptable data quality for decisionmaking, even when the measurements were qualified for failure to achieve one or more LPC or MQO.
- CVS measurements seldom were between the RL and the RG, therefore the need additional evaluation of data was uncommon.
- Often when a CVS measurement was between the RL and the RG, another analyte in the same parameter group failed the RG, the grid was excavated and retested, and the questioned CVS measurement was superseded by new CVS results. The usability of the later results will be evaluated in a subsequent data usability report.
- Sometimes when a CVS measurement was between the RL and the RG, a duplicate analysis was performed on the same sample with approximately the same result, thereby adding confidence in the quality of the CVS measurement and making it usable.
- Evaluation of measurements that were between the RL and RG included detailed review of laboratory and field quality control information specific to the analytical batch and an evaluation of trends. These evaluations resulted in confidence gained by the observations of generally good batch LPC and MQO performance and consequently validated use of the suspect measurement.

Measurements that were below but very near the RG e.g., between the RL and RG, without supporting duplicate analyses; not superseded by excavation and reanalysis; and lack additional supporting evidence as described above are further evaluated in Appendix A. These conditions are limited to cadmium and PCBs measurements. Dioxin/furan measurement warrant special attention due to the limited extent of field QC applied during the program and will be evaluated further in DUR 3. Cadmium, PCBs and dioxin/furan concerns are discussed in the following three paragraphs.

8.2 Cadmium measurements for 14 West Site grids

Cadmium concentrations for fourteen West Site grids (D1, E1, F7, F8, H1, H6, J3, J5, K2, K3, L2, L3, L4 and M1) were lower than the RG but exceeded the derived RL. A more detailed review of the laboratory and field QC data does not support that the cadmium measurements for these grids is better than suggested by NPS QC data that was used to calculate the RL. It is concluded that less than optimal measurement quality could impact the integrity of decisions regarding attainment of cadmium RGs for the fourteen grids. However, both RI and RA results suggested that elevated metal concentrations seldom involve a single metal. Tier 1 and Tier 2 RG goals were established, in part, to provide some relief if there were a marginal exceedance of the RG by a single analyte. Cadmium was the only analyte in the metals parameter group exceeding a Tier 1 RG in the grids listed above. Therefore, the elevated cadmium measurements are not likely associated with contamination, and accepting additional uncertainty regarding attainment of the cadmium RG in these fourteen grids is acceptable.

8.3 PCB measurements for 9 grids

PCB measurements for nine grids are higher than the calculated RL but below the RG and are of a quality that is less than desired. These measurements are for three grids that were resampled and retested after failing to achieve the RG on the first try (ES-J03, ES-Q05, WS-L02) consistent with the SOW, and for six grids that were not resampled (ES-B01, ES-H02, ES-O05, ES-R05, WS-F02, WS-I06). All other PCB CVS measurements were either below the RL or above the RG, so that data quality will not significantly impact RG achievement decisions. When developing RGs, it was understood that imprecision could result in concentrations near the RG exhibiting measurements above and below the RG with nearly equal likelihood. The NPS QC data suggests that, given that the PCB measurements under discussion are less than the PCB RG and the precision is reasonably good, it is more likely than not that the sample true concentration does not exceed the RG by 20 percent or more. This fact, together with the fact that only a few grids are at greater risk of an erroneous decision, leads to concluding that lesser decisionmaking confidence with respect to the PCB measurements for these nine grids is acceptable.

8.4 Dioxin/furan data usability

NPS did not submit dioxin CRMs however 14 sets of duplicates were submitted by EQIS and allow a calculation of the RL. These CRMs were submitted in 2005 long before dioxin CVS occurred and may not be indicative of CVS data quality. Therefore, the calculated RL is not used solely as the indicator of data quality. Other factors considered include favorable DOI laboratory audit reports, good performance by the same laboratory during the RI coupled with an observation during the audit that many of the same people who performed dioxin/furan analyses for the RI are performing the analyses for the RA, and generally successful laboratory QC performance.

Calculation of the RL is as follows. The CRM contained only the dioxin congener 2,3,7,8 TCDD. The vender certified concentration was 3.01 pg/g and performance acceptance limits were 2.11 to 3.91 pg/g. The results of the 28 analyses (14 sets of duplicate CRM analyses) ranged between 2.0 and 4.4 pg/g with an average value of 2.6 pg/g. The standard deviation of the data set was calculated to be 0.48 pg/g. The average recovery is calculated to be 86.4 percent. Using this standard deviation, recovery, and considering the 2,3,7,8 TCDD TEQ RG is 3.0 pg/g, the RL is calculated to be 2.71 pg/g. As discussed previously, an RL less than the RG indicates measurements not as good as desired. However, lack of desired quality does not impact decision making in this instance because all CVS measurements below the RG are also below the calculated RL. Consequently, dioxin/furan data is sufficient for the RG-achievement decisionmaking purpose.

Section 9. RG Attainment

The SOW provides the following with regard to RG achievement:

> *Post-excavation characterization will be performed to verify that remaining soils meet the Remediation Goals (RGs) set forth in Appendix D. . . . One composite sample comprising 40 specimens collected on a grid pattern within each 1/4-acre will be analyzed for all parameters shown in Appendix D that are associated with the area, except for dioxin/furan (which is described in Step 7 below) and benzene. . . . The following verification criteria shall apply. For parameters with Tier-2 RGs, up to two exceedances of Tier-1 RGs are permitted for each 1/4-acre area, so long as the Tier-2 RGs are achieved for those parameters. For parameters without defined Tier-2 RGs, exceedance of a Tier-1 RG within any 1/4-acre area constitutes failure. In the event that a 1/4-acre verification sample fails either of these verification criteria, Ford may collect a resample from a multi-point grid with similar point spacing used in the original sample, offset to a new origin. The resample would be analyzed for each parameter group that had an exceedance. For example, if there is an exceedance for one metal parameter, all metals would be analyzed on the resample. The parameter groups are: (1) metals; (2) volatile organic compounds; (3) polycyclic aromatic hydrocarbons; (4) pesticides and PCBs; (5) phthalate esters; and (6) dioxin/furan. The relevant parameter group for each parameter is shown in Appendix D. If the resample results satisfy the verification criteria for all parameters in the parameter group, the 1/4-acre area will be deemed to have achieved the RGs for all contaminants except dioxin/furan.*

Appendix B herein compares the remediation goals set forth in the SOW, Appendix D, to the CVS test results contained in the September 11, 2009 database. The data is presented for each analyte in each grid, with each column presenting results from a separate sampling event. Column labels are sample identifiers. Sample identifiers are unique to each sampling event and grid and include the Site, grid identifier, and date of the sampling event. CVS results indicating an RG failure are distinguished by a boxed or bolded[11] entry. Italicized entries indicate that the measured concentration was less than the method detection limit, in which case the presented value is the method detection limit. In addition, the column label is shaded for grids that failed to achieve an RG.

There is no provision in the SOW or QAPP for reanalysis of a sample that failed an RG[12]. There is a single instance in which a sample (ES-006-081111) was reanalyzed inappropriately. This is highlighted in the Appendix B table. Because the original sample and a test on a resample both failed to achieve the RG, the East Site grid 006 is counted among those that have not achieved an RG following the initial excavation.

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[11] A failure of a Tier 2 RG is boxed. Likewise a failure of a Tier 1 RG is boxed if there is not Tier 2 RG for that analyte. A failure of a Tier 1 RG is bolded if it is exceeded and a respective Tier 2 RG for the analyte is not exceeded.

[12] Although the reanalysis of a failing sample is not allowed, a limited amount of resampling and testing of failing grids is allowed. Results of resampling and testing were almost always about the same as the original measurement.

The dioxin/furan provision, referred to as Step 7 in the previous SOW citation includes the following, in relevant part:

> *Dioxin/furan sampling and analysis will be conducted as follows, unless Ford and the NPS mutually agree to a different methodology. Verification sampling for the dioxin/furan RG will be conducted in areas R1, R2, and R3 only, after RGs have been achieved in these areas for the other 38 parameters or it has been determined that no further excavation for those parameters is required. . . . A 4-part unbiased composite sample will be collected from 1-acre sections of these areas. . . . If initial dioxin/furan sampling results reveal an exceedance of the dioxin/furan RG, Ford may resample the area by collecting a 40-specimen composite from each ¼-acre area in the original acre. If the resample results satisfy the RG for dioxin/furan, the ¼-acre section will be deemed to have achieved that RG, and no further excavation will be required. . . .*

There are twelve (12), one-acre dioxin/furan test areas on the Site. As detailed in the SOW, initially each 1-acre area (rather than its four ¼-acre grids) was represented by a single, multi-increment dioxin/furan sample. Although the SOW provided that dioxin/furan sampling would not be conducted until after RGs had been achieved in the tested area for all other parameters, NPS did not object when EQIS requested the opportunity to conduct earlier dioxin/furan sampling because the provision was included for efficiency purposes and early dioxin/furan sampling would cause no harm. Most of the 1-acre grids initially failed to achieve the dioxin/furan RG and were subsequently sampled by their respective ¼-acre grids, as provided in the SOW. The initial test results are shown on the table in Appendix B. Subsequent analyses of CVS collected following additional excavation will be evaluated and presented in the DUR 3 report.

Each dioxin/furan measurement is expressed as a 2,3,7,8-TCDD Toxic Equivalency (TEQ) concentration. The TEQ is determined by multiplying the measured concentration of each of fourteen (14) different 2,3,7,8-congeners by its Toxicity Equivalent Factor (TEF), and then summing the resulting products. Often a dioxin/furan TEQ will include an established set of seventeen (17) 2,3,7,8 congeners. At the Krejci Site, three (3) congeners (2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDD, and OCDD) were excluded from the TEQ used to derive the RG by agreement between Ford and NPS, because they were found in various blanks during investigative sampling and apparently had a ubiquitous presence on site that was unrelated to and/or indiscernible from site contamination. The exclusion of the 3 congeners from the TEQ prevented their inappropriate influence on CVS measurements. In Appendix B, the calculated dioxin/furan TEQ is associated with each ¼-acre grid included in the one-acre areas.

All grids attained RGs for one or more parameter groups. This is significant because for failing grids the SOW requires excavation followed by CVS and analysis for all analytes in the failing parameter group(s). Consequently, grids that have attained all RGs for a parameter group are finished with respect to that group. Table 9.1 and 9.2 present a summary of grids and parameter group RG successes for the West and East Sites respectively. In these tables, "P" indicates the subject grid has passed the RGs for all analytes in the respective parameter group and a "/" indicates a failure.

There were 186 grids represented by CVS results in the September 11, 2009 database. Of these, all grids achieved most RGs, but only 69 grids achieved all RGs (8 on the West Site and 61 on the East Site). The grids that achieved all RGs are presented in Table 9.3.

Table 9.1 West Site RG Successes Sorted by Parameter Groups.

["P" = grid has passed RGs for all analytes in respective parameter group; "/" indicates failure]

Grid	Metals	PCBs	Pesticides	Semivoloatile Organics	Volatile Organics	Dioxin/furans	Overall Success
A04	P	P	P	P	P	/	/
B02	/	/	P	P	P		/
B03	/	P	P	P	P		/
B04	P	P	P	P	P	/	/
B05	P	P	P	P	P	/	/
C01	P	P	P	P	P		P
C02	/	P	P	P	P		/
C03	P	P	P	P	P	/	/
C04	/	P	P	P	P	/	/
C05	/	P	P	P	P	/	/
C06	/	P	P	P	P	P	/
D01	P	P	P	P	P		P
D02	P	P	P	P	P		P
D03	P	P	P	P	P	/	/
D04	/	P	P	P	P	/	/
D05	/	P	P	P	P	P	/
D06	/	P	P	P	P	P	/
D07	/	P	P	P	P	P	/
E01	P	P	P	P	P		P
E02	/	P	P	P	P		/
E03	/	P	P	P	P	/	/
E04	/	P	P	P	P	/	/
E05	/	P	P	P	P	P	/
E06	/	P	P	P	P	P	/
E07	/	P	P	P	P	/	/
E08	/	/	P	P	P	/	/
F01	/	P	P	P	P		/
F02	/	P	P	P	P		/
F03	/	P	P	P	P	/	/
F04	/	P	P	P	P	/	/
F05	/	/	P	P	P	P	/
F06	/	P	P	P	P	P	/
F07	P	P	P	P	P	/	/

F08	P	P	P	P	P	/	/
G01	/	P	P	P	P		/
G02	/	P	P	P	P	/	/
G03	/	P	P	P	P	/	/
G04	/	P	P	P	P	/	/
G05	/	/	P	P	P	/	/
G06	/	P	P	P	P	/	/
G07	/	/	P	P	/	/	/
H01	P	P	P	P	P		P
H02	/	P	P	P	P	/	/
H03	/	P	P	P	P	/	/
H04	/	P	P	P	P	/	/
H05	/	/	P	P	P	/	/
H06	/	P	P	P	P		/
I01	/	P	P	P	P		/
I02	/	P	P	P	P	/	/
I03	/	P	P	P	P	/	/
I04	/	P	P	P	P	/	/
I05	/	P	P	P	P	/	/
I06	/	P	P	P	P	/	/
J01	/	P	P	P	P		/
J02	/	P	P	P	P	/	/
J03	/	P	P	P	P	/	/
J04	/	/	P	P	P	/	/
J05	/	/	P	P	P	/	/
K01	/	P	P	P	P		/
K02	P	P	P	P	P		P
K03	P	P	P	P	/		/
K04	/	/	P	P	P		/
K05	/	/	P	P	P		/
L01	P	P	P	P	P		P
L02	/	P	P	P	P		/
L03	/	P	P	P	P		/
L04	P	P	P	P	P		P
M01	/	P	P	P	P		/
M02	/	P	P	P	P		/
M03	/	P	P	/	P		/
M04	/	/	P	/	P		/
N01	/	P	P	P	P		/
N02	/	P	P	P	P		/
N03	/	/	P	P	P		/
O01	/	P	P	P	/		/
O02	/	P	P	P	/		/

Table 9.2 East Site RG Successes Sorted by Parameter Groups.
["P" = grid has passed RGs for all analytes in respective parameter group; "/" indicates failure]

Grid	Metals	PCBs	Pesticides	Semivoloatile Organics	Volatile Organics	Dioxin/furans	Overall
A01	/	/	P	P	P	P	/
B01	P	P	P	P	P	P	P
C01	/	/	P	P	P	P	/
D01	P	P	P	P	P	P	P
E01	/	/	P	P	P		/
E02	/	/	P	P	P		/
F01	P	P	P	P	P		P
G01	P	P	P	P	P		P
G02	P	P	P	P	P		P
H01	/	P	P	P	P		/
H02	P	P	P	P	P		P
H03	P	P	P	P	P		P
I01	/	P	P	P	P		/
I02	P	P	P	P	P		P
I03	P	P	P	P	P		P
I04	/	P	P	P	P		/
J01	P	P	P	P	P		P
J02	/	P	P	P	P		/
J03	/	/	P	/	P		/
J03	/	P		P			/
J04	/	P	P	P	P		/
J05	/	P	P	P	P		/
K01	P	P	P	P	P		P
K02	/	/	P	P	P		/
K03	/	P	P	P	P		/
K04	P	P	P	P	P		P
K05	P	P	P	P	P		P
K07	/	P	P	P	P		/
L01	P	P	P	P	P		P
L02	P	P	P	P	P		P
L03	/	P	P	P	P		/
L04	/	/	P	P	P		/
L05	/	/	P	P	P		/
M01	P	P	P	P	P		P
M02	P	P	P	P	P		P
M03	/	/	P	P	P		/
M04	P	P	P	P	P		P

M05	P	P	P	P	P		P
M06	/	P	P	P			/
M07	/	/	P	P	P		/
M08	/	P	P	P	P		/
M09	P	P	P	P	P		P
N02	P	P	P	P	P		P
N03	/	P	P	P	/		/
N04	P	P	P	P	P		P
N05	/	P	P	P	P		/
N06	P	P	P	P	P		P
N07	/	P	P	P	P		/
N08	/	P	P	P	P		/
N09	/	P	P	P	P		/
N10	P	P	P	P	P		P
O03	P	P	P	P	P		P
O04	P	P	P	P	P		P
O05	P	P	P	P			/
O06	/	/	P	P	P		/
O07	/	/	P	P	P		/
O08	/	P	P	P	/		/
O09	/	/	P	P	P		/
O10	/	/	P	P	P		/
P04	P	P	P	P	P		P
P05	P	P	P	P	P		P
P06	P	P	P	P	P		P
P07	/	/	/	P	P		/
P08	P	P	P	P	P		P
P10	/	P	P	P	P		/
P11	/	P	P	P	P		/
Q05	/	P	P	P	P		/
Q06	/	/	P	P			/
Q07	/	/	/	P	P		/
Q08	/	/	P	P	P		/
Q09	P	P	P	P	P		P
Q10	/	P	P	P	P		/
Q11	P	P	P	P	P		P
Q17	P	P	P	P	P		P
R05	/	P	P	P	P		/
R06	P	P	P	P	P		P
R07	P	P	P	P	P		P
R08	/	/	P	P	P		/
R09	/	P	P	P			/
R10	P	P	P	P	P		P
R11	/	P	P	P	P		/

R12	P	P	P	P	P		P
R16	P	P	P	P	P		P
R17	P	P	P	P	P		P
S05	P	P	P	P	P		P
S06	P	P	P	P	P		P
S07	P	P	P	P	P		P
S08	/	/	P	P	P		/
S09	P	P	P	P	P		P
S10	P	P	P	P	P		P
S11	/	P	P	P	P		/
S12	P	P	P	P	P		P
S13	P	P	P	P	P		P
S17	/	/	P	P	P		/
S18	P	P	P	P	P		P
T07	P	P	P	P	P		P
T08	P	P	P	P	P		P
T09	/	P	P	P	P		P
T10	/	P	P	P	P		/
T11	P	P	P	P	P		P
T12	P	P	P	P	P		P
T13	P	P	P	P	P		P
T14	P	P	P	P	P		P
U10	P	P	P	P	P		P
U11	P	P	P	P	P		P
U13	P	P	P	P	P		P
U14	P	P	P	P	P		P
V11	P	P	P	P	P		P
V14	P	P	P	P	P		P
W12	P	P	P	P	P		P

Table 9.3 Grids that have achieved all RGs following initial excavation based on data contained in the September 11, 2009 database.

West Site Grids							
C01	D01	D02	E01	H01	K02	L01	L04
East Site Grids							
B01	D01	F01	G01	G02	H02	I02	I03
J01	K01	L01	L02	M01	M02	M04	M05
N02	N04	N06	N10	O03	O04	P04	P05
P06	P08	Q09	Q11	Q17	R06	R07	R10
R12	R16	R17	S05	S06	S07	S09	S10
S12	S13	S18	T07	T08	T09	T11	T12
T13	T14	U10	U11	U13	U14	V11	V14
W12	H03	K04	K05	M09			

The grids that did not achieve all RGs at the conclusion of the initial excavation in June, 2007 have since undergone additional excavation, sampling and testing. The new CVS samples, however, would be only analyzed for analytes within each parameter group that had an exceedance. If, following initial excavation there was an exceedance for one metal parameter, all metals would be analyzed in the new CVS sample. But if the September 11, 2009 CVS data showed RG achievement for all analytes within a parameter group, none of those analytes would be evaluated in the new CVS sample. Thus, data in the September 11, 2009 database related to analytes within a parameter group for which all analytes achieved their respective RGs, is the data used for establishing RG achievement for those analytes. This is true even though subsequent, additional excavation, sampling and testing will have been conducted in the grid.

Section 10. Conclusion

Soil samples were collected and tested in accordance with Site Cleanup Verification Sampling (CVS) protocols after the initial excavation of the Krejci Dump Site (Site) in order to determine if the excavation removed contaminants as required by the Record of Decision (ROD) and the Consent Decree (CD). This report presents an evaluation of the quality of this CVS data with the objective of ascertaining whether the data is sufficiently reliable for use in determining with confidence that Site soil has achieved the Site remediation goals (RGs). This report concludes that the CVS data (both qualified and not) from samples collected after the initial excavation, contained in the September 11, 2009 database, that is relevant and required for making decisions regarding the attainment of RGs, does have the quality necessary to use in making such decisions. This report also compares this usable CVS data to the RGs and identifies RG achievement by analyte, parameter group, and Site area (grid). Out of a total 186 Site grids, this report establishes that 69 grids met all RGs for all applicable analytes at the conclusion of the initial Site excavation in June, 2007.

Grids that did not achieve all RGs after the initial Site excavation have undergone additional excavation, CVS sampling and testing. The new CVS samples, however, will be only analyzed for analytes within each parameter group that had an exceedance. Data in the September 11, 2009 database related to analytes within a parameter group for which all analytes achieved their respective RGs is the data used for establishing RG achievement for those analytes. DQEs 2 and 3 and DURs 2 and 3 evaluate CVS data generated from samples collected subsequent to the initial excavation, determine data usability, and identify RG achievement for all remaining Site grids and analytes.

Section 11. Related References

June 2000, Final Remedial Investigation Report, Krejci Dump Site, Cuyahoga Valley National Recreation Area, prepared for the National Park Service by the Bureau of Reclamation, Lakewood CO.

April 2002, Partial Consent Decree, United States v. Chrysler Corp., et al., Civil Action No. 5:97 CV00894 (N.D. Ohio).

June 2005, Final (100%) Remedial Design Report, Krejci Dump Site, Cuyahoga Valley National Park, Summit County, Ohio, Prepared by Conestoga-Rovers & Associates, Waterloo, Ontario.

September 2005, Remedial Action Work Plan, Krejci Dump Site, Cuyahoga Valley National Park, Summit County, Ohio, Prepared by Conestoga-Rovers & Associates, Waterloo, Ontario.

July 2009, Final Amendments to the Krejci Site Remedial Action Documents (effective as of June 8, 2009).

May 2012, Data Quality Evaluation 1, Cleanup Verification Sampling Results for August 2008 to September 2009, prepared for EQIS, Ypsilanti, MI, by ReSolution Partners, LLC, Madison, Wisconsin.

May 2012, Data Quality Evaluation 2, Cleanup Verification Sampling Results for October 2009 through December 2010, prepared for EQIS, Ypsilanti, MI, by ReSolution Partners, LLC, Madison, Wisconsin.

May 2012, Data Quality Evaluation 3, Cleanup Verification Sampling Results for January 2011 through December 2011, prepared for EQIS, Ypsilanti, MI, by ReSolution Partners, LLC, Madison, Wisconsin.

May 2012, Data Usability Report 2, Cleanup Verification Sampling Data, Krejci Dump Site, prepared for the National Park Service by MCG Geotechnical Engineering, Inc., Morrison, Colorado.

May 2012, Data Usability Report 3, Cleanup Verification Sampling Data, Krejci Dump Site, prepared for the National Park Service by MCG Geotechnical Engineering, Inc., Morrison, Colorado.

Appendix A

Data Usability Analyses

Table Al-1: Aluminum Data Quality Summary			
Laboratory Performance Criteria	Criteria	Measured	Comment
Minimum LCS Recovery	80%	83%	
Minimum Matrix Spike Recovery	70%	47%	low
Average LCS Recovery	N/A	95%	
Average Matrix Spike Recovery	N/A	89%	
Maximum LCS RPD	20%	17%	
Maximum Laboratory Duplicate RPD	20%	11%	
Average LCS RPD	N/A	3%	
Average Laboratory Duplicate RPD	N/A	4%	
Measurement Quality Objectives	Criteria	Measured	
NPS CRM	Recovery =>6590 mg/kg	Minimum Recovery =	8560 mg/kg
EQIS CRM	N/A	See Note 1	
CVS Split Analysis RPD	RPD=<35%	Maximum RPD =	34.07 %
CRM Split Analysis RPD	RPD=<35%	Maximum RPD =	53.4 %
Overall QC Indicator Measurements	Criteria	Measured	
NPS CRM "Made to" (Bias measure)	N/A	Average Recovery =	76 %
NPS Replicate Test (Precision measure)	N/A	Standard Deviation =	3602 mg/kg
Data Quality Relative to Remediation Goals			
Tier 1 Remediation Goal	21000 mg/kg		
Tier 2 Remediation Goal	24000 mg/kg		
QC Derived reliance level	19150 mg/kg	See Note 2	

Comments: Generally, the laboratory analytical equipment provided good measurement of extracted aluminum concentrations as indicated by generally good attainment of laboratory performance criteria. However, laboratory batch 59382 demonstrates likely contamination as evidenced by exceedance of the upper acceptance limit for the associated NPS CRM and unusually high measured concentration for both the NPS and EQIS CRM samples. Low average recovery of NPS CRM (77%) and a low average matrix spike recovery (89%), coupled with a large sample measurement standard deviation (3602 mg/kg) relative to the mean (15513 mg/kg) for repeated tests on the same sample, suggests less overall precision and accuracy, respectively, than desired. The imprecision and accuracy is likely due, in part, to nuances of the extraction process, i.e. the amount of aluminum extracted from the soil is very sensitive to digestion process variables. Matrix interference is also a possible contributor to loss of accuracy. Less than desirable precision and accuracy results in a derived reliance level (19150 mg/kg) less than the Tier 1 RG. All CVS aluminum measurements are below the QC derived reliance level. Therefore contamination of batch 59382 and more general accuracy and precision problems are likely inconsequential to decision-making. It is concluded that CVS aluminum concentration measurements may be used to determine RG compliance.

Note 1: The QAPP required CRMs have only 4 analytes from each analyte group. Aluminum is not one of these analytes.

Note 2: Derived reliance level is calculated as: (Tier 2 RG)(1.2)(Average Recovery)-(0.84)(Standard deviation) = (24000)(1.2)(.76)-(0.84)(3602) = 19150 mg/kg

Table AI-2: ALUMINUM - NPS CRMs

Blind NPS CRM Results

Sample	Result	Analysis Date	Batch	Detect
BOR Sample 1-BOR 56	11100	5/3/09	57226	Y
BOR Sample 4-BOR 82	10800	5/8/09	57514	Y
BOR 83	9350	5/27/09	57790	Y
BOR 84	9320	5/27/09	57848	Y
BOR Sample 3-BOR 58	8620	5/27/09	57790	Y
BOR Sample 7-BOR 105	9300	5/27/09	57848	Y
BOR 85	8660	6/5/09	58137	Y
BOR Sample 8-BOR 106	8890	6/5/09	58137	Y
BOR 86	10600	6/11/09	58213	Y
BOR 108	9950	6/19/09	58563	Y
BOR 87	10200	6/19/09	58563	Y
BOR 109	9400	6/30/09	58729	Y
BOR 110	15400	7/11/09	59382	Y
BOR Sample 9-BOR 107	9600	7/24/09	59758	Y
BOR 111	8560	7/30/09	59890	Y
BOR Sample 6-BOR 81	9070	5/4/09	57400	Y

CRMs		Vendor Supplied Information
Mean	9926	*"Made to"*
Standard Error	414	*13000 mg/kg*
Median	9375	
Standard Deviation	1655	*Upper Acceptance Limit*
Sample Variance	2739398	*13377 mg/kg*
Kurtosis	8	
Skewness	3	*Lower Acceptance Limit*
Range	6840	*6590 ,g/kg*
Minimum	8560	
Maximum	15400	
Sum	158820	
Count	16	
Largest(2)	11100	
Smallest(2)	8620	

Table AI-3: ALUMINUM - NPS Background Sample Replicate Tests				
Results of Replicate Analyses of a Single Sample				
Sample	Result	Analysis Date	Batch	Detect
BOR 112	19000	5/3/09	57226	Y
BOR 59	13200	5/4/09	57400	Y
BOR 60	16200	5/8/09	57514	Y
BOR 113	13300	5/27/09	57790	Y
BOR 61	13200	5/27/09	57790	Y
BOR 62	15600	6/11/09	58213	Y
BOR 63	12800	6/19/09	58563	Y
BOR 89	11400	6/19/09	58563	Y
BOR 115	14900	6/30/09	58729	Y
BOR 64	13300	7/8/09	59165	Y
BOR 91	14500	7/8/09	59165	Y
BOR 116	25700	7/11/09	59382	Y
BOR 92	18300	7/11/09	59382	Y
BOR 65	13200	7/22/09	59623	Y
BOR 88	12700	7/30/09	59890	Y

Replicate analyses of Single Sample	
Mean	15153
Standard Error	930
Median	13300
Standard Deviation	3602
Sample Variance	12976952
Kurtosis	5
Skewness	2
Range	14300
Minimum	11400
Maximum	25700
Sum	227300
Count	15
Largest(2)	19000
Smallest(2)	12700

Table AI-4: ALUMINUM NPS and EQIS CVS Duplicates							
Sample	Result	Analysis Date	Batch	Split	Result	Analysis Date	RPD
BOR 503	15600	5/4/09	57400	ES-T11-080530	18200	6/11/09	15
BOR 506	18300	5/8/09	57514	ES-S10-080523	17200	6/11/09	6
BOR 504	14500	5/27/09	57790	ES-M05-080527	12000	5/27/09	19
BOR 507	10100	6/5/09	58137	ES-O09-080610			
BOR 508	12300	6/19/09	58563	ES-Q11-080606	16000	5/8/09	26
BOR 510	16100	6/30/09	58729	OU-8HR-080605	16600	5/3/09	3
BOR 501	12400	7/8/09	59165	WS-L04-080508	13000	7/8/09	5
BOR 505	10200	7/22/09	59623	WS-K03-080509	10600	7/8/09	4
BOR 502	13500	7/24/09	59758	WS-F05-080612	11700	8/17/09	14
BOR 509	12600	7/24/09	59758	WS-E06-080613	12100	7/24/09	4
DUP-11	15200	5/3/09	57100	ES-J03-080513	13800	6/19/09	10
DUP-17	12700	5/4/09	57400	ES-F01-080529	14800	5/8/09	15
DUP-15	9920	5/8/09	57514	ES-J02-080527	12700	5/27/09	25
DUP-18	15500	5/8/09	57514	ES-J04-080530	14300	5/27/09	8
DUP-12	13000	5/27/09	57790	ES-P06-080515	12700	6/5/09	2
DUP-16	13700	5/27/09	57790	ES-P04-080528	14600	6/5/09	6
DUP-19	12900	5/27/09	57848	ES-K05-080605	12900	5/27/09	0
DUP-13	14300	6/5/09	58137	ES-T08-080522	16500	6/11/09	14
DUP-14	15400	6/11/09	58213	ES-T10-080523	16600	6/11/09	8
DUP-3	14000	6/19/09	58563	WS-C01-080501	13000	6/19/09	7
DUP-4	17000	6/19/09	58563	WS-G01-080501	17700	6/30/09	4
DUP-5	13000	6/30/09	58729	WS-I01-080501	13200	6/30/09	2
DUP-6	12000	6/30/09	58729	WS-J01-080505	11800	6/30/09	2
DUP-7	11300	7/8/09	59165	WS-M01-080505	11200	7/8/09	1
DUP-9	13000	7/8/09	59165	WS-L04-080508	13000	7/8/09	0
DUP-1	18600	7/11/09	59382	WS-E02-080428	15700	7/22/09	17
DUP-2	16800	7/11/09	59382	WS-D02-080429	13100	7/22/09	25
DUP-8	9550	7/22/09	59623	WS-M03-080507	6770	8/11/09	34
DUP-10	12400	7/24/09	59758	WS-K04-080513	13900	7/8/09	11

RPD of Sample Splits	
Mean	10.26
Standard Error	1.71
Median	7.45
Standard Deviation	9.03
Sample Variance	81.57
Kurtosis	0.35
Skewness	1.00
Range	34.07
Minimum	0.00
Maximum	34.07
Sum	287.28
Count	28.00
Largest(2)	26.15
Smallest(2)	0.00

Table AI-5: ALUMINUM EQIS CRMs

Results of Duplicate Analysis of EQIS CRMs

Sample	Result	Date	Batch	Detect	Average	RPD
ES-Z11-080605A	16900	5/3/09	57100	Y		
ES-Z11-080605B	10300	5/3/09	57100	Y	13600	49
ES-Z09-080529A	9590	5/4/09	57400	Y		
ES-Z09-080529B	8640	5/4/09	57400	Y	9115	10
ES-Z12-080606A	8480	5/4/09	57400	Y		
ES-Z12-080606B	8620	5/4/09	57400	Y	8550	2
ES-Z05-080519A	14700	5/8/09	57514	Y		
ES-Z05-080519B	16400	5/8/09	57514	Y	15550	11
ES-Z06-080520A	16800	5/8/09	57514	Y		
ES-Z06-080520B	15400	5/8/09	57514	Y	16100	9
ES-Z07-080522A	8180	5/27/09	57790	Y		
ES-Z07-080522B	6810	5/27/09	57790	Y	7495	18
ES-Z13-080610A	8030	5/27/09	57848	Y		
ES-Z13-080610B	7970	5/27/09	57848	Y	8000	1
ES-Z10-080602A	9480	6/5/09	58137	Y		
ES-Z10-080602B	7230	6/5/09	58137	Y	8355	27
ES-Z08-080527A	8450	6/11/09	58213	Y		
ES-Z08-080527B	9740	6/11/09	58213	Y	9095	14
ES-Z14-080611A	15500	6/19/09	58563	Y		
ES-Z14-080611B	8970	6/19/09	58563	Y	12235	53
ES-Z06-080520C	9340	6/30/09	58729	Y		
ES-Z06-080520D	7860	6/30/09	58729	Y	8600	17
ES-Z05-080519C	7560	7/8/09	59165	Y		
ES-Z05-080519D	7800	7/8/09	59165	Y	7680	3
ES-Z19-080624A	18000	7/11/09	59382	Y		
ES-Z19-080624B	18600	7/11/09	59382	Y	18300	3
WS-Z17-080618A	17100	7/11/09	59382	Y		
WS-Z17-080618B	20200	7/11/09	59382	Y	18650	17
WS-Z15-080613A	6760	7/22/09	59623	Y		
WS-Z15-080613B	7480	7/22/09	59623	Y	7120	10
WS-Z18-080620A	7990	7/22/09	59623	Y		
WS-Z18-080620B	8130	7/22/09	59623	Y	8060	2
WS-Z16-080617A	5360	7/30/09	59890	Y		
WS-Z16-080617B	5250	7/30/09	59890	Y	5305	2

Analysis of EQIS CRMs	
Mean	10695
Standard Error	740.89
Median	8630
Standard Deviation	4320.1
Sample Variance	2E+07
Kurtosis	-0.7056
Skewness	0.8819
Range	14950
Minimum	5250
Maximum	20200
Sum	363620
Count	34
Largest(2)	18600
Smallest(2)	5360

RPD of EQIS CRMs	
Mean	14.58
Standard Error	
Median	10.42
Standard Deviation	15.53
Sample Variance	241.19
Kurtosis	2.24
Skewness	1.65
Range	52.62
Minimum	0.75
Maximum	53.37
Sum	247.89
Count	17
Largest(2)	48.53
Smallest(2)	1.64

Table AI-6: ALUMINUM MS and LCS

Matrix Spike Recovery %		Batch Order	LCS Recovery %		Batch Order
97	7160081	1	100	49187	2
112	49187	2	97	49189	3
107	49189	3	100	49537	4
110	49537	4	105	49539	5
115	49539	5	95	54626-627	6
81	54626-627	6	94	54821-822	7
81	54821-822	7	99	54891-892	8
77	54891-892	8	101	54915-916	9
47	54915-916	9	94	57100	10
63	57100	10	88	57226	11
88	57226	11	92	57514	12
106	57514	12	83	57790	13
67	57790	13	83	57848	14
78	57848	14	86	58137	15
77	58137	15	96	58213	16
110	58213	16	108	58563	17
106	58563	17	102	58729	18
104	58729	18	98	59165	19
90	59165	19	89	59382	20
86	59382	20	92	59623	21
71	59623	21	91	59758	22
90	59758	22	88	59890	23
83	59890	23	90	60089	24
92	60089	24	97	60440	25
97	60440	25			

Average MS Recovery = 89 %
Minimum MS Recovery = 47 %

Average LCS Recovery = 95 %
Minimum LCS Recovery = 83 %

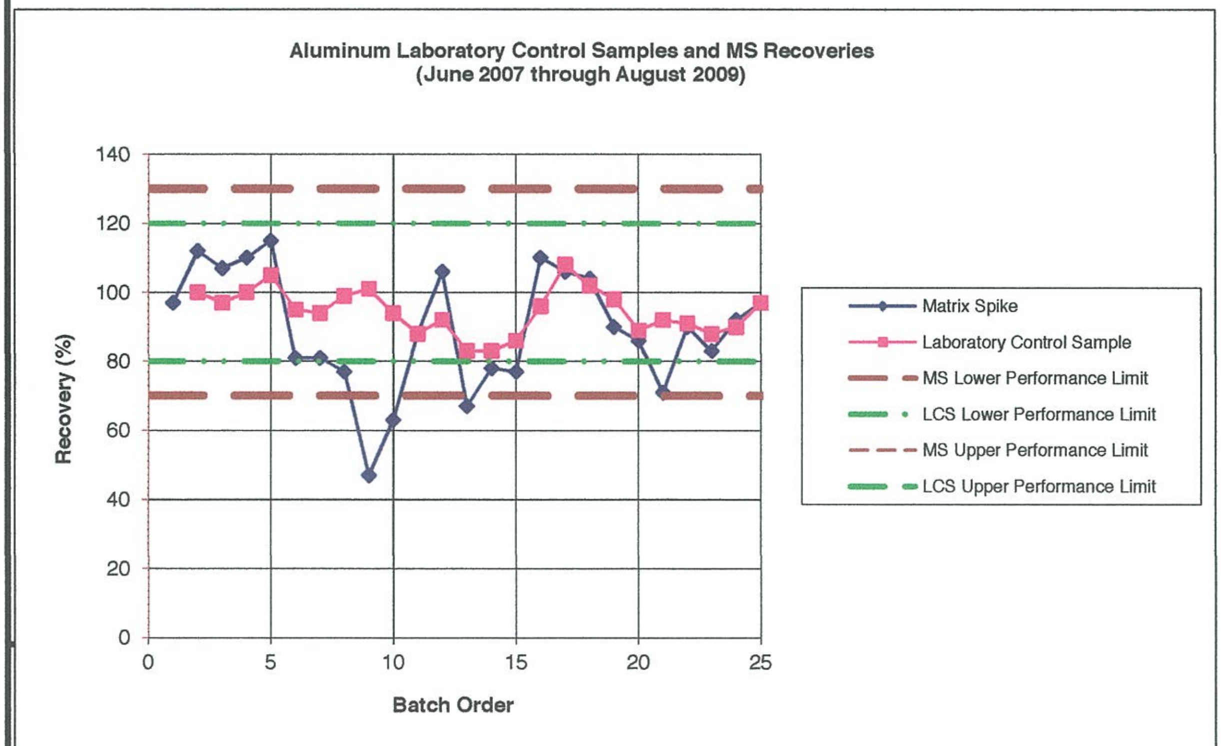
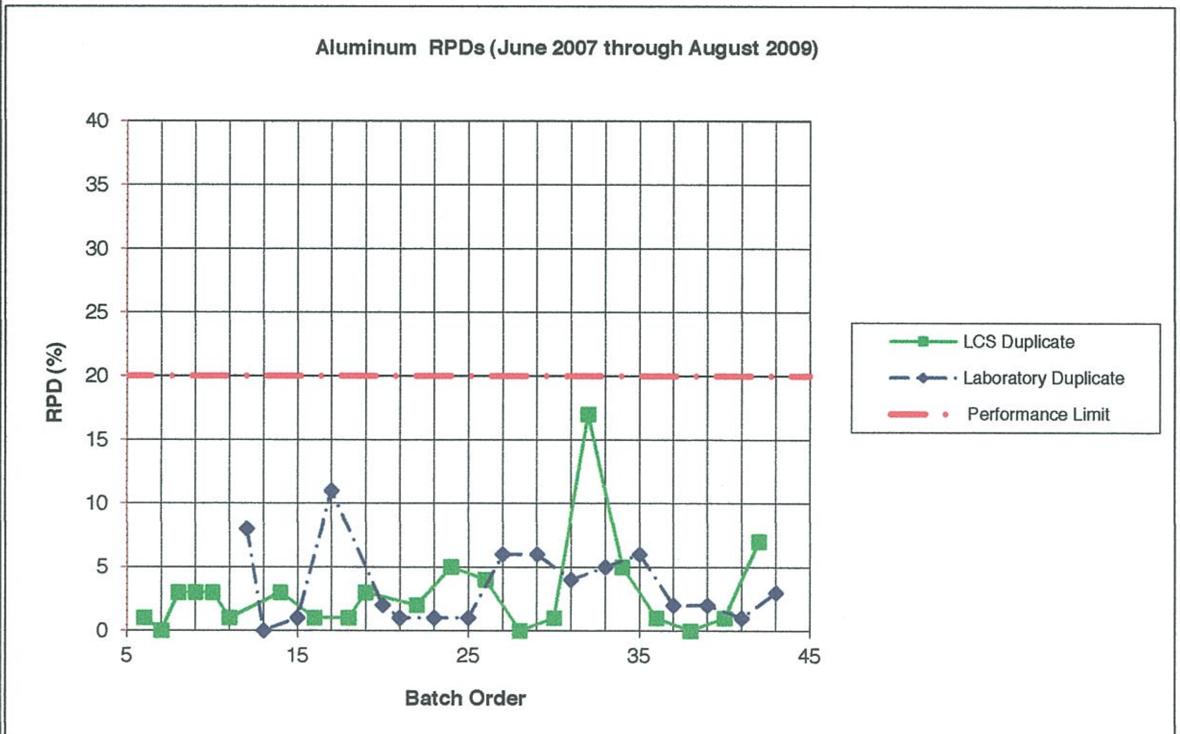


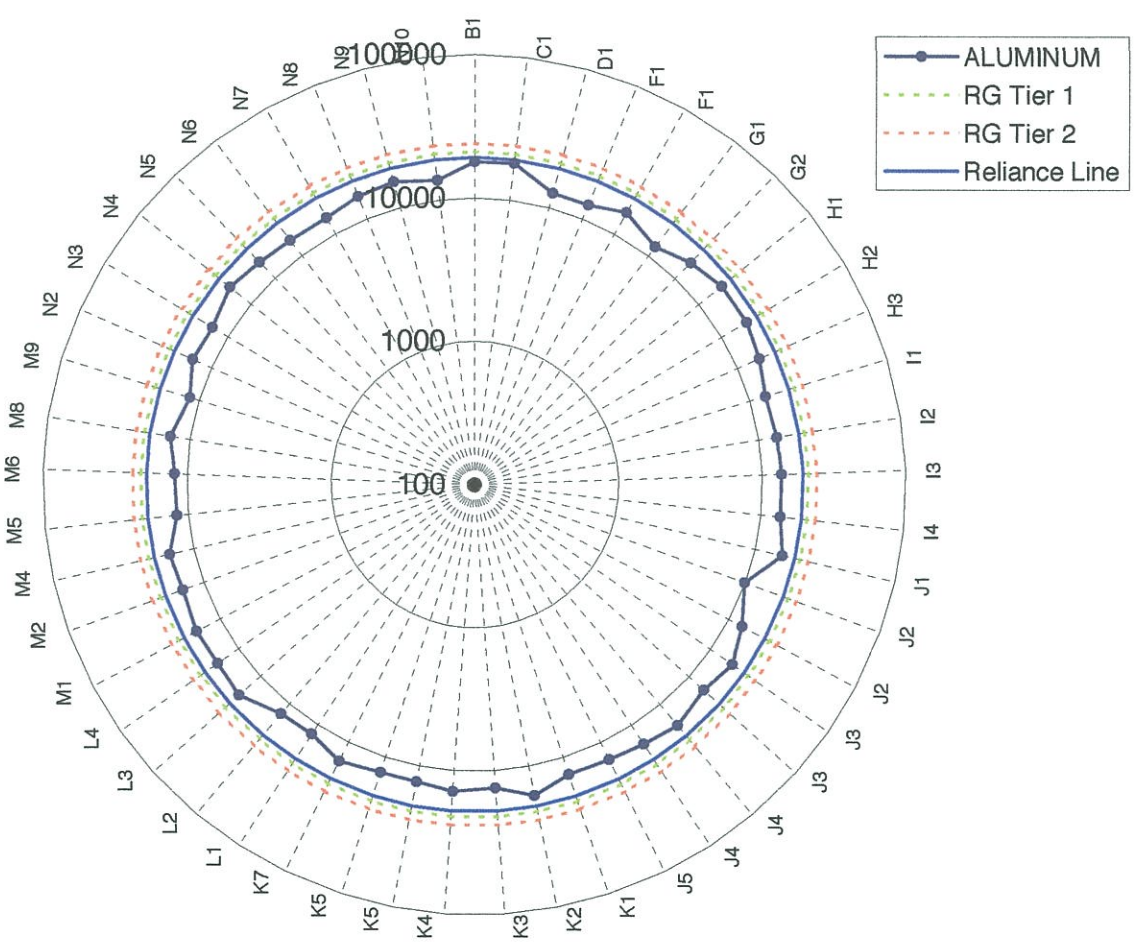
Table Al-7: ALUMINUM - Laboratory LCS and CVS duplicates					
Laboratory Duplicate RPD		Batch Order	LCS Duplicate RPD		Batch Order
8	57100	12	1	54626-627	6
0.0001	57226	13	0	54821-822	7
1	57400	15	3	54891-892	8
11	57514	17	3	54915-916	9
2	57790	20	3	57100	10
1	57848	21	1	57226	11
1	58137	23	3	57400	14
1	58213	25	1	57514	16
6	58563	27	1	57790	18
6	58729	29	3	57848	19
4	59165	31	2	58137	22
5	59382	33	5	58213	24
6	59623	35	4	58563	26
2	59758	37	0	58729	28
2	59890	39	1	59165	30
1	60089	41	17	59382	32
3	60440	43	5	59623	34
			1	59758	36
			0	59890	38
			1	60089	40
			7	60440	42

Average Duplicate RPD = 4 %
Maximum Duplicate RPD = 11 %

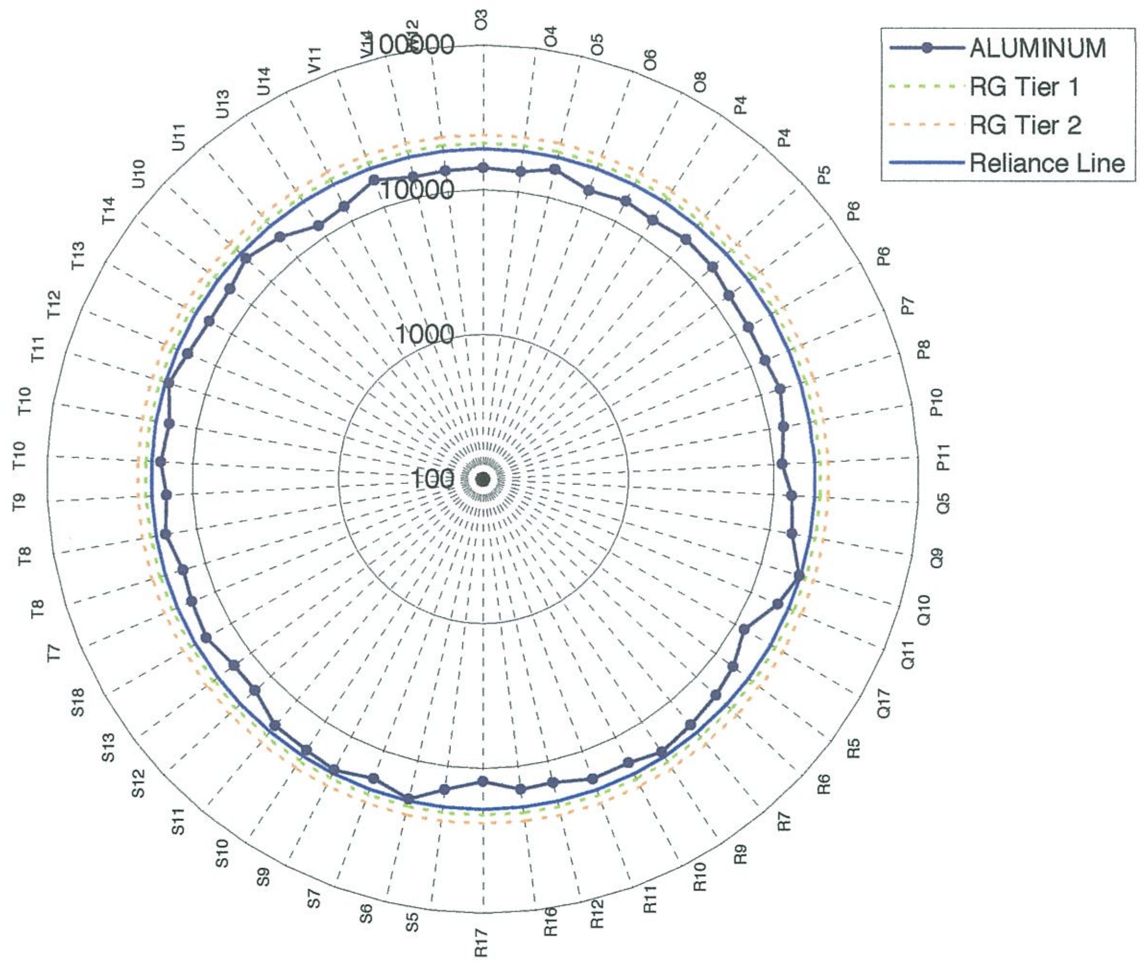
Average LCS RPD = 3 %
Maximum LCS RPD = 17 %



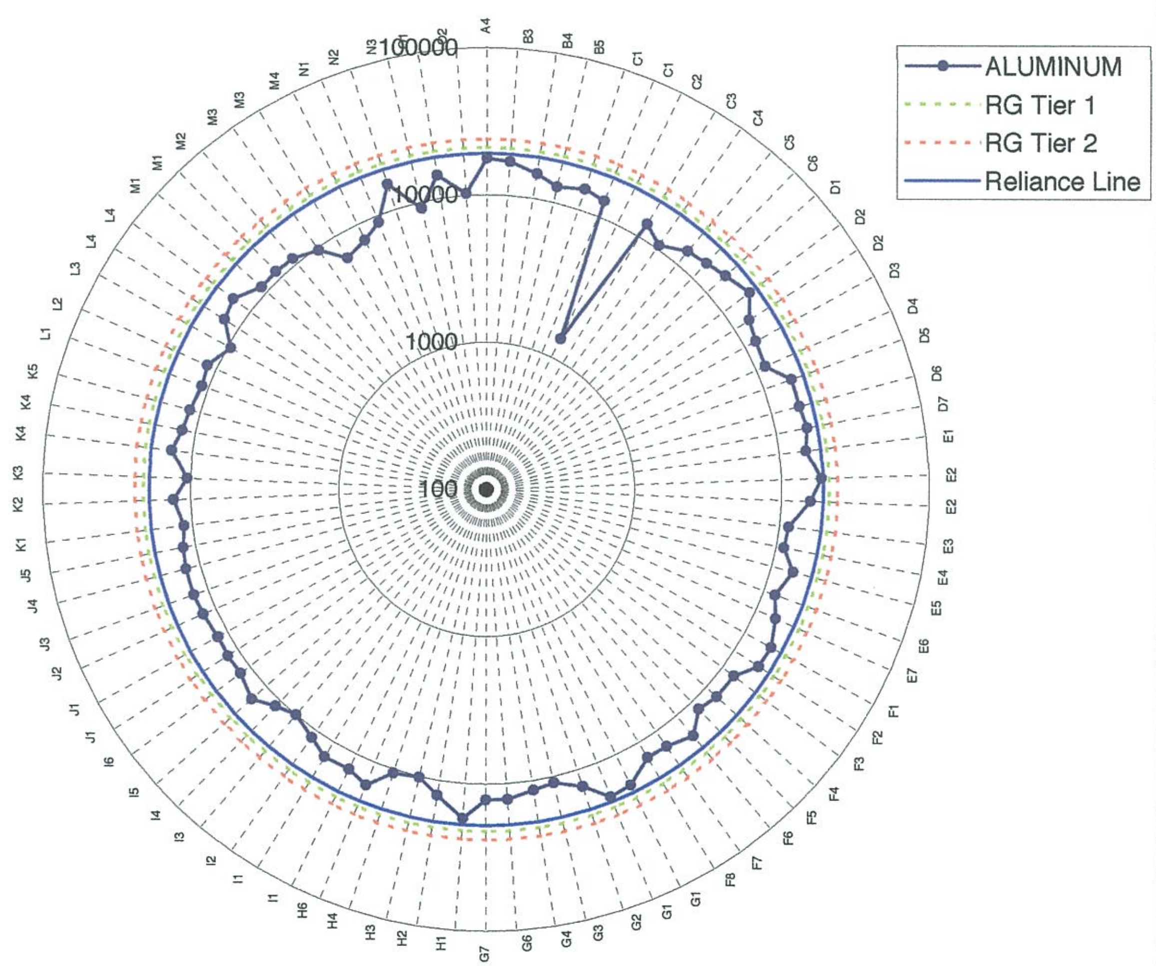
East Site
Grids A through N



East Site
Grids O through W



West Site


ALUMINUM
RG Tier 1
RG Tier 2
Reliance Line
100000
10000
1000
100
A4
B3
B4
B5
C1
C1
C2
C3
C4
C5
C6
D1
D2
D2
D3
D4
D5
D6
D7
E1
E2
E2
E3
E4
E5
E6
E7
F1
F2
F3
F4
F5
F6
F7
F8
G1
G1
G2
G3
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I1
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J4
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K4
K5
L1
L2
L3
L4
L4
M1
M1
M2
M3
M3
M4
N1
N2
N3

ALUMINUM CVS Results from 09/11/09 database								
Site	quarter _acre_ grid	sample_location	chemical_name	result (mg/kg)	analysis_ date	batch_id	detect_ flag	sample_name
East	B1	ES-B01-080623	ALUMINUM	17900	5/3/09	57100	Y	ES-B01-080623
East	C1	ES-C01-080624	ALUMINUM	18100	5/3/09	57100	Y	ES-C01-080624
East	D1	ES-D01-080624	ALUMINUM	12700	6/5/09	58137	Y	ES-D01-080624
East	F1	ES-F01-080529	ALUMINUM	12700	5/4/09	57400	Y	DUP-17
East	F1	ES-F01-080529	ALUMINUM	14800	5/8/09	57514	Y	ES-F01-080529
East	G1	ES-G01-080529	ALUMINUM	12000	5/8/09	57514	Y	ES-G01-080529
East	G2	ES-G02-080605	ALUMINUM	14200	5/8/09	57514	Y	ES-G02-080605
East	H1	ES-H01-080528	ALUMINUM	15900	5/8/09	57514	Y	ES-H01-080528
East	H2	ES-H02-080515	ALUMINUM	15900	5/8/09	57514	Y	ES-H02-080515
East	H3	ES-H03-080605	ALUMINUM	14600	5/27/09	57790	Y	ES-H03-080605
East	I1	ES-I01-080529	ALUMINUM	13000	5/27/09	57790	Y	ES-I01-080529
East	I2	ES-I02-080514	ALUMINUM	13400	5/27/09	57790	Y	ES-I02-080514
East	I3	ES-I03-080513	ALUMINUM	13600	5/27/09	57790	Y	ES-I03-080513
East	I4	ES-I04-080602	ALUMINUM	13600	5/27/09	57790	Y	ES-I04-080602
East	J1	ES-J01-080529	ALUMINUM	15600	5/27/09	57790	Y	ES-J01-080529
East	J2	ES-J02-080527	ALUMINUM	9920	5/8/09	57514	Y	DUP-15
East	J2	ES-J02-080527	ALUMINUM	12700	5/27/09	57790	Y	ES-J02-080527
East	J3	ES-J03-080513	ALUMINUM	15200	5/3/09	57100	Y	DUP-11
East	J3	ES-J03-080513	ALUMINUM	13800	6/19/09	58563	Y	ES-J03-080513
East	J4	ES-J04-080530	ALUMINUM	15500	5/8/09	57514	Y	DUP-18
East	J4	ES-J04-080530	ALUMINUM	14300	5/27/09	57790	Y	ES-J04-080530
East	J5	ES-J05-080602	ALUMINUM	13600	5/27/09	57790	Y	ES-J05-080602
East	K1	ES-K01-080602	ALUMINUM	13300	5/27/09	57790	Y	ES-K01-080602
East	K2	ES-K02-080602	ALUMINUM	16200	5/8/09	57514	Y	ES-K02-080602
East	K3	ES-K03-080514	ALUMINUM	13200	5/27/09	57790	Y	ES-K03-080514
East	K4	ES-K04-080527	ALUMINUM	13900	5/27/09	57848	Y	ES-K04-080527
East	K5	ES-K05-080605	ALUMINUM	12900	5/27/09	57848	Y	ES-K05-080605
East	K5	ES-K05-080605	ALUMINUM	12900	5/27/09	57848	Y	DUP-19
East	K7	ES-K07-080611	ALUMINUM	14000	5/4/09	57400	Y	ES-K07-080611
East	L1	ES-L01-080625	ALUMINUM	11900	5/27/09	57848	Y	ES-L01-080625
East	L2	ES-L02-080625	ALUMINUM	12300	5/27/09	57848	Y	ES-L02-080625
East	L3	ES-L03-080604	ALUMINUM	15800	5/27/09	57848	Y	ES-L03-080604
East	L4	ES-L04-080604	ALUMINUM	15000	6/19/09	58563	Y	ES-L04-080604
East	M1	ES-M01-080527	ALUMINUM	15300	5/27/09	57848	Y	ES-M01-080527
East	M2	ES-M02-080519	ALUMINUM	14300	5/27/09	57848	Y	ES-M02-080519
East	M4	ES-M04-080515	ALUMINUM	14900	5/27/09	57848	Y	ES-M04-080515
East	M5	ES-M05-080527	ALUMINUM	12000	5/27/09	57848	Y	ES-M05-080527

ALUMINUM CVS Results from 09/11/09 database								
Site	quarter _acre_ grid	sample_location	chemical_name	result (mg/kg)	analysis_ date	batch_id	detect_ flag	sample_name
East	M6	ES-M06-080520	ALUMINUM	12200	5/27/09	57848	Y	ES-M06-080520
East	M8	ES-M08-080610	ALUMINUM	13700	5/4/09	57400	Y	ES-M08-080610
East	M9	ES-M09-080611	ALUMINUM	11700	5/4/09	57400	Y	ES-M09-080611
East	N2	ES-N02-080528	ALUMINUM	13900	5/27/09	57848	Y	ES-N02-080528
East	N3	ES-N03-080520	ALUMINUM	13300	5/27/09	57848	Y	ES-N03-080520
East	N4	ES-N04-080519	ALUMINUM	15400	5/27/09	57848	Y	ES-N04-080519
East	N5	ES-N05-080519	ALUMINUM	14300	5/27/09	57848	Y	ES-N05-080519
East	N6	ES-N06-080527	ALUMINUM	13500	6/5/09	58137	Y	ES-N06-080527
East	N7	ES-N07-080530	ALUMINUM	13400	6/5/09	58137	Y	ES-N07-080530
East	N8	ES-N08-080610	ALUMINUM	14700	5/4/09	57400	Y	ES-N08-080610
East	N9	ES-N09-080610	ALUMINUM	15300	5/4/09	57400	Y	ES-N09-080610
East	N10	ES-N10-080610	ALUMINUM	13700	5/4/09	57400	Y	ES-N10-080610
East	O3	ES-O03-080528	ALUMINUM	14200	6/5/09	58137	Y	ES-O03-080528
East	O4	ES-O04-080515	ALUMINUM	13800	6/5/09	58137	Y	ES-O04-080515
East	O5	ES-O05-080520	ALUMINUM	15700	6/5/09	58137	Y	ES-O05-080520
East	O6	ES-O06-080529	ALUMINUM	13300	6/5/09	58137	Y	ES-O06-080529
East	O8	ES-O08-080530	ALUMINUM	14300	7/24/09	59758	Y	ES-O08-080530
East	P4	ES-P04-080528	ALUMINUM	13700	5/27/09	57790	Y	DUP-16
East	P4	ES-P04-080528	ALUMINUM	14600	6/5/09	58137	Y	ES-P04-080528
East	P5	ES-P05-080513	ALUMINUM	14200	6/5/09	58137	Y	ES-P05-080513
East	P6	ES-P06-080515	ALUMINUM	13000	5/27/09	57790	Y	DUP-12
East	P6	ES-P06-080515	ALUMINUM	12700	6/5/09	58137	Y	ES-P06-080515
East	P7	ES-P07-080519	ALUMINUM	12800	5/27/09	57848	Y	ES-P07-080519
East	P8	ES-P08-080530	ALUMINUM	13800	6/5/09	58137	Y	ES-P08-080530
East	P10	ES-P10-080606	ALUMINUM	12600	5/4/09	57400	Y	ES-P10-080606
East	P11	ES-P11-080606	ALUMINUM	11400	5/4/09	57400	Y	ES-P11-080606
East	Q5	ES-Q05-080520	ALUMINUM	13300	6/5/09	58137	Y	ES-Q05-080520
East	Q9	ES-Q09-080612	ALUMINUM	14300	6/5/09	58137	Y	ES-Q09-080612
East	Q10	ES-Q10-080606	ALUMINUM	18800	5/8/09	57514	Y	ES-Q10-080606
East	Q11	ES-Q11-080606	ALUMINUM	16000	5/8/09	57514	Y	ES-Q11-080606
East	Q17	ES-Q17-080609	ALUMINUM	11800	5/3/09	57100	Y	ES-Q17-080609
East	R5	ES-R05-080521	ALUMINUM	14100	6/5/09	58137	Y	ES-R05-080521
East	R6	ES-R06-080521	ALUMINUM	15300	6/19/09	58563	Y	ES-R06-080521
East	R7	ES-R07-080521	ALUMINUM	16400	6/11/09	58213	Y	ES-R07-080521
East	R9	ES-R09-080520	ALUMINUM	17600	6/11/09	58213	Y	ES-R09-080520
East	R10	ES-R10-080602	ALUMINUM	15800	6/11/09	58213	Y	ES-R10-080602
East	R11	ES-R11-080605	ALUMINUM	16000	5/8/09	57514	Y	ES-R11-080605

ALUMINUM CVS Results from 09/11/09 database								
Site	quarter _acre_ grid	sample_location	chemical_name	result (mg/kg)	analysis_ date	batch_id	detect_ flag	sample_name
East	R12	ES-R12-080611	ALUMINUM	14200	5/8/09	57514	Y	ES-R12-080611
East	R16	ES-R16-080605	ALUMINUM	14400	5/3/09	57100	Y	ES-R16-080605
East	R17	ES-R17-080606	ALUMINUM	12300	5/3/09	57100	Y	ES-R17-080606
East	S5	ES-S05-080521	ALUMINUM	14500	6/11/09	58213	Y	ES-S05-080521
East	S6	ES-S06-080521	ALUMINUM	18600	6/11/09	58213	Y	ES-S06-080521
East	S7	ES-S07-080521	ALUMINUM	16000	6/11/09	58213	Y	ES-S07-080521
East	S9	ES-S09-080522	ALUMINUM	18200	6/11/09	58213	Y	ES-S09-080522
East	S10	ES-S10-080523	ALUMINUM	17200	6/11/09	58213	Y	ES-S10-080523
East	S11	ES-S11-080528	ALUMINUM	16900	6/11/09	58213	Y	ES-S11-080528
East	S12	ES-S12-080609	ALUMINUM	14000	5/3/09	57100	Y	ES-S12-080609
East	S13	ES-S13-080610	ALUMINUM	13900	5/3/09	57100	Y	ES-S13-080610
East	S18	ES-S18-080606	ALUMINUM	15700	5/3/09	57100	Y	ES-S18-080606
East	T7	ES-T07-080612	ALUMINUM	14900	6/11/09	58213	Y	ES-T07-080612
East	T8	ES-T08-080522	ALUMINUM	14300	6/5/09	58137	Y	DUP-13
East	T8	ES-T08-080522	ALUMINUM	16500	6/11/09	58213	Y	ES-T08-080522
East	T9	ES-T09-080522	ALUMINUM	15100	6/11/09	58213	Y	ES-T09-080522
East	T10	ES-T10-080523	ALUMINUM	16600	6/11/09	58213	Y	ES-T10-080523
East	T10	ES-T10-080523	ALUMINUM	15400	6/11/09	58213	Y	DUP-14
East	T11	ES-T11-080530	ALUMINUM	18200	6/11/09	58213	Y	ES-T11-080530
East	T12	ES-T12-080609	ALUMINUM	16100	5/3/09	57100	Y	ES-T12-080609
East	T13	ES-T13-080609	ALUMINUM	15000	5/3/09	57100	Y	ES-T13-080609
East	T14	ES-T14-080610	ALUMINUM	15100	5/3/09	57100	Y	ES-T14-080610
East	U10	ES-U10-080523	ALUMINUM	17100	6/11/09	58213	Y	ES-U10-080523
East	U11	ES-U11-080602	ALUMINUM	15100	6/19/09	58563	Y	ES-U11-080602
East	U13	ES-U13-080610	ALUMINUM	12200	5/4/09	57400	Y	ES-U13-080610
East	U14	ES-U14-080610	ALUMINUM	13000	5/4/09	57400	Y	ES-U14-080610
East	V11	ES-V11-080529	ALUMINUM	15800	6/19/09	58563	Y	ES-V11-080529
East	V14	ES-V14-080605	ALUMINUM	13900	5/4/09	57400	Y	ES-V14-080605
East	W12	ES-W12-080527	ALUMINUM	14000	6/19/09	58563	Y	ES-W12-080527
West	A4	WS-A04-080626	ALUMINUM	17700	7/11/09	59382	Y	WS-A04-080626
West	B3	WS-B03-080502	ALUMINUM	17100	7/11/09	59382	Y	WS-B03-080502
West	B4	WS-B04-080626	ALUMINUM	14800	7/11/09	59382	Y	WS-B04-080626
West	B5	WS-B05-080626	ALUMINUM	12900	7/24/09	59758	Y	WS-B05-080626
West	C1	WS-C01-080501	ALUMINUM	13000	6/19/09	58563	Y	WS-C01-080501
West	C1	WS-C01-080501	ALUMINUM	14000	6/19/09	58563	Y	DUP-3
West	C2	WS-C02-080428	ALUMINUM	1380	7/22/09	59623	Y	WS-C02-080428
West	C3	WS-C03-080620	ALUMINUM	12700	7/22/09	59623	Y	WS-C03-080620

ALUMINUM CVS Results from 09/11/09 database								
Site	quarter _acre_ grid	sample_location	chemical_name	result (mg/kg)	analysis_ date	batch_id	detect_ flag	sample_name
West	C4	WS-C04-080623	ALUMINUM	10600	7/22/09	59623	Y	WS-C04-080623
West	C5	WS-C05-080620	ALUMINUM	13000	7/24/09	59758	Y	WS-C05-080620
West	C6	WS-C06-080624	ALUMINUM	13800	7/24/09	59758	Y	WS-C06-080624
West	D1	WS-D01-080430	ALUMINUM	14900	6/19/09	58563	Y	WS-D01-080430
West	D2	WS-D02-080429	ALUMINUM	16800	7/11/09	59382	Y	DUP-2
West	D2	WS-D02-080429	ALUMINUM	13100	7/22/09	59623	Y	WS-D02-080429
West	D3	WS-D03-080620	ALUMINUM	12100	7/22/09	59623	Y	WS-D03-080620
West	D4	WS-D04-080623	ALUMINUM	11600	8/17/09	60440	Y	WS-D04-080623
West	D5	WS-D05-080620	ALUMINUM	15800	7/24/09	59758	Y	WS-D05-080620
West	D6	WS-D06-080619	ALUMINUM	15600	7/24/09	59758	Y	WS-D06-080619
West	D7	WS-D07-080619	ALUMINUM	16300	7/24/09	59758	Y	WS-D07-080619
West	E1	WS-E01-080430	ALUMINUM	15200	6/19/09	58563	Y	WS-E01-080430
West	E2	WS-E02-080428	ALUMINUM	18600	7/11/09	59382	Y	DUP-1
West	E2	WS-E02-080428	ALUMINUM	15700	7/22/09	59623	Y	WS-E02-080428
West	E3	WS-E03-080619	ALUMINUM	11500	7/22/09	59623	Y	WS-E03-080619
West	E4	WS-E04-080613	ALUMINUM	11300	7/24/09	59758	Y	WS-E04-080613
West	E5	WS-E05-080613	ALUMINUM	14200	7/24/09	59758	Y	WS-E05-080613
West	E6	WS-E06-080613	ALUMINUM	12100	7/24/09	59758	Y	WS-E06-080613
West	E7	WS-E07-080613	ALUMINUM	14000	7/24/09	59758	Y	WS-E07-080613
West	F1	WS-F01-080429	ALUMINUM	16100	6/19/09	58563	Y	WS-F01-080429
West	F2	WS-F02-080429	ALUMINUM	15800	7/22/09	59623	Y	WS-F02-080429
West	F3	WS-F03-080619	ALUMINUM	12500	7/22/09	59623	Y	WS-F03-080619
West	F4	WS-F04-080616	ALUMINUM	12500	7/30/09	59890	Y	WS-F04-080616
West	F5	WS-F05-080612	ALUMINUM	11700	8/17/09	60440	Y	WS-F05-080612
West	F6	WS-F06-080612	ALUMINUM	15100	7/30/09	59890	Y	WS-F06-080612
West	F7	WS-F07-080617	ALUMINUM	13300	6/30/09	58729	Y	WS-F07-080617
West	F8	WS-F08-080618	ALUMINUM	13100	6/30/09	58729	Y	WS-F08-080618
West	G1	WS-G01-080501	ALUMINUM	17000	6/19/09	58563	Y	DUP-4
West	G1	WS-G01-080501	ALUMINUM	17700	6/30/09	58729	Y	WS-G01-080501
West	G2	WS-G02-080618	ALUMINUM	13100	7/22/09	59623	Y	WS-G02-080618
West	G3	WS-G03-080619	ALUMINUM	11000	7/22/09	59623	Y	WS-G03-080619
West	G4	WS-G04-080616	ALUMINUM	11600	7/30/09	59890	Y	WS-G04-080616
West	G6	WS-G06-080616	ALUMINUM	12800	7/30/09	59890	Y	WS-G06-080616
West	G7	WS-G07-080617	ALUMINUM	12800	6/30/09	58729	Y	WS-G07-080617
West	H1	WS-H01-080501	ALUMINUM	17400	6/30/09	58729	Y	WS-H01-080501
West	H2	WS-H02-080618	ALUMINUM	12600	7/22/09	59623	Y	WS-H02-080618
West	H3	WS-H03-080619	ALUMINUM	10100	7/30/09	59890	Y	WS-H03-080619

ALUMINUM CVS Results from 09/11/09 database								
Site	quarter _acre_ grid	sample_location	chemical_name	result (mg/kg)	analysis_ date	batch_id	detect_ flag	sample_name
West	H4	WS-H04-080616	ALUMINUM	10600	7/30/09	59890	Y	WS-H04-080616
West	H6	WS-H06-080617	ALUMINUM	14700	6/30/09	58729	Y	WS-H06-080617
West	I1	WS-I01-080501	ALUMINUM	13200	6/30/09	58729	Y	WS-I01-080501
West	I1	WS-I01-080501	ALUMINUM	13000	6/30/09	58729	Y	DUP-5
West	I2	WS-I02-080618	ALUMINUM	11400	7/24/09	59758	Y	WS-I02-080618
West	I3	WS-I03-080618	ALUMINUM	9990	7/30/09	59890	Y	WS-I03-080618
West	I4	WS-I04-080617	ALUMINUM	11200	7/30/09	59890	Y	WS-I04-080617
West	I5	WS-I05-080617	ALUMINUM	13600	6/30/09	58729	Y	WS-I05-080617
West	I6	WS-I06-080617	ALUMINUM	12000	6/30/09	58729	Y	WS-I06-080617
West	J1	WS-J01-080505	ALUMINUM	12000	6/30/09	58729	Y	DUP-6
West	J1	WS-J01-080505	ALUMINUM	11800	6/30/09	58729	Y	WS-J01-080505
West	J2	WS-J02-080624	ALUMINUM	12400	6/30/09	58729	Y	WS-J02-080624
West	J3	WS-J03-080620	ALUMINUM	12600	7/8/09	59165	Y	WS-J03-080620
West	J4	WS-J04-080617	ALUMINUM	12600	7/8/09	59165	Y	WS-J04-080617
West	J5	WS-J05-080618	ALUMINUM	12200	7/8/09	59165	Y	WS-J05-080618
West	K1	WS-K01-080505	ALUMINUM	11400	7/8/09	59165	Y	WS-K01-080505
West	K2	WS-K02-080509	ALUMINUM	13100	7/8/09	59165	Y	WS-K02-080509
West	K3	WS-K03-080509	ALUMINUM	10600	7/8/09	59165	Y	WS-K03-080509
West	K4	WS-K04-080513	ALUMINUM	13900	7/8/09	59165	Y	WS-K04-080513
West	K4	WS-K04-080513	ALUMINUM	12400	7/24/09	59758	Y	DUP-10
West	K5	WS-K05-080509	ALUMINUM	11800	7/8/09	59165	Y	WS-K05-080509
West	L1	WS-L01-080505	ALUMINUM	11100	7/8/09	59165	Y	WS-L01-080505
West	L2	WS-L02-080508	ALUMINUM	11600	7/8/09	59165	Y	WS-L02-080508
West	L3	WS-L03-080508	ALUMINUM	9480	7/8/09	59165	Y	WS-L03-080508
West	L4	WS-L04-080508	ALUMINUM	13000	7/8/09	59165	Y	DUP-9
West	L4	WS-L04-080508	ALUMINUM	14000	7/8/09	59165	Y	WS-L04-080508
West	M1	WS-M01-080505	ALUMINUM	11200	7/8/09	59165	Y	WS-M01-080505
West	M1	WS-M01-080505	ALUMINUM	11300	7/8/09	59165	Y	DUP-7
West	M2	WS-M02-080507	ALUMINUM	11000	7/24/09	59758	Y	WS-M02-080507
West	M3	WS-M03-080507	ALUMINUM	9550	7/22/09	59623	Y	DUP-8
West	M3	WS-M03-080507	ALUMINUM	6770	8/11/09	60089	Y	WS-M03-080507
West	M4	WS-M04-080507	ALUMINUM	7610	8/11/09	60089	Y	WS-M04-080507
West	N1	WS-N01-080506	ALUMINUM	8980	8/11/09	60089	Y	WS-N01-080506
West	N2	WS-N02-080506	ALUMINUM	15100	7/11/09	59382	Y	WS-N02-080506
West	N3	WS-N03-080507	ALUMINUM	9090	6/30/09	58729	Y	WS-N03-080507
West	O1	WS-O01-080506	ALUMINUM	14500	7/11/09	59382	Y	WS-O01-080506
West	O2	WS-O02-080506	ALUMINUM	10300	7/11/09	59382	Y	WS-O02-080506

Table Sb-1: Antimony Data Quality Summary			
Laboratory Performance Criteria	Criteria	Measured	Comment
Minimum LCS Recovery	greater than 80%	90%	
Minimum Matrix Spike Recovery	greater than 70%	5%	low
Average LCS Recovery	N/A	104%	
Average Matrix Spike Recovery	N/A	55%	
Maximum LCS RPD	less than 20%	18%	
Maximum Laboratory Duplicate RPD	less than 20%	91%	high
Average LCS RPD	N/A	4%	
Average Laboratory Duplicate RPD	N/A	24%	
Measurement Quality Objectives	Critera	Measured	
NPS CRM	Recovery greater than DL	Minimum Recovery =	2 mg/kg
EQIS CRM	See Note 1		
CVS Split Analysis RPD	RPD less than 35%	Maximum RPD =	127 %
CRM Split Analysis RPD	RPD less than 35%	Maximum RPD =	62 %
Overall QC Indicator Measurements	Criteria	Measured	
NPS CRM "Made to" (Bias measure)	N/A	Average Recovery =	71.2 %
NPS Replicate Test (Precision measure)	N/A	Standard Deviation =	0.17 mg/kg
Data Quality Relative to Remediation Goals			
Tier 1 Remediation Goal	1.9		
Tier 2 Remediation Goal	2.2		
QC Derived Reliance Level	1.73 mg/kg	See Note 2	

Comments: Antimony laboratory control sample (LCS) recovery (90%) is good, however the average matrix spike recovery (55%) is low, which indicates a bias towards low measurements. The LCS duplicate RPD (18%) is acceptably low, however the laboratory duplicate RPD (91%) is very high, which is indicative of imprecision. Imprecision is also indicated by a high maximum CVS split RPD (127%), high maximum CRM split RPD (123%), and a large standard deviation (0.17 mg/kg) relative to it's mean (0.47 mg/kg) in repeated tests on the same sample. The equivocal measurement quality is reflected in a derived reliance level (1.7 mg/kg) that is lower than RGs. Only one CVS measurement exceeded the derived reliance level and that measurement also exceeded the Tier 2 RG. It is concluded that antimony CVS measurements have adequate quality to be used to verify attainment of RGs and may be used to determine RG compliance.

Note 1: The QAPP required CRMs have only 4 analytes from each analyte group. Antimony is not one of these.

Note 2: Derived reliance level is calculated as: (Tier 2 RG)(1.2)(Average Recovery)-(0.84)(Standard deviation) = (2.2)(1.2)(.712)-(0.84)(.17) = 1.73 mg/kg

Table Sb-2: Antimony - NPS CRMs				
Blind NPS CRM Results				
Sample	Result	Analysis Date	Batch	Detect
BOR Sample 1-BOR 56	3	4/28/09	57270	Y
BOR Sample 4-BOR 82	2.5	5/11/09	57557	Y
BOR 83	2.7	6/8/09	58143	Y
BOR 84	2.9	6/8/09	58175	Y
BOR Sample 3-BOR 58	2.4	6/8/09	58143	Y
BOR Sample 7-BOR 105	3.1	6/8/09	58175	Y
BOR 85	2.2	6/28/09	58861	Y
BOR Sample 8-BOR 106	2.6	6/28/09	58861	Y
BOR 86	2.5	6/29/09	58862	Y
BOR 87	2.5	7/10/09	59378	Y
BOR 108	2.3	7/11/09	59378	Y
BOR 109	2.4	7/11/09	59379	Y
BOR 110	3.2	7/20/09	59651	Y
BOR 111	3.2	8/4/09	60069	Y
BOR Sample 9-BOR 107	3.4	8/4/09	60068	Y
BOR Sample 6-BOR 81	2.4	5/8/09	57509	Y

CRMs		Vendor Supplied Information
Mean	2.71	*Made to*
Standard Error	0.09	*3.8 mg/kg*
Median	2.55	
Standard Deviation	0.37	*Upper Acceptance Limit*
Sample Variance	0.14	*3.5 mg/kg*
Kurtosis	-1.10	
Skewness	0.52	*Lower Acceptance Limit*
Range	1.2	*Detection Limit (DL)*
Minimum	2.2	
Maximum	3.4	
Sum	43.3	
Count	16	
Largest(2)	3.2	
Smallest(2)	2.3	

Table Sb-3: Antimony - NPS Background Sample Replicate Tests				
Results of Replicate Analyses of a Single Sample				
Sample	Result	Analysis Date	Batch	Detect
BOR 112	0.56	4/28/09	57270	Y
BOR 59	0.5	5/8/09	57509	Y
BOR 60	0.55	5/11/09	57557	Y
BOR 113	0.4	6/8/09	58143	Y
BOR 61	0.38	6/8/09	58143	Y
BOR 62	0.27	6/29/09	58862	Y
BOR 115	0.4	7/11/09	59379	Y
BOR 63	0.1	7/11/09	59378	N
BOR 89	0.38	7/11/09	59378	Y
BOR 64	0.46	7/12/09	59391	Y
BOR 91	0.43	7/12/09	59391	Y
BOR 116	0.76	7/20/09	59651	Y
BOR 92	0.6	7/20/09	59651	Y
BOR 65	0.71	7/21/09	59653	Y
BOR 88	0.62	8/4/09	60069	Y

Replicate analyses of Single Sample	
Mean	0.47
Standard Error	0.04
Median	0.46
Standard Deviation	0.17
Sample Variance	0.03
Kurtosis	0.54
Skewness	-0.36
Range	0.66
Minimum	0.1
Maximum	0.76
Sum	7.12
Count	15
Largest(2)	0.71
Smallest(2)	0.27

Table Sb-4: Antimony NPS and EQIS Duplicates

Sample	Result	Analysis Date	Batch	Split	Result	Analysis Date	RPD
BOR 503	0.28	5/8/09	57509	ES-T11-080530	0.14	6/29/2009	67
BOR 506	0.27	5/11/09	57557	ES-S10-080523	0.26	6/29/2009	4
BOR 504	0.29	6/8/09	58143	ES-M05-080527	0.2	6/8/2009	37
BOR 507	0.83	6/28/09	58861	ES-O09-080610			
BOR 508	0.23	7/10/09	59378	ES-Q11-080606	0.26	5/11/2009	12
BOR 510	0.22	7/11/09	59379	OU-8HR-080605	0.049	4/28/2009	127
BOR 501	0.51	7/12/09	59391	WS-L04-080508	0.47	7/11/2009	8
BOR 505	1.4	7/21/09	59653	WS-K03-080509	1.2	7/11/2009	15
BOR 500	0.9	8/4/09	60069	WS-F01-080429	0.33	7/11/2009	93
BOR 502	0.75	8/4/09	60068	WS-F05-080612	0.71	8/19/2009	5
DUP-11	0.72	4/28/09	57269	ES-J03-080513	0.41	7/10/2009	55
DUP-17	0.24	5/8/09	57509	ES-F01-080529	0.25	5/11/2009	4
DUP-15	0.23	5/11/09	57557	ES-J02-080527	0.26	6/8/2009	12
DUP-18	0.32	5/11/09	57557	ES-J04-080530	0.4	6/8/2009	22
DUP-12	0.27	6/8/09	58143	ES-P06-080515	0.23	6/28/2009	16
DUP-16	0.25	6/8/09	58143	ES-P04-080528	0.29	6/28/2009	15
DUP-19	0.22	6/8/09	58175	ES-K05-080605	0.22	6/8/2009	0
DUP-13	0.19	6/28/09	58861	ES-T08-080522	0.23	6/29/2009	19
DUP-14	0.19	6/29/09	58862	ES-T10-080523	0.4	6/29/2009	71
DUP-3	0.35	7/11/09	59378	WS-C01-080501	0.26	7/10/2009	30
DUP-4	0.32	7/11/09	59378	WS-G01-080501	0.32	7/11/2009	0
DUP-5	0.49	7/11/09	59379	WS-I01-080501	0.63	7/11/2009	25
DUP-6	0.89	7/11/09	59379	WS-J01-080505	0.98	7/11/2009	10
DUP-7	0.64	7/12/09	59391	WS-M01-080505	0.7	7/11/2009	9
DUP-9	0.42	7/12/09	59391	WS-L04-080508	0.47	7/11/2009	11
DUP-1	0.62	7/20/09	59651	WS-E02-080428	0.7	7/21/2009	12
DUP-2	0.38	7/20/09	59651	WS-D02-080429	0.43	7/21/2009	12
DUP-8	1.3	7/21/09	59653	WS-M03-080507	1	8/19/2009	26
DUP-10	0.75	8/4/09	60068	WS-K04-080513	0.71	7/11/2009	5

RPD of Sample Splits	
Mean	25.8
Standard Error	5.7
Median	13.6
Standard Deviation	30.3
Sample Variance	916.8
Kurtosis	4.1
Skewness	2.0
Range	127.1
Minimum	0.0
Maximum	127.1
Sum	723.1
Count	28
Largest(2)	92.7
Smallest(2)	0.0

Table Sb-5: EQIS CRMs

Results of Duplicate Analysis of EQIS CRMs

Sample	Result	Date	Batch	Detect	Average	RPD
ES-Z11-080605A	1.7	4/28/09	57269	Y		
ES-Z11-080605B	1.4	4/28/09	57269	Y	1.55	19
ES-Z09-080529A	1.4	5/8/09	57509	Y		
ES-Z09-080529B	1.3	5/8/09	57509	Y	1.35	7
ES-Z12-080606A	1.5	5/8/09	57509	Y		
ES-Z12-080606B	1.3	5/8/09	57509	Y	1.4	14
ES-Z05-080519A	1.9	5/11/09	57557	Y		
ES-Z05-080519B	1.9	5/11/09	57557	Y	1.9	0
ES-Z06-080520A	1.8	5/11/09	57557	Y		
ES-Z06-080520B	1.7	5/11/09	57557	Y	1.75	6
ES-Z07-080522A	1.8	6/8/09	58143	Y		
ES-Z07-080522B	1.6	6/8/09	58143	Y	1.7	12
ES-Z13-080610A	1.2	6/8/09	58175	Y		
ES-Z13-080610B	2	6/8/09	58175	Y	1.6	50
ES-Z10-080602A	0.9	6/28/09	58861	Y		
ES-Z10-080602B	1.7	6/28/09	58861	Y	1.3	62
ES-Z08-080527A	1.8	6/29/09	58862	Y		
ES-Z08-080527B	1.6	6/29/09	58862	Y	1.7	12
ES-Z14-080611A	1.8	7/10/09	59378	Y		
ES-Z14-080611B	1.7	7/10/09	59378	Y	1.75	6
ES-Z06-080520C	1.7	7/11/09	59379	Y		
ES-Z06-080520D	2.3	7/11/09	59379	Y	2	30
ES-Z05-080519C	2.1	7/12/09	59391	Y		
ES-Z05-080519D	2.2	7/12/09	59391	Y	2.15	5
ES-Z19-080624A	2.1	7/20/09	59651	Y		
ES-Z19-080624B	1.9	7/20/09	59651	Y	2	10
WS-Z17-080618A	2.4	7/20/09	59651	Y		
WS-Z17-080618B	2.3	7/20/09	59651	Y	2.35	4
WS-Z15-080613A	2.2	7/21/09	59653	Y		
WS-Z15-080613B	2.4	7/21/09	59653	Y	2.3	9
WS-Z18-080620A	2.3	7/21/09	59653	Y		
WS-Z18-080620B	2.2	7/21/09	59653	Y	2.25	4
WS-Z16-080617A	2.5	8/4/09	60069	Y		
WS-Z16-080617B	2.4	8/4/09	60069	Y	2.45	4

Analysis of EQIS CRMs	
Mean	1.9
Standard Error	0.1
Median	1.8
Standard Deviation	0.4
Sample Variance	0.2
Kurtosis	-0.4
Skewness	-0.3
Range	1.6
Minimum	0.9
Maximum	2.5
Sum	63.0
Count	34
Largest(2)	2.4
Smallest(2)	1.2

RPD of EQIS CRMs	
Mean	14.92
Standard Error	
Median	8.70
Standard Deviation	17.01
Sample Variance	289.32
Kurtosis	3.31
Skewness	1.98
Range	61.54
Minimum	0.00
Maximum	61.54
Sum	253.67
Count	17
Largest(2)	50.00
Smallest(2)	4.08

Table Sb-6: Antimony MS and LCS

Matrix Spike Recovery %	Batch	Order	LCS Recovery %	Batch	Order
87	7160081	1	120	49291	2
93	7160081	1	108	49292	3
5	49291	2	92	49523	4
6	49292	3	92	49524	5
13	49523	4	105	54612	6
6	49524	5	105	54842	7
15	54612	6	111	54937	8
95	54842	7	120	54938	9
42	54937	8	100	57269	10
64	54938	9	100	57270	11
59	57269	10	115	57557	12
86	57270	11	105	58143	13
55	57557	12	94	58175	14
53	58143	13	100	58861	15
49	58175	14	100	58862	16
45	58861	15	105	59378	17
57	58862	16	100	59379	18
29	59378	17	95	59651	20
69	59379	18	90	59653	21
55	59391	19	105	60068	22
100	59391	19	119	60069	23
81	59651	20	110	60477	24
65	59653	21	105	60478	25
51	60068	22			
64	60069	23			
61	60477	24			
68	60478	25			

Average MS Recovery = 55 % Average LCS Recovery = 104 %
Minimum MS Recovery = 5 % Minimum LCS Recovery = 90 %

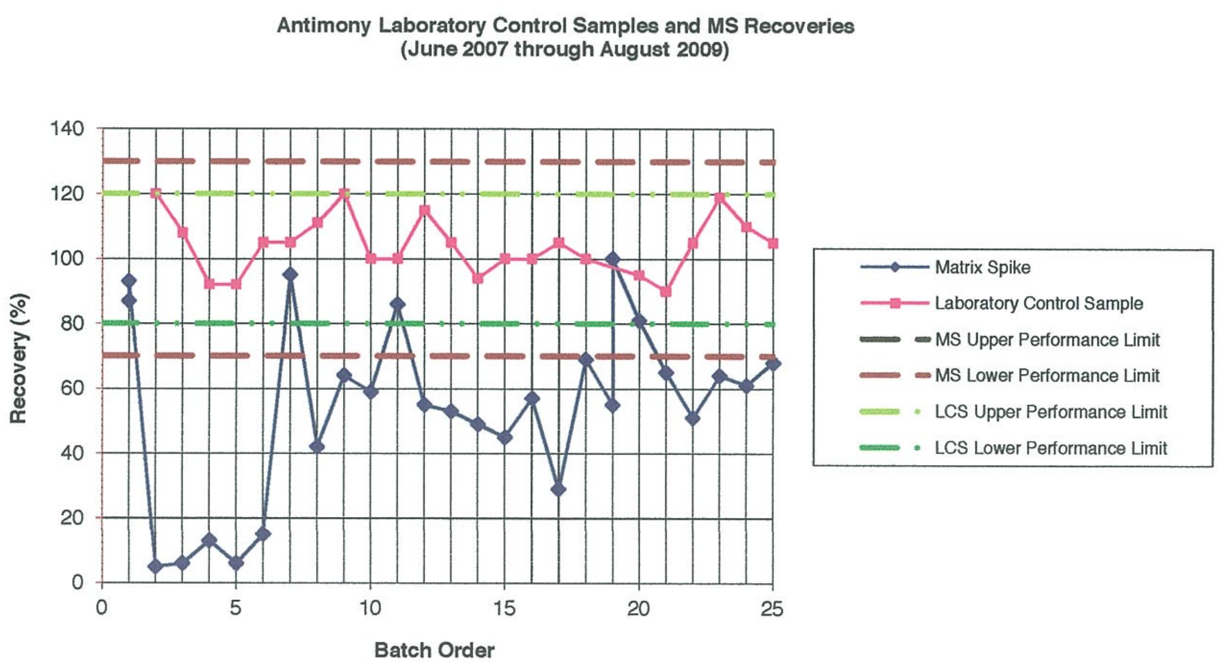
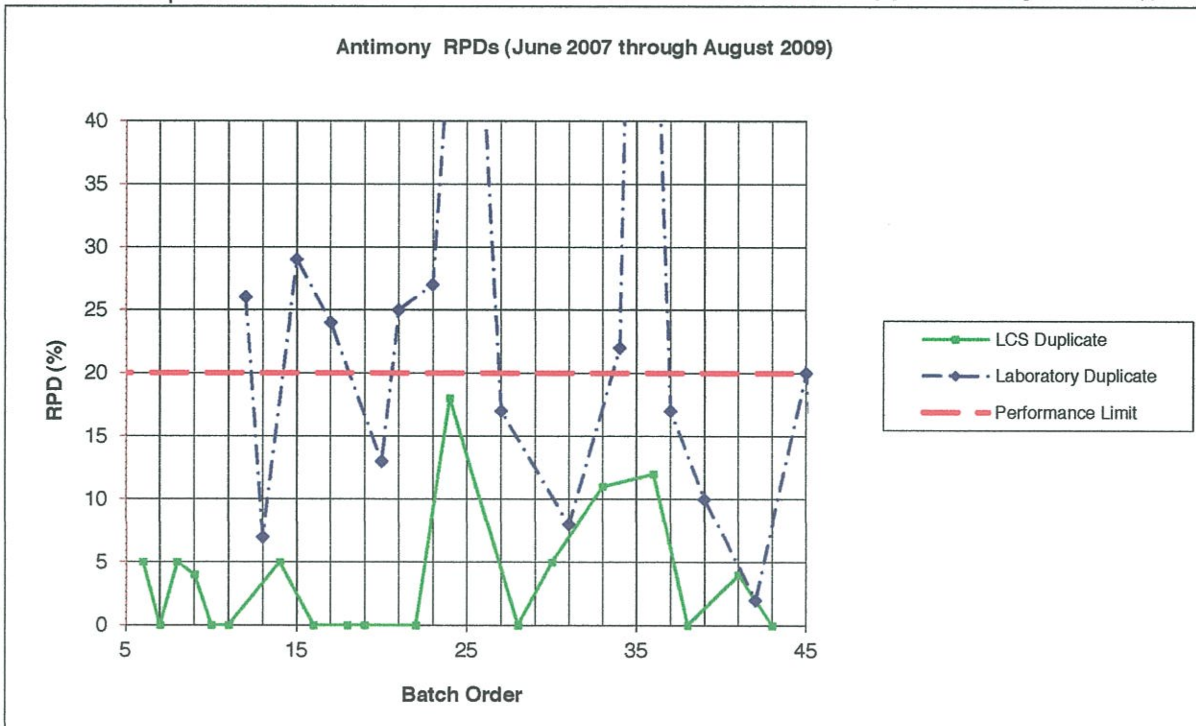


Table Sb-7: Antimony - Laboratory Duplicate and LCS Duplicate

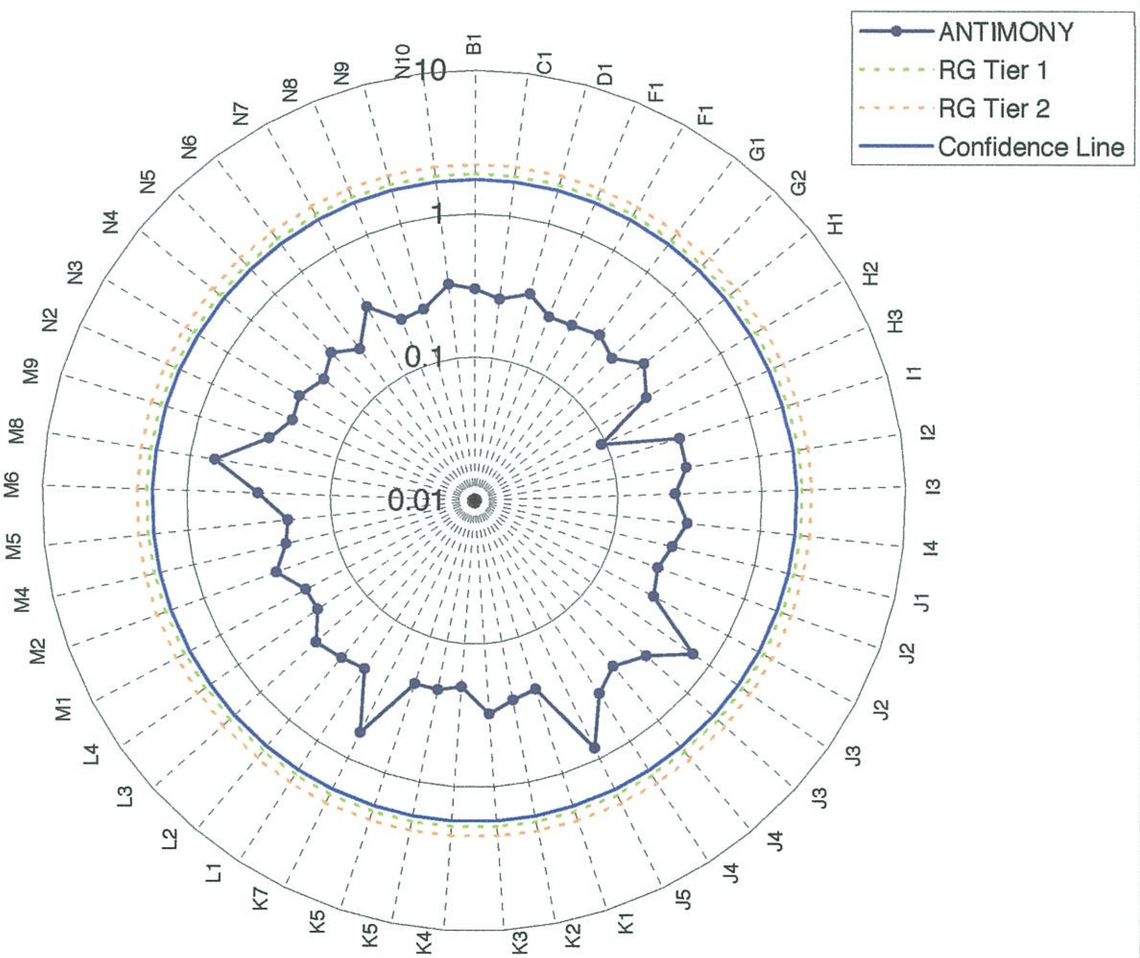
Laboratory Duplicate RPD	Batch	Order	LCS Duplicate RPD	Batch	Order
26	57269	12	5	54612	6
7	57270	13	0	54842	7
29	57509	15	5	54937	8
24	57557	17	4	54938	9
13	58143	20	0	57269	10
25	58175	21	0	57270	11
27	58861	23	5	57509	14
67	58862	25	0	57557	16
17	59378	27	0	58143	18
8	59379	31	0	58175	19
22	59391	34	0	58861	22
91	59651	35	18	58862	24
17	59653	37	0	59378	28
10	60068	39	5	59391	30
2	60069	42	11	59651	33
20	60477	45	12	59653	36
4	60478	46	0	60068	38
			4	60069	41
			0	60477	43
			5	60478	44

Average Duplicate RPD = 24 % | Average LCS RPD = 4 %

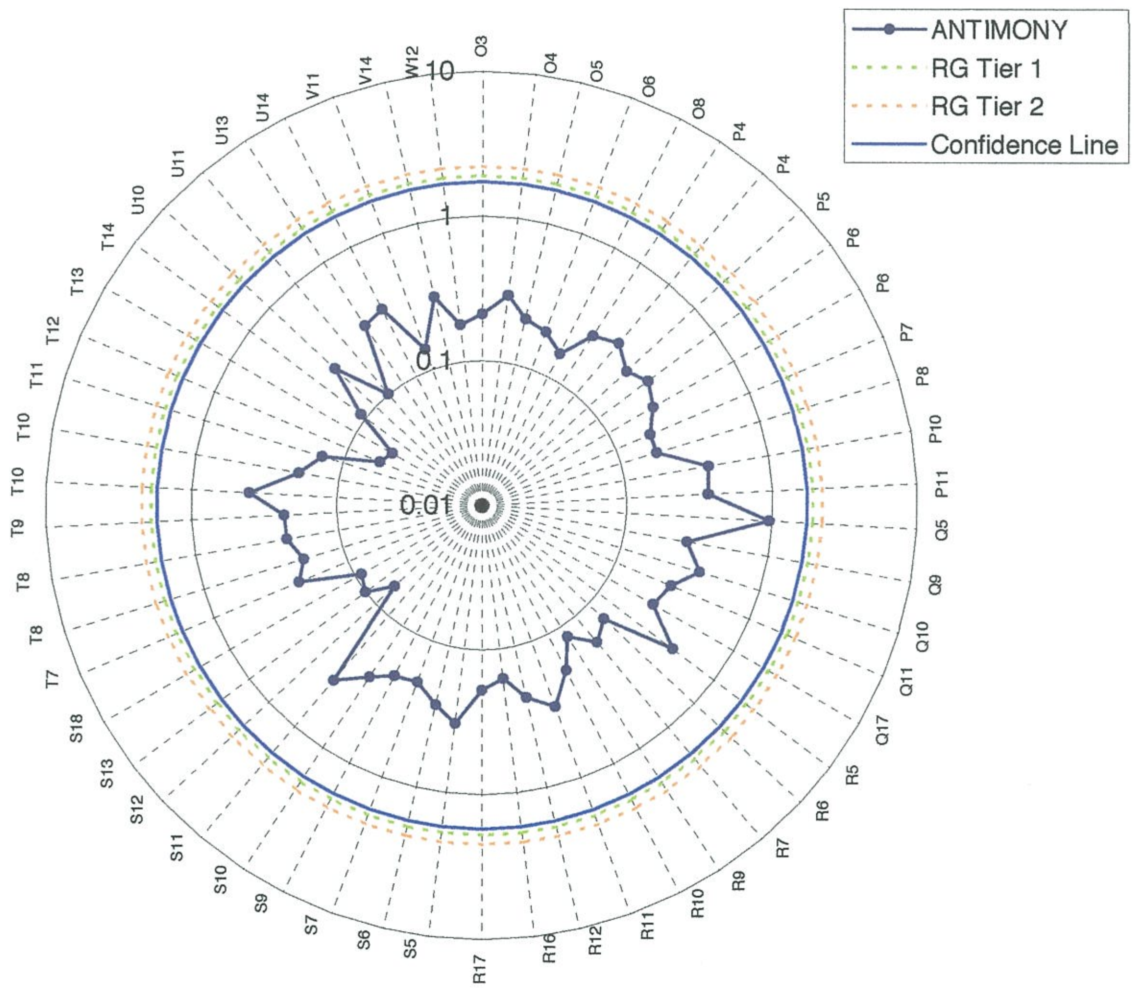
Maximum Duplicate RPD = 91 % | Maximum LCS RPD = 18 %



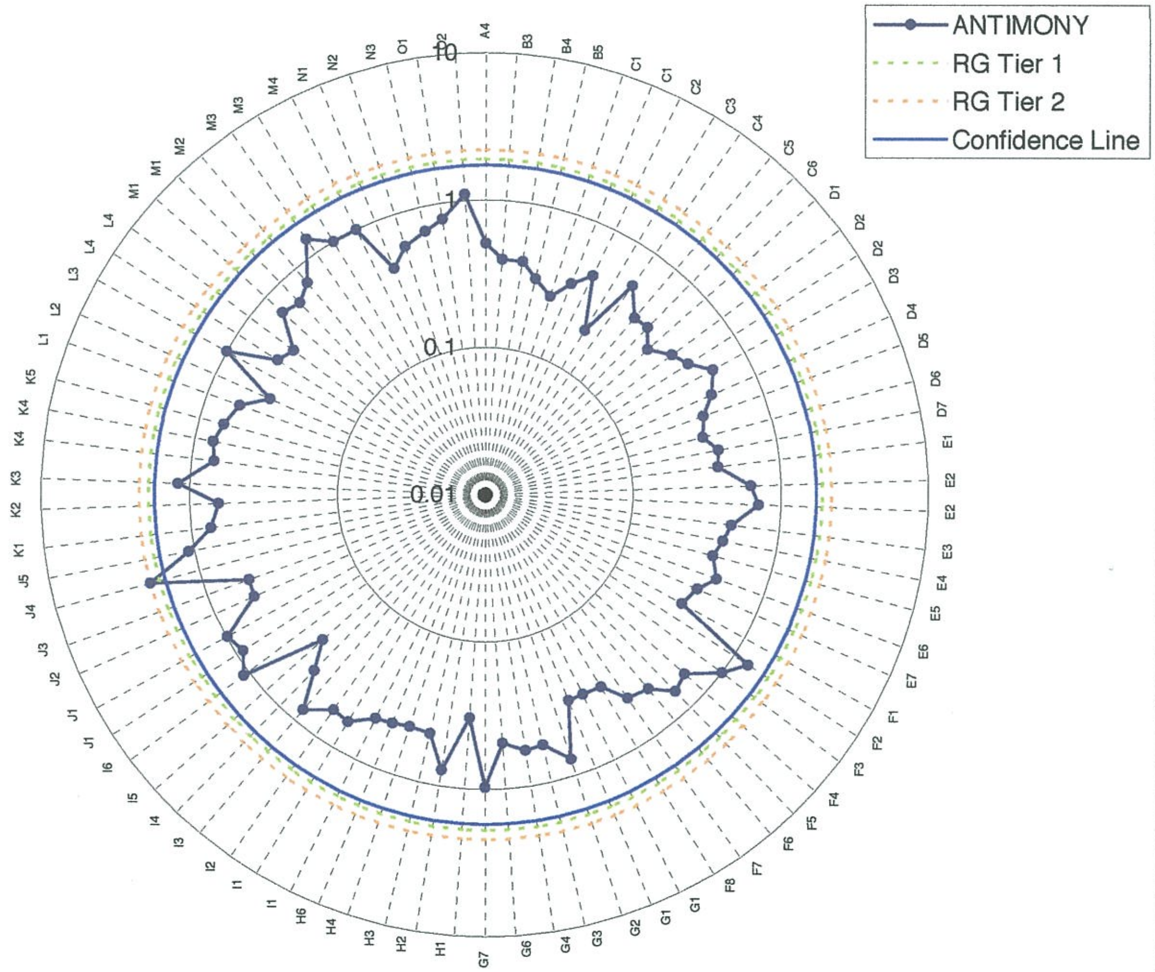
East Site
Grids A through N



East Site
Grids O through W



West Site



ANTIMONY Results from 09/11/09 database								
Site	quarter_acre_grid	sample_location	chemical_name	result_value	analysis_date	batch_id	detect_flag	sample_name
East	B1	ES-B01-080623	ANTIMONY	0.3	04/28/09	57269	Y	ES-B01-080623
East	C1	ES-C01-080624	ANTIMONY	0.26	04/28/09	57269	Y	ES-C01-080624
East	D1	ES-D01-080624	ANTIMONY	0.31	06/28/09	58861	Y	ES-D01-080624
East	F1	ES-F01-080529	ANTIMONY	0.24	05/08/09	57509	Y	DUP-17
East	F1	ES-F01-080529	ANTIMONY	0.25	05/11/09	57557	Y	ES-F01-080529
East	G1	ES-G01-080529	ANTIMONY	0.28	05/11/09	57557	Y	ES-G01-080529
East	G2	ES-G02-080605	ANTIMONY	0.24	05/11/09	57557	Y	ES-G02-080605
East	H1	ES-H01-080528	ANTIMONY	0.33	05/11/09	57557	Y	ES-H01-080528
East	H2	ES-H02-080515	ANTIMONY	0.25	05/11/09	57557	Y	ES-H02-080515
East	H3	ES-H03-080605	ANTIMONY	0.092	06/08/09	58143	Y	ES-H03-080605
East	I1	ES-I01-080529	ANTIMONY	0.31	06/08/09	58143	Y	ES-I01-080529
East	I2	ES-I02-080514	ANTIMONY	0.31	06/08/09	58143	Y	ES-I02-080514
East	I3	ES-I03-080513	ANTIMONY	0.25	06/08/09	58143	Y	ES-I03-080513
East	I4	ES-I04-080602	ANTIMONY	0.31	06/08/09	58143	Y	ES-I04-080602
East	J1	ES-J01-080529	ANTIMONY	0.26	06/08/09	58143	Y	ES-J01-080529
East	J2	ES-J02-080527	ANTIMONY	0.23	05/11/09	57557	Y	DUP-15
East	J2	ES-J02-080527	ANTIMONY	0.26	06/08/09	58143	Y	ES-J02-080527
East	J3	ES-J03-080513	ANTIMONY	0.72	04/28/09	57269	Y	DUP-11
East	J3	ES-J03-080513	ANTIMONY	0.41	07/10/09	59378	Y	ES-J03-080513
East	J4	ES-J04-080530	ANTIMONY	0.32	05/11/09	57557	Y	DUP-18
East	J4	ES-J04-080530	ANTIMONY	0.4	06/08/09	58143	Y	ES-J04-080530
East	J5	ES-J05-080602	ANTIMONY	0.83	06/08/09	58143	Y	ES-J05-080602
East	K1	ES-K01-080602	ANTIMONY	0.24	06/08/09	58143	Y	ES-K01-080602
East	K2	ES-K02-080602	ANTIMONY	0.26	05/11/09	57557	Y	ES-K02-080602
East	K3	ES-K03-080514	ANTIMONY	0.31	06/08/09	58143	Y	ES-K03-080514
East	K4	ES-K04-080527	ANTIMONY	0.2	06/08/09	58175	Y	ES-K04-080527
East	K5	ES-K05-080605	ANTIMONY	0.22	06/08/09	58175	Y	ES-K05-080605
East	K5	ES-K05-080605	ANTIMONY	0.22	06/08/09	58175	Y	DUP-19
East	K7	ES-K07-080611	ANTIMONY	0.63	05/08/09	57509	Y	ES-K07-080611
East	L1	ES-L01-080625	ANTIMONY	0.25	06/08/09	58175	Y	ES-L01-080625
East	L2	ES-L02-080625	ANTIMONY	0.27	06/08/09	58175	Y	ES-L02-080625
East	L3	ES-L03-080604	ANTIMONY	0.3	06/08/09	58175	Y	ES-L03-080604
East	L4	ES-L04-080604	ANTIMONY	0.21	07/10/09	59378	Y	ES-L04-080604
East	M1	ES-M01-080527	ANTIMONY	0.21	06/08/09	58175	Y	ES-M01-080527
East	M2	ES-M02-080519	ANTIMONY	0.29	06/08/09	58175	Y	ES-M02-080519
East	M4	ES-M04-080515	ANTIMONY	0.22	06/08/09	58175	Y	ES-M04-080515
East	M5	ES-M05-080527	ANTIMONY	0.2	06/08/09	58175	Y	ES-M05-080527
East	M6	ES-M06-080520	ANTIMONY	0.32	06/08/09	58175	Y	ES-M06-080520
East	M8	ES-M08-080610	ANTIMONY	0.67	05/08/09	57509	Y	ES-M08-080610
East	M9	ES-M09-080611	ANTIMONY	0.31	05/08/09	57509	Y	ES-M09-080611
East	N2	ES-N02-080528	ANTIMONY	0.24	06/08/09	58175	Y	ES-N02-080528
East	N3	ES-N03-080520	ANTIMONY	0.26	06/08/09	58175	Y	ES-N03-080520
East	N4	ES-N04-080519	ANTIMONY	0.22	06/08/09	58175	Y	ES-N04-080519
East	N5	ES-N05-080519	ANTIMONY	0.27	06/08/09	58175	Y	ES-N05-080519

ANTIMONY Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch _id	detect _flag	sample_name
East	N6	ES-N06-080527	ANTIMONY	0.21	06/28/09	58861	Y	ES-N06-080527
East	N7	ES-N07-080530	ANTIMONY	0.35	06/28/09	58861	Y	ES-N07-080530
East	N8	ES-N08-080610	ANTIMONY	0.23	05/08/09	57509	Y	ES-N08-080610
East	N9	ES-N09-080610	ANTIMONY	0.24	05/08/09	57509	Y	ES-N09-080610
East	N10	ES-N10-080610	ANTIMONY	0.33	05/08/09	57509	Y	ES-N10-080610
East	O3	ES-O03-080528	ANTIMONY	0.21	06/28/09	58861	Y	ES-O03-080528
East	O4	ES-O04-080515	ANTIMONY	0.29	06/28/09	58861	Y	ES-O04-080515
East	O5	ES-O05-080520	ANTIMONY	0.21	06/28/09	58861	Y	ES-O05-080520
East	O6	ES-O06-080529	ANTIMONY	0.19	06/28/09	58861	Y	ES-O06-080529
East	O8	ES-O08-080530	ANTIMONY	0.15	08/03/09	60068	Y	ES-O08-080530
East	P4	ES-P04-080528	ANTIMONY	0.25	06/08/09	58143	Y	DUP-16
East	P4	ES-P04-080528	ANTIMONY	0.29	06/28/09	58861	Y	ES-P04-080528
East	P5	ES-P05-080513	ANTIMONY	0.23	06/28/09	58861	Y	ES-P05-080513
East	P6	ES-P06-080515	ANTIMONY	0.27	06/08/09	58143	Y	DUP-12
East	P6	ES-P06-080515	ANTIMONY	0.23	06/28/09	58861	Y	ES-P06-080515
East	P7	ES-P07-080519	ANTIMONY	0.18	06/08/09	58175	Y	ES-P07-080519
East	P8	ES-P08-080530	ANTIMONY	0.18	06/28/09	58861	Y	ES-P08-080530
East	P10	ES-P10-080606	ANTIMONY	0.38	05/08/09	57509	Y	ES-P10-080606
East	P11	ES-P11-080606	ANTIMONY	0.36	05/08/09	57509	Y	ES-P11-080606
East	Q5	ES-Q05-080520	ANTIMONY	0.95	06/28/09	58861	Y	ES-Q05-080520
East	Q9	ES-Q09-080612	ANTIMONY	0.27	06/28/09	58861	Y	ES-Q09-080612
East	Q10	ES-Q10-080606	ANTIMONY	0.37	05/11/09	57557	Y	ES-Q10-080606
East	Q11	ES-Q11-080606	ANTIMONY	0.26	05/11/09	57557	Y	ES-Q11-080606
East	Q17	ES-Q17-080609	ANTIMONY	0.23	04/28/09	57269	Y	ES-Q17-080609
East	R5	ES-R05-080521	ANTIMONY	0.44	06/28/09	58861	Y	ES-R05-080521
East	R6	ES-R06-080521	ANTIMONY	0.14	07/10/09	59378	Y	ES-R06-080521
East	R7	ES-R07-080521	ANTIMONY	0.17	06/29/09	58862	Y	ES-R07-080521
East	R9	ES-R09-080520	ANTIMONY	0.12	06/29/09	58862	Y	ES-R09-080520
East	R10	ES-R10-080602	ANTIMONY	0.19	06/29/09	58862	Y	ES-R10-080602
East	R11	ES-R11-080605	ANTIMONY	0.3	05/11/09	57557	Y	ES-R11-080605
East	R12	ES-R12-080611	ANTIMONY	0.23	05/11/09	57557	Y	ES-R12-080611
East	R16	ES-R16-080605	ANTIMONY	0.16	04/28/09	57269	Y	ES-R16-080605
East	R17	ES-R17-080606	ANTIMONY	0.19	04/28/09	57269	Y	ES-R17-080606
East	S5	ES-S05-080521	ANTIMONY	0.33	06/29/09	58862	Y	ES-S05-080521
East	S6	ES-S06-080521	ANTIMONY	0.26	06/29/09	58862	Y	ES-S06-080521
East	S7	ES-S07-080521	ANTIMONY	0.2	06/29/09	58862	Y	ES-S07-080521
East	S9	ES-S09-080522	ANTIMONY	0.21	06/29/09	58862	Y	ES-S09-080522
East	S10	ES-S10-080523	ANTIMONY	0.26	06/29/09	58862	Y	ES-S10-080523
East	S11	ES-S11-080528	ANTIMONY	0.38	06/29/09	58862	Y	ES-S11-080528
East	S12	ES-S12-080609	ANTIMONY	0.066	04/28/09	57269	N	ES-S12-080609
East	S13	ES-S13-080610	ANTIMONY	0.1	04/28/09	57269	Y	ES-S13-080610
East	S18	ES-S18-080606	ANTIMONY	0.09	04/28/09	57269	Y	ES-S18-080606
East	T7	ES-T07-080612	ANTIMONY	0.23	06/29/09	58862	Y	ES-T07-080612
East	T8	ES-T08-080522	ANTIMONY	0.19	06/28/09	58861	Y	DUP-13

ANTIMONY Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch _id	detect _flag	sample_name
East	T8	ES-T08-080522	ANTIMONY	0.23	06/29/09	58862	Y	ES-T08-080522
East	T9	ES-T09-080522	ANTIMONY	0.23	06/29/09	58862	Y	ES-T09-080522
East	T10	ES-T10-080523	ANTIMONY	0.4	06/29/09	58862	Y	ES-T10-080523
East	T10	ES-T10-080523	ANTIMONY	0.19	06/29/09	58862	Y	DUP-14
East	T11	ES-T11-080530	ANTIMONY	0.14	06/29/09	58862	Y	ES-T11-080530
East	T12	ES-T12-080609	ANTIMONY	0.058	04/28/09	57269	N	ES-T12-080609
East	T13	ES-T13-080609	ANTIMONY	0.052	04/28/09	57269	Y	ES-T13-080609
East	T14	ES-T14-080610	ANTIMONY	0.11	04/28/09	57269	Y	ES-T14-080610
East	U10	ES-U10-080523	ANTIMONY	0.24	06/29/09	58862	Y	ES-U10-080523
East	U11	ES-U11-080602	ANTIMONY	0.1	07/10/09	59378	N	ES-U11-080602
East	U13	ES-U13-080610	ANTIMONY	0.3	05/08/09	57509	Y	ES-U13-080610
East	U14	ES-U14-080610	ANTIMONY	0.33	05/08/09	57509	Y	ES-U14-080610
East	V11	ES-V11-080529	ANTIMONY	0.14	07/10/09	59378	Y	ES-V11-080529
East	V14	ES-V14-080605	ANTIMONY	0.3	05/08/09	57509	Y	ES-V14-080605
East	W12	ES-W12-080527	ANTIMONY	0.18	07/10/09	59378	Y	ES-W12-080527
West	A4	WS-A04-080626	ANTIMONY	0.51	07/20/09	59651	Y	WS-A04-080626
West	B3	WS-B03-080502	ANTIMONY	0.4	07/20/09	59651	Y	WS-B03-080502
West	B4	WS-B04-080626	ANTIMONY	0.4	07/20/09	59651	Y	WS-B04-080626
West	B5	WS-B05-080626	ANTIMONY	0.32	08/03/09	60068	Y	WS-B05-080626
West	C1	WS-C01-080501	ANTIMONY	0.26	07/10/09	59378	Y	WS-C01-080501
West	C1	WS-C01-080501	ANTIMONY	0.35	07/11/09	59378	Y	DUP-3
West	C2	WS-C02-080428	ANTIMONY	0.45	07/21/09	59653	Y	WS-C02-080428
West	C3	WS-C03-080620	ANTIMONY	0.2	07/21/09	59653	Y	WS-C03-080620
West	C4	WS-C04-080623	ANTIMONY	0.54	07/21/09	59653	Y	WS-C04-080623
West	C5	WS-C05-080620	ANTIMONY	0.37	08/03/09	60068	Y	WS-C05-080620
West	C6	WS-C06-080624	ANTIMONY	0.38	08/03/09	60068	Y	WS-C06-080624
West	D1	WS-D01-080430	ANTIMONY	0.3	07/10/09	59378	Y	WS-D01-080430
West	D2	WS-D02-080429	ANTIMONY	0.38	07/20/09	59651	Y	DUP-2
West	D2	WS-D02-080429	ANTIMONY	0.43	07/21/09	59653	Y	WS-D02-080429
West	D3	WS-D03-080620	ANTIMONY	0.57	07/21/09	59653	Y	WS-D03-080620
West	D4	WS-D04-080623	ANTIMONY	0.47	08/19/09	60478	Y	WS-D04-080623
West	D5	WS-D05-080620	ANTIMONY	0.37	08/03/09	60068	Y	WS-D05-080620
West	D6	WS-D06-080619	ANTIMONY	0.33	08/03/09	60068	Y	WS-D06-080619
West	D7	WS-D07-080619	ANTIMONY	0.4	08/03/09	60068	Y	WS-D07-080619
West	E1	WS-E01-080430	ANTIMONY	0.38	07/11/09	59378	Y	WS-E01-080430
West	E2	WS-E02-080428	ANTIMONY	0.62	07/20/09	59651	Y	DUP-1
West	E2	WS-E02-080428	ANTIMONY	0.7	07/21/09	59653	Y	WS-E02-080428
West	E3	WS-E03-080619	ANTIMONY	0.47	07/21/09	59653	Y	WS-E03-080619
West	E4	WS-E04-080613	ANTIMONY	0.43	08/03/09	60068	Y	WS-E04-080613
West	E5	WS-E05-080613	ANTIMONY	0.39	08/03/09	60068	Y	WS-E05-080613
West	E6	WS-E06-080613	ANTIMONY	0.46	08/03/09	60068	Y	WS-E06-080613
West	E7	WS-E07-080613	ANTIMONY	0.37	08/04/09	60068	Y	WS-E07-080613
West	F1	WS-F01-080429	ANTIMONY	0.33	07/11/09	59378	Y	WS-F01-080429
West	F2	WS-F02-080429	ANTIMONY	1.3	07/21/09	59653	Y	WS-F02-080429

ANTIMONY Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch _id	detect _flag	sample_name
West	F3	WS-F03-080619	ANTIMONY	1	07/21/09	59653	Y	WS-F03-080619
West	F4	WS-F04-080616	ANTIMONY	0.65	08/04/09	60069	Y	WS-F04-080616
West	F5	WS-F05-080612	ANTIMONY	0.71	08/19/09	60478	Y	WS-F05-080612
West	F6	WS-F06-080612	ANTIMONY	0.52	08/04/09	60069	Y	WS-F06-080612
West	F7	WS-F07-080617	ANTIMONY	0.48	07/11/09	59379	Y	WS-F07-080617
West	F8	WS-F08-080618	ANTIMONY	0.33	07/11/09	59379	Y	WS-F08-080618
West	G1	WS-G01-080501	ANTIMONY	0.32	07/11/09	59379	Y	WS-G01-080501
West	G1	WS-G01-080501	ANTIMONY	0.32	07/11/09	59378	Y	DUP-4
West	G2	WS-G02-080618	ANTIMONY	0.77	07/21/09	59653	Y	WS-G02-080618
West	G3	WS-G03-080619	ANTIMONY	0.55	07/21/09	59653	Y	WS-G03-080619
West	G4	WS-G04-080616	ANTIMONY	0.57	08/04/09	60069	Y	WS-G04-080616
West	G6	WS-G06-080616	ANTIMONY	0.49	08/04/09	60069	Y	WS-G06-080616
West	G7	WS-G07-080617	ANTIMONY	0.97	07/11/09	59379	Y	WS-G07-080617
West	H1	WS-H01-080501	ANTIMONY	0.33	07/11/09	59379	Y	WS-H01-080501
West	H2	WS-H02-080618	ANTIMONY	0.78	07/21/09	59653	Y	WS-H02-080618
West	H3	WS-H03-080619	ANTIMONY	0.46	08/04/09	60069	Y	WS-H03-080619
West	H4	WS-H04-080616	ANTIMONY	0.45	08/04/09	60069	Y	WS-H04-080616
West	H6	WS-H06-080617	ANTIMONY	0.47	07/11/09	59379	Y	WS-H06-080617
West	I1	WS-I01-080501	ANTIMONY	0.49	07/11/09	59379	Y	DUP-5
West	I1	WS-I01-080501	ANTIMONY	0.63	07/11/09	59379	Y	WS-I01-080501
West	I2	WS-I02-080618	ANTIMONY	0.61	08/03/09	60068	Y	WS-I02-080618
West	I3	WS-I03-080618	ANTIMONY	0.81	08/04/09	60069	Y	WS-I03-080618
West	I4	WS-I04-080617	ANTIMONY	0.46	08/04/09	60069	Y	WS-I04-080617
West	I5	WS-I05-080617	ANTIMONY	0.3	07/11/09	59379	Y	WS-I05-080617
West	I6	WS-I06-080617	ANTIMONY	1.1	07/11/09	59379	Y	WS-I06-080617
West	J1	WS-J01-080505	ANTIMONY	0.89	07/11/09	59379	Y	DUP-6
West	J1	WS-J01-080505	ANTIMONY	0.98	07/11/09	59379	Y	WS-J01-080505
West	J2	WS-J02-080624	ANTIMONY	0.51	07/11/09	59379	Y	WS-J02-080624
West	J3	WS-J03-080620	ANTIMONY	0.5	07/11/09	59391	Y	WS-J03-080620
West	J4	WS-J04-080617	ANTIMONY	2.2	07/11/09	59391	Y	WS-J04-080617
West	J5	WS-J05-080618	ANTIMONY	1.1	07/11/09	59391	Y	WS-J05-080618
West	K1	WS-K01-080505	ANTIMONY	0.74	07/11/09	59391	Y	WS-K01-080505
West	K2	WS-K02-080509	ANTIMONY	0.64	07/11/09	59391	Y	WS-K02-080509
West	K3	WS-K03-080509	ANTIMONY	1.2	07/11/09	59391	Y	WS-K03-080509
West	K4	WS-K04-080513	ANTIMONY	0.71	07/11/09	59391	Y	WS-K04-080513
West	K4	WS-K04-080513	ANTIMONY	0.75	08/04/09	60068	Y	DUP-10
West	K5	WS-K05-080509	ANTIMONY	0.68	07/11/09	59391	Y	WS-K05-080509
West	L1	WS-L01-080505	ANTIMONY	0.58	07/11/09	59391	Y	WS-L01-080505
West	L2	WS-L02-080508	ANTIMONY	0.39	07/11/09	59391	Y	WS-L02-080508
West	L3	WS-L03-080508	ANTIMONY	1	07/11/09	59391	Y	WS-L03-080508
West	L4	WS-L04-080508	ANTIMONY	0.47	07/11/09	59391	Y	WS-L04-080508
West	L4	WS-L04-080508	ANTIMONY	0.42	07/12/09	59391	Y	DUP-9
West	M1	WS-M01-080505	ANTIMONY	0.7	07/11/09	59391	Y	WS-M01-080505
West	M1	WS-M01-080505	ANTIMONY	0.64	07/12/09	59391	Y	DUP-7

ANTIMONY Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch _id	detect _flag	sample_name
West	M2	WS-M02-080507	ANTIMONY	0.75	08/03/09	60068	Y	WS-M02-080507
West	M3	WS-M03-080507	ANTIMONY	1.3	07/21/09	59653	Y	DUP-8
West	M3	WS-M03-080507	ANTIMONY	1	08/19/09	60477	Y	WS-M03-080507
West	M4	WS-M04-080507	ANTIMONY	1	08/19/09	60477	Y	WS-M04-080507
West	N1	WS-N01-080506	ANTIMONY	0.45	08/19/09	60477	Y	WS-N01-080506
West	N2	WS-N02-080506	ANTIMONY	0.59	07/20/09	59651	Y	WS-N02-080506
West	N3	WS-N03-080507	ANTIMONY	0.68	07/11/09	59379	Y	WS-N03-080507
West	O1	WS-O01-080506	ANTIMONY	0.78	07/20/09	59651	Y	WS-O01-080506
West	O2	WS-O02-080506	ANTIMONY	1.1	07/20/09	59651	Y	WS-O02-080506

Table As-1: Arsenic Data Quality Summary

Laboratory Performance Criteria	Criteria	Measured	Comment
Minimum LCS Recovery	greater than 80%	88%	
Minimum Matrix Spike Recovery	greater than 70%	9%	
Average LCS Recovery	N/A	102%	
Average Matrix Spike Recovery	N/A	92%	
Maximum LCS RPD	less than 20%	16%	
Maximum Laboratory Duplicate RPD	less than 20%	15%	
Average LCS RPD	N/A	3%	
Average Laboratory Duplicate RPD	N/A	5%	
Measurement Quality Objectives	**Critera**	**Measured**	
NPS CRM	Recovery greater than 4.88	Minimum Recovery =	5.10 mg/kg
EQIS CRM	Recovery greater than 2.68	Minimum Recovery =	4 mg/kg
CVS Split Analysis RPD	RPD less than 35%	Maximum RPD =	37 %
CRM Split Analysis RPD	RPD less than 35%	Maximum RPD =	69 %
Overall QC Indicator Measurements	**Criteria**	**Measured**	
NPS CRM "Made to" (Bias measure)	N/A	Average Recovery =	97.2 %
NPS Replicate Test (Precision measure)	N/A	Standard Deviation =	0.87 mg/kg
Data Quality Relative to Remediation Goals			
Tier 1 Remediation Goal	13		
Tier 2 Remediation Goal	30		
QC Derived Reliance Level	31	See note 1	

Comments: Arsenic analyses attained all laboratory performance criteria with one exception. There were low matrix spike recoveries for laboratory batches 49334 and 49335, but because only background samples were tested in these batches the qualified arsenic recovery in these batches does not imply a problem with CVS samples. High RPD in CVS splits (37%), and CRM splits (138%) raised a question about measurement precision, however, a standard deviation (0.87 mg/kg) relative to the mean (6.38 mg/kg) for repeated tests on the same sample indicates acceptable precision. The average recovery of arsenic in BOR CRMs (97%) is good. As desired, the derived reliance level (31 mg/kg) for arsenic is greater than the RG, reflecting the generally good precision and accuracy in arsenic measurements. Therefore, it is concluded that arsenic CVS measurements are of acceptable quality and may be used to determine RG achievement.

Note 1: The derived reliance level is calculated as: (Tier 2 RG)(1.2)(Average Recovery)-(0.84)(Standard deviation) = (30)(1.2)(.972)-(0.84)(.87) = 31mg/kg.

Table As-2: Arsenic - NPS CRMs

Blind NPS CRM Results

Sample	Result	Analysis Date	Batch	Detect
BOR Sample 1-BOR 56	7.3	4/29/09	57304	Y
BOR Sample 4-BOR 82	7	5/20/09	57706	Y
BOR 83	6.3	6/4/09	57767	Y
BOR Sample 3-BOR 58	6.2	6/4/09	57767	Y
BOR 84	7.7	6/10/09	58208	Y
BOR Sample 7-BOR 105	6.4	6/10/09	58208	Y
BOR 85	6.6	6/11/09	58236	Y
BOR Sample 8-BOR 106	7.1	6/11/09	58236	Y
BOR 108	5.1	7/9/09	59250	Y
BOR 86	5.6	7/9/09	59251	Y
BOR 87	5.6	7/9/09	59250	Y
BOR 109	6.2	7/14/09	59472	Y
BOR 110	6.2	7/23/09	59738	Y
BOR Sample 9-BOR 107	5.3	7/28/09	59840	Y
BOR 111	6.6	8/7/09	60228	Y
BOR Sample 6-BOR 81	9.9	5/15/09	57603	Y

CRMs		Vendor Supplied Information
Mean	6.57	*Made to*
Standard Error	0.29	*6.76 mg/kg*
Median	6.35	
Standard Deviation	1.14	*Upper Acceptance Limit*
Sample Variance	1.30	*7.19 mg/kg*
Kurtosis	4.18	
Skewness	1.63	*Lower Acceptance Limit*
Range	4.8	*4.88 mg/kg*
Minimum	5.1	
Maximum	9.9	
Sum	105.1	
Count	16	
Largest(2)	7.7	
Smallest(2)	5.3	

Table As-3: Arsenic - NPS Replicate Test On Background Sample

Results of Replicate Analyses of a Single Sample

Sample	Result	Analysis Date	Batch	Detect
BOR 112	7.1	4/29/09	57304	Y
BOR 59	8.5	5/15/09	57603	Y
BOR 60	5.8	5/20/09	57706	Y
BOR 113	5.6	6/4/09	57767	Y
BOR 61	5.9	6/4/09	57767	Y
BOR 62	5.5	7/9/09	59251	Y
BOR 63	5.8	7/9/09	59250	Y
BOR 89	5.5	7/9/09	59250	Y
BOR 115	6.6	7/14/09	59472	Y
BOR 64	6.6	7/15/09	59473	Y
BOR 91	7.2	7/15/09	59473	Y
BOR 116	5.8	7/23/09	59738	Y
BOR 92	5.9	7/23/09	59738	Y
BOR 65	6.4	7/28/09	59841	Y
BOR 88	7.5	8/7/09	60228	Y

Replicate analyses of Single Sample	
Mean	6.38
Standard Error	0.23
Median	5.90
Standard Deviation	0.87
Sample Variance	0.76
Kurtosis	0.87
Skewness	1.14
Range	3
Minimum	5.5
Maximum	8.5
Sum	95.7
Count	15
Largest(2)	7.5
Smallest(2)	5.5

Table As-4: Arsenic Precision Demonstrated by NPS and EQIS Homogenized Sample Splits

Sample	Result	Analysis Date	Batch	Split	Result	Analysis Date	RPD
BOR 503	14.7	5/15/09	57603	ES-T11-080530	10.6	7/9/2009	32
BOR 506	11.6	5/20/09	57706	ES-S10-080523	9.3	7/9/2009	22
BOR 504	12.1	6/4/09	57767	ES-M05-080527	10.5	6/10/2009	14
BOR 507	13	6/11/09	58236	ES-O09-080610			
BOR 508	12.7	7/9/09	59250	ES-Q11-080606	13.3	5/20/2009	5
BOR 510	12.3	7/14/09	59472	OU-8HR-080605	12.4	4/29/2009	1
BOR 501	12.7	7/15/09	59473	WS-L04-080508	13.9	7/14/2009	9
BOR 502	8.6	7/28/09	59840	WS-F05-080612	12.1	8/17/2009	34
BOR 505	9.2	7/28/09	59841	WS-K03-080509	10	7/14/2009	8
BOR 509	10.5	7/28/09	59840	WS-E06-080613	10.9	7/28/2009	4
DUP-11	10.5	4/29/09	57303	ES-J03-080513	7.2	7/9/2009	37
DUP-17	11.6	5/15/09	57603	ES-F01-080529	9.4	5/20/2009	21
DUP-15	12.5	5/20/09	57706	ES-J02-080527	11.8	6/4/2009	6
DUP-18	12.4	5/20/09	57706	ES-J04-080530	11	6/4/2009	12
DUP-12	13.1	6/4/09	57767	ES-P06-080515	13.8	6/10/2009	5
DUP-16	11.8	6/4/09	57767	ES-P04-080528	13.2	6/10/2009	11
DUP-19	10.9	6/10/09	58208	ES-K05-080605	10.5	6/10/2009	4
DUP-13	11.1	6/11/09	58236	ES-T08-080522	9.4	7/9/2009	17
DUP-14	9.7	7/9/09	59251	ES-T10-080523	9.7	7/9/2009	0
DUP-3	6.8	7/9/09	59250	WS-C01-080501	6.6	7/9/2009	3
DUP-4	11.3	7/9/09	59250	WS-G01-080501	10.8	7/14/2009	5
DUP-5	9.4	7/14/09	59472	WS-I01-080501	9.3	7/14/2009	1
DUP-6	9	7/14/09	59472	WS-J01-080505	9.1	7/14/2009	1
DUP-7	10.1	7/15/09	59473	WS-M01-080505	9.4	7/15/2009	7
DUP-9	13.1	7/15/09	59473	WS-L04-080508	13.9	7/14/2009	6
DUP-1	11.7	7/23/09	59738	WS-E02-080428	13.7	7/28/2009	16
DUP-2	11.6	7/23/09	59738	WS-D02-080429	11.9	7/28/2009	3
DUP-10	8.2	7/28/09	59840	WS-K04-080513	10.2	7/14/2009	22
DUP-8	9.4	7/28/09	59841	WS-M03-080507	7.9	8/7/2009	17

RPD of Sample Splits	
Mean	11.5
Standard Error	2.0
Median	7.8
Standard Deviation	10.5
Sample Variance	109.7
Kurtosis	0.5
Skewness	1.1
Range	37.3
Minimum	0.0
Maximum	37.3
Sum	321.8
Count	28
Largest(2)	33.8
Smallest(2)	0.8

Table As-5: Arsenic EQIS CRMs

Results of Duplicate Analysis of EQIS CRMs

Sample	Result	Date	Batch	Detect	Average	RPD
ES-Z11-080605A	14.7	4/29/09	57303	Y		
ES-Z11-080605B	17.5	4/29/09	57303	Y	16.1	17
ES-Z09-080529A	5.5	5/15/09	57603	Y		
ES-Z09-080529B	5.5	5/15/09	57603	Y	5.5	0
ES-Z12-080606A	5.2	5/15/09	57603	Y		
ES-Z12-080606B	4.7	5/15/09	57603	Y	4.95	10
ES-Z05-080519A	4.2	5/20/09	57706	Y		
ES-Z05-080519B	5.2	5/20/09	57706	Y	4.7	21
ES-Z06-080520A	4.4	5/20/09	57706	Y		
ES-Z06-080520B	4.7	5/20/09	57706	Y	4.55	7
ES-Z07-080522A	4.5	6/4/09	57767	Y		
ES-Z07-080522B	4.8	6/5/09	57767	Y	4.65	6
ES-Z13-080610A	4.5	6/10/09	58208	Y		
ES-Z13-080610B	4.6	6/10/09	58208	Y	4.55	2
ES-Z10-080602A	5.7	6/11/09	58236	Y		
ES-Z10-080602B	5.2	6/11/09	58236	Y	5.45	9
ES-Z08-080527A	4.4	7/9/09	59251	Y		
ES-Z08-080527B	4.4	7/9/09	59251	Y	4.4	0
ES-Z14-080611A	8.2	7/9/09	59250	Y		
ES-Z14-080611B	4	7/9/09	59250	Y	6.1	69
ES-Z06-080520C	5.2	7/14/09	59472	Y		
ES-Z06-080520D	5.1	7/14/09	59472	Y	5.15	2
ES-Z05-080519C	5.6	7/15/09	59473	Y		
ES-Z05-080519D	5.6	7/15/09	59473	Y	5.6	0
ES-Z19-080624A	5.3	7/23/09	59738	Y		
ES-Z19-080624B	4.8	7/23/09	59738	Y	5.05	10
WS-Z17-080618A	5.3	7/23/09	59738	Y		
WS-Z17-080618B	6.7	7/23/09	59738	Y	6	23
WS-Z15-080613A	5.7	7/28/09	59841	Y		
WS-Z15-080613B	6.1	7/28/09	59841	Y	5.9	7
WS-Z18-080620A	6.3	7/28/09	59841	Y		
WS-Z18-080620B	6.2	7/28/09	59841	Y	6.25	2
WS-Z16-080617A	6.4	8/7/09	60228	Y		
WS-Z16-080617B	5.7	8/7/09	60228	Y	6.05	12

Analysis of EQIS CRMs

Mean	5.9
Standard Error	0.5
Median	5.3
Standard Deviation	2.7
Sample Variance	7.5
Kurtosis	12.2
Skewness	3.5
Range	13.5
Minimum	4.0
Maximum	17.5
Sum	201.9
Count	34
Largest(2)	14.7
Smallest(2)	4.2

RPD of EQIS CRMs

Mean	11.60
Standard Error	
Median	6.78
Standard Deviation	16.42
Sample Variance	269.62
Kurtosis	9.95
Skewness	2.92
Range	68.85
Minimum	0.00
Maximum	68.85
Sum	197.16
Count	17
Largest(2)	23.33
Smallest(2)	0.00

Table As-6: Arsenic Laboratory MS and LCS

Matrix Spike Recovery %	Batch	Order	LCS Recovery %	Batch	Order
90	7160081	1	95	49334	2
90	7160081	1	110	49334	2
9	49334	2	108	49596	4
47	49335	3	108	49597	5
98	49596	4	95	54777	6
106	49597	5	110	54882	7
25	54777	6	100	54991	8
116	54882	7	100	54993	9
105	54991	8	106	57303	10
90	54993	9	103	57304	11
106	57303	10	93	57706	12
96	57304	11	90	57767	13
89	57706	12	99	58208	14
85	57767	13	104	58236	15
81	58208	14	99	59250	16
95	58236	15	111	59251	17
134	59250	16	105	59473	19
149	59251	17	106	59472	20
101	59472	18	105	59738	21
99	59473	19	94	59840	22
115	59738	21	104	59841	23
99	59840	22	103	60228	24
96	59841	23	88	60229	25
102	60228	24	102	60446	26
77	60229	25			
101	60446	26			

Average MS Recovery = 92 % | Average LCS Recovery = 102 %
Minimum MS Recovery = 9 % | Minimum LCS Recovery = 88 %

Arsenic Laboratory Control Samples and MS Recoveries (June 2007 through August 2009)

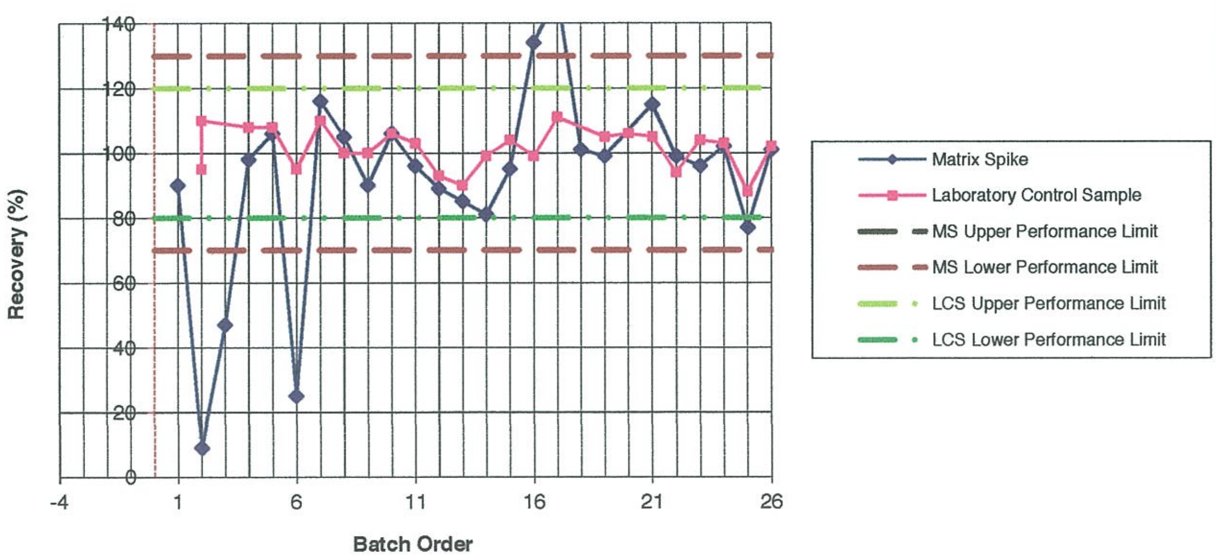
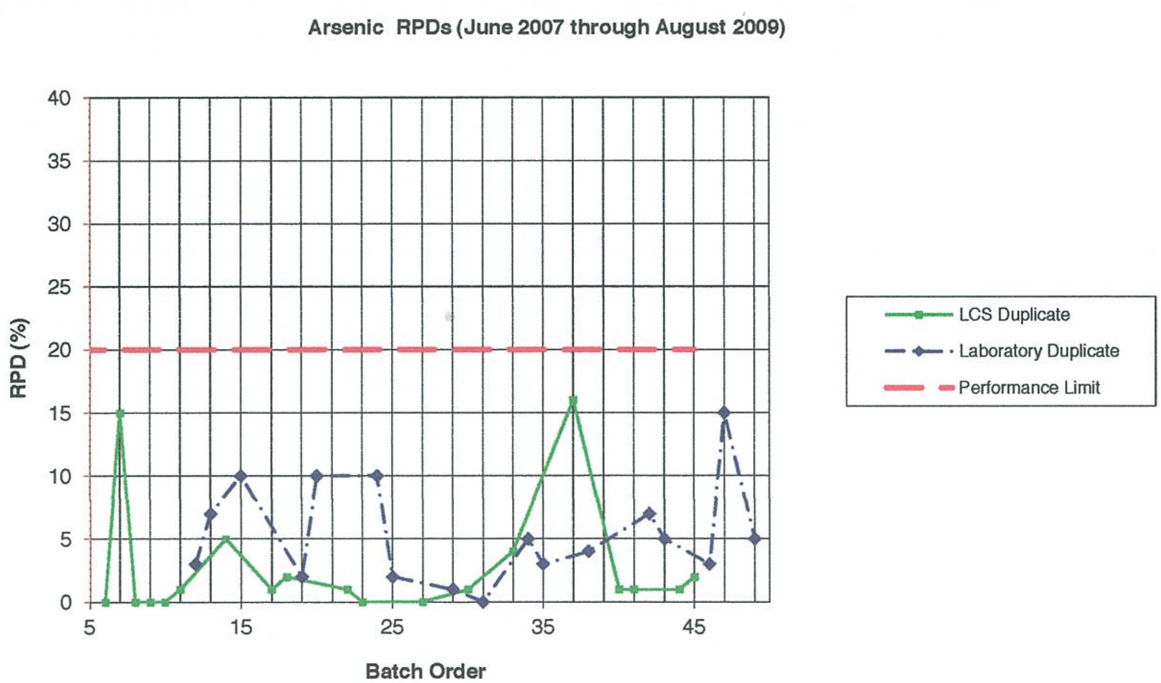


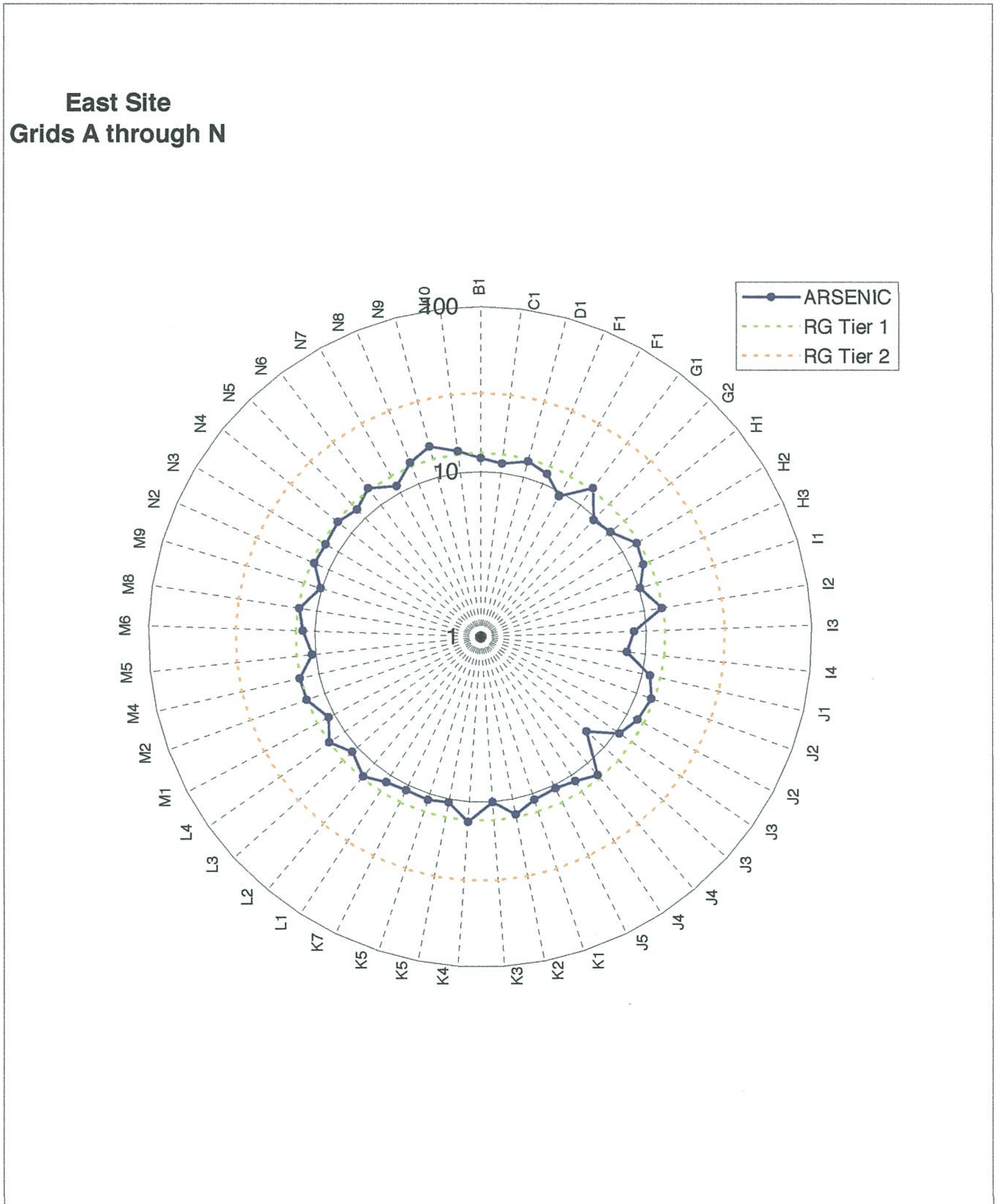
Table As-7: Arsenic - Laboratory Duplicate and LCS Duplicate

Laboratory Duplicate RPD	Batch	Order	LCS Duplicate RPD	Batch	Order
3	57303	12	0	54777	6
7	57304	13	15	54882	7
10	57603	15	0	54991	8
2	57706	19	0	54993	9
10	57767	20	0	57303	10
10	58208	24	1	57304	11
2	58236	25	5	57603	14
1	59250	29	1	57706	17
0	59251	31	2	57767	18
5	59472	34	1	58208	22
3	59473	35	0	58236	23
4	59738	38	0	59250	27
7	59840	42	1	59251	30
5	59841	43	4	59473	33
3	60228	46	16	59738	37
15	60229	47	1	59840	40
5	60446	49	1	59841	41
			1	60228	44
			2	60229	45
			1	60446	48

Average Duplicate RPD = 5 % Average LCS RPD = 3 %

Maximum Duplicate RPD = 15 % Maximum LCS RPD = 16 %





East Site
Grids A through N
ARSENIC
RG Tier 1
RG Tier 2
100
10
1
B1
C1
D1
F1
F1
G1
G2
H1
H2
H3
I1
I2
I3
I4
J1
J2
J2
J3
J3
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M2
M4
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N7
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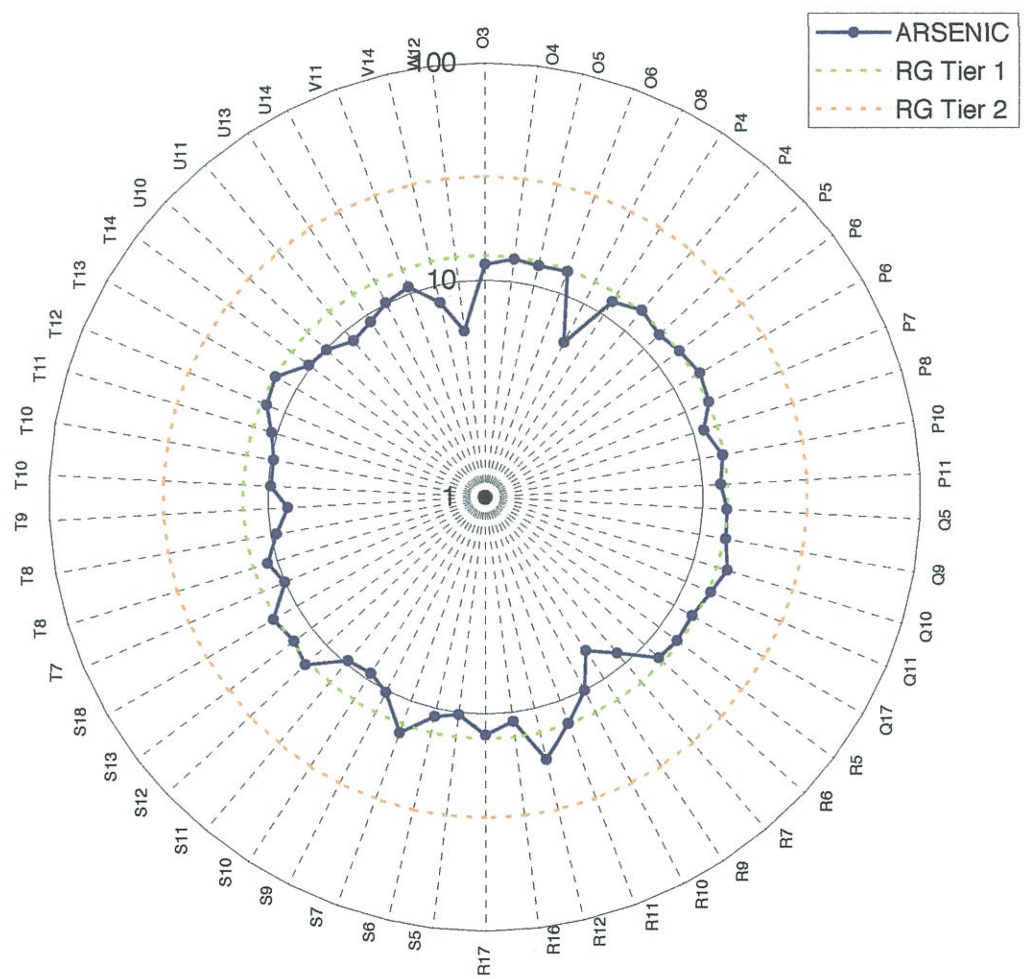
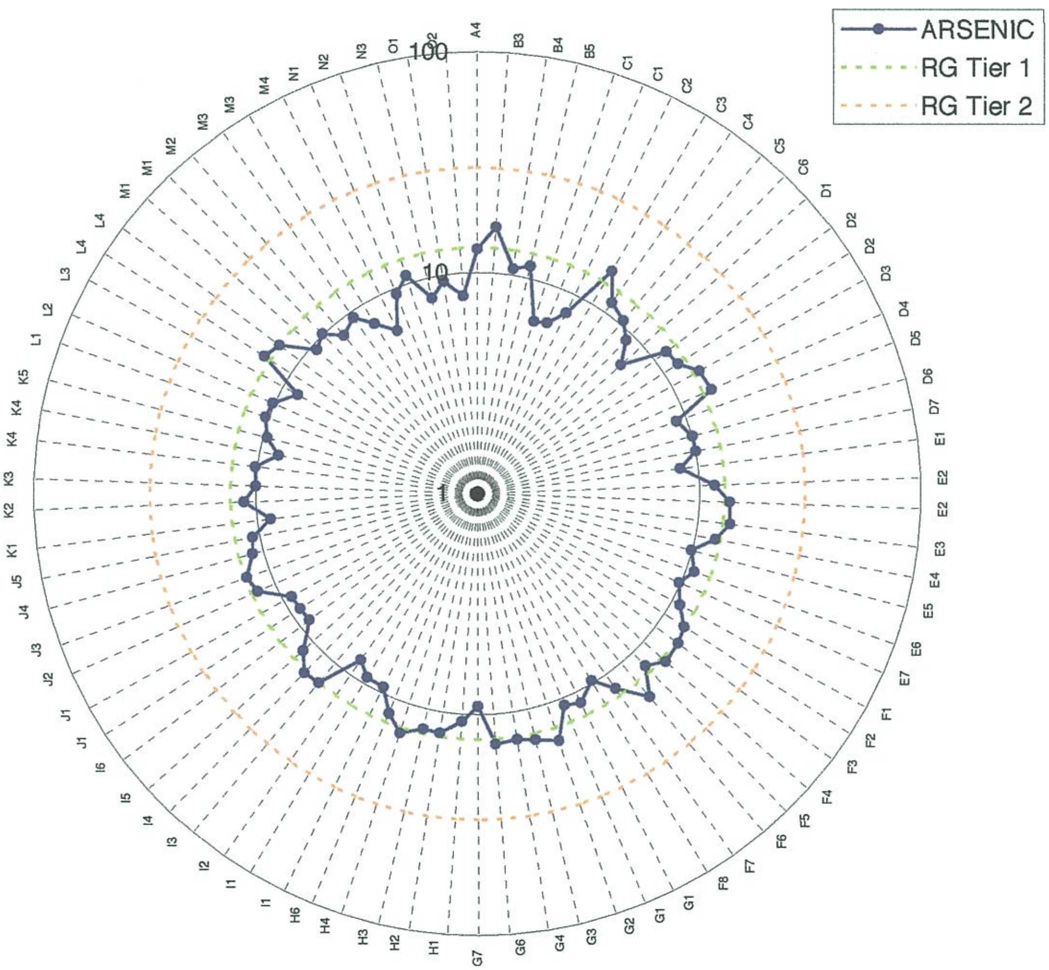
N9
M10

East Site
Grids O through W



West Site



ARSENIC Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch_id	detect _flag	sample_name
East	B1	ES-B01-080623	ARSENIC	12.1	04/29/09	57303	Y	ES-B01-080623
East	C1	ES-C01-080624	ARSENIC	11.4	04/29/09	57303	Y	ES-C01-080624
East	D1	ES-D01-080624	ARSENIC	12.6	06/11/09	58236	Y	ES-D01-080624
East	F1	ES-F01-080529	ARSENIC	11.6	05/15/09	57603	Y	DUP-17
East	F1	ES-F01-080529	ARSENIC	9.4	05/20/09	57706	Y	ES-F01-080529
East	G1	ES-G01-080529	ARSENIC	13.4	05/20/09	57706	Y	ES-G01-080529
East	G2	ES-G02-080605	ARSENIC	9.6	05/20/09	57706	Y	ES-G02-080605
East	H1	ES-H01-080528	ARSENIC	10.2	05/20/09	57706	Y	ES-H01-080528
East	H2	ES-H02-080515	ARSENIC	12.6	05/20/09	57706	Y	ES-H02-080515
East	H3	ES-H03-080605	ARSENIC	11.9	05/20/09	57767	Y	ES-H03-080605
East	I1	ES-I01-080529	ARSENIC	10.2	05/20/09	57767	Y	ES-I01-080529
East	I2	ES-I02-080514	ARSENIC	12.8	05/20/09	57767	Y	ES-I02-080514
East	I3	ES-I03-080513	ARSENIC	8.4	06/04/09	57767	Y	ES-I03-080513
East	I4	ES-I04-080602	ARSENIC	7.7	06/04/09	57767	Y	ES-I04-080602
East	J1	ES-J01-080529	ARSENIC	11.2	06/04/09	57767	Y	ES-J01-080529
East	J2	ES-J02-080527	ARSENIC	12.5	05/20/09	57706	Y	DUP-15
East	J2	ES-J02-080527	ARSENIC	11.8	06/04/09	57767	Y	ES-J02-080527
East	J3	ES-J03-080513	ARSENIC	10.5	04/29/09	57303	Y	DUP-11
East	J3	ES-J03-080513	ARSENIC	7.2	07/09/09	59250	Y	ES-J03-080513
East	J4	ES-J04-080530	ARSENIC	12.4	05/20/09	57706	Y	DUP-18
East	J4	ES-J04-080530	ARSENIC	11	06/04/09	57767	Y	ES-J04-080530
East	J5	ES-J05-080602	ARSENIC	10.5	06/04/09	57767	Y	ES-J05-080602
East	K1	ES-K01-080602	ARSENIC	10.9	06/04/09	57767	Y	ES-K01-080602
East	K2	ES-K02-080602	ARSENIC	12.5	05/20/09	57706	Y	ES-K02-080602
East	K3	ES-K03-080514	ARSENIC	10.1	06/04/09	57767	Y	ES-K03-080514
East	K4	ES-K04-080527	ARSENIC	13.3	06/10/09	58208	Y	ES-K04-080527
East	K5	ES-K05-080605	ARSENIC	10.5	06/10/09	58208	Y	ES-K05-080605
East	K5	ES-K05-080605	ARSENIC	10.9	06/10/09	58208	Y	DUP-19
East	K7	ES-K07-080611	ARSENIC	10.8	05/13/09	57603	Y	ES-K07-080611
East	L1	ES-L01-080625	ARSENIC	11.2	06/10/09	58208	Y	ES-L01-080625
East	L2	ES-L02-080625	ARSENIC	12.7	06/10/09	58208	Y	ES-L02-080625
East	L3	ES-L03-080604	ARSENIC	11	06/10/09	58208	Y	ES-L03-080604
East	L4	ES-L04-080604	ARSENIC	13	07/09/09	59250	Y	ES-L04-080604
East	M1	ES-M01-080527	ARSENIC	10.9	06/10/09	58208	Y	ES-M01-080527
East	M2	ES-M02-080519	ARSENIC	13.1	06/10/09	58208	Y	ES-M02-080519
East	M4	ES-M04-080515	ARSENIC	13.2	06/10/09	58208	Y	ES-M04-080515
East	M5	ES-M05-080527	ARSENIC	10.5	06/10/09	58208	Y	ES-M05-080527
East	M6	ES-M06-080520	ARSENIC	11.8	06/10/09	58208	Y	ES-M06-080520
East	M8	ES-M08-080610	ARSENIC	12.8	05/13/09	57603	Y	ES-M08-080610
East	M9	ES-M09-080611	ARSENIC	10.2	05/13/09	57603	Y	ES-M09-080611
East	N2	ES-N02-080528	ARSENIC	12.5	06/10/09	58208	Y	ES-N02-080528
East	N3	ES-N03-080520	ARSENIC	12.3	06/10/09	58208	Y	ES-N03-080520
East	N4	ES-N04-080519	ARSENIC	12.8	06/10/09	58208	Y	ES-N04-080519
East	N5	ES-N05-080519	ARSENIC	11.8	06/10/09	58208	Y	ES-N05-080519
East	N6	ES-N06-080527	ARSENIC	13.4	06/10/09	58236	Y	ES-N06-080527
East	N7	ES-N07-080530	ARSENIC	11.1	06/10/09	58236	Y	ES-N07-080530

ARSENIC Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch_id	detect _flag	sample_name
East	N8	ES-N08-080610	ARSENIC	13.7	05/21/09	57603	Y	ES-N08-080610
East	N9	ES-N09-080610	ARSENIC	15.6	05/13/09	57603	Y	ES-N09-080610
East	N10	ES-N10-080610	ARSENIC	13.6	05/13/09	57603	Y	ES-N10-080610
East	O3	ES-O03-080528	ARSENIC	11.8	06/10/09	58236	Y	ES-O03-080528
East	O4	ES-O04-080515	ARSENIC	12.7	06/10/09	58236	Y	ES-O04-080515
East	O5	ES-O05-080520	ARSENIC	12.4	06/10/09	58236	Y	ES-O05-080520
East	O6	ES-O06-080529	ARSENIC	12.7	06/10/09	58236	Y	ES-O06-080529
East	O8	ES-O08-080530	ARSENIC	6.3	07/28/09	59840	Y	ES-O08-080530
East	P4	ES-P04-080528	ARSENIC	11.8	06/04/09	57767	Y	DUP-16
East	P4	ES-P04-080528	ARSENIC	13.2	06/10/09	58236	Y	ES-P04-080528
East	P5	ES-P05-080513	ARSENIC	12.4	06/10/09	58236	Y	ES-P05-080513
East	P6	ES-P06-080515	ARSENIC	13.1	06/04/09	57767	Y	DUP-12
East	P6	ES-P06-080515	ARSENIC	13.8	06/10/09	58236	Y	ES-P06-080515
East	P7	ES-P07-080519	ARSENIC	13.1	06/10/09	58208	Y	ES-P07-080519
East	P8	ES-P08-080530	ARSENIC	11.2	06/10/09	58236	Y	ES-P08-080530
East	P10	ES-P10-080606	ARSENIC	12.8	05/13/09	57603	Y	ES-P10-080606
East	P11	ES-P11-080606	ARSENIC	12.1	05/13/09	57603	Y	ES-P11-080606
East	Q5	ES-Q05-080520	ARSENIC	12.9	06/10/09	58236	Y	ES-Q05-080520
East	Q9	ES-Q09-080612	ARSENIC	13.2	06/11/09	58236	Y	ES-Q09-080612
East	Q10	ES-Q10-080606	ARSENIC	14.5	05/20/09	57706	Y	ES-Q10-080606
East	Q11	ES-Q11-080606	ARSENIC	13.3	05/20/09	57706	Y	ES-Q11-080606
East	Q17	ES-Q17-080609	ARSENIC	12.5	04/29/09	57303	Y	ES-Q17-080609
East	R5	ES-R05-080521	ARSENIC	12.6	06/11/09	58236	Y	ES-R05-080521
East	R6	ES-R06-080521	ARSENIC	12.2	07/09/09	59250	Y	ES-R06-080521
East	R7	ES-R07-080521	ARSENIC	8.7	07/10/09	59251	Y	ES-R07-080521
East	R9	ES-R09-080520	ARSENIC	7	07/10/09	59251	Y	ES-R09-080520
East	R10	ES-R10-080602	ARSENIC	10	07/09/09	59251	Y	ES-R10-080602
East	R11	ES-R11-080605	ARSENIC	12.9	05/20/09	57706	Y	ES-R11-080605
East	R12	ES-R12-080611	ARSENIC	17.4	05/20/09	57706	Y	ES-R12-080611
East	R16	ES-R16-080605	ARSENIC	11	04/29/09	57303	Y	ES-R16-080605
East	R17	ES-R17-080606	ARSENIC	12.5	04/29/09	57303	Y	ES-R17-080606
East	S5	ES-S05-080521	ARSENIC	10.2	07/09/09	59251	Y	ES-S05-080521
East	S6	ES-S06-080521	ARSENIC	10.9	07/09/09	59251	Y	ES-S06-080521
East	S7	ES-S07-080521	ARSENIC	14.3	07/10/09	59251	Y	ES-S07-080521
East	S9	ES-S09-080522	ARSENIC	10.2	07/09/09	59251	Y	ES-S09-080522
East	S10	ES-S10-080523	ARSENIC	9.3	07/09/09	59251	Y	ES-S10-080523
East	S11	ES-S11-080528	ARSENIC	9.6	07/09/09	59251	Y	ES-S11-080528
East	S12	ES-S12-080609	ARSENIC	13.5	04/29/09	57303	Y	ES-S12-080609
East	S13	ES-S13-080610	ARSENIC	12.6	04/29/09	57303	Y	ES-S13-080610
East	S18	ES-S18-080606	ARSENIC	13.3	04/29/09	57303	Y	ES-S18-080606
East	T7	ES-T07-080612	ARSENIC	10	07/09/09	59251	Y	ES-T07-080612
East	T8	ES-T08-080522	ARSENIC	11.1	06/11/09	58236	Y	DUP-13
East	T8	ES-T08-080522	ARSENIC	9.4	07/09/09	59251	Y	ES-T08-080522
East	T9	ES-T09-080522	ARSENIC	8.1	07/09/09	59251	Y	ES-T09-080522
East	T10	ES-T10-080523	ARSENIC	9.7	07/09/09	59251	Y	ES-T10-080523
East	T10	ES-T10-080523	ARSENIC	9.7	07/09/09	59251	Y	DUP-14

ARSENIC Results from 09/11/09 database								
Site	quarter_acre_grid	sample_location	chemical_name	result_value	analysis_date	batch_id	detect_flag	sample_name
East	T11	ES-T11-080530	ARSENIC	10.6	07/09/09	59251	Y	ES-T11-080530
East	T12	ES-T12-080609	ARSENIC	12.3	04/29/09	57303	Y	ES-T12-080609
East	T13	ES-T13-080609	ARSENIC	12.9	04/29/09	57303	Y	ES-T13-080609
East	T14	ES-T14-080610	ARSENIC	10.3	04/29/09	57303	Y	ES-T14-080610
East	U10	ES-U10-080523	ARSENIC	9.9	07/09/09	59251	Y	ES-U10-080523
East	U11	ES-U11-080602	ARSENIC	8.7	07/09/09	59250	Y	ES-U11-080602
East	U13	ES-U13-080610	ARSENIC	9.2	05/13/09	57603	Y	ES-U13-080610
East	U14	ES-U14-080610	ARSENIC	10.1	05/13/09	57603	Y	ES-U14-080610
East	V11	ES-V11-080529	ARSENIC	10.7	07/09/09	59250	Y	ES-V11-080529
East	V14	ES-V14-080605	ARSENIC	8.3	05/13/09	57603	Y	ES-V14-080605
East	W12	ES-W12-080527	ARSENIC	5.9	07/09/09	59250	Y	ES-W12-080527
West	A4	WS-A04-080626	ARSENIC	12.8	07/23/09	59738	Y	WS-A04-080626
West	B3	WS-B03-080502	ARSENIC	16.2	07/23/09	59738	Y	WS-B03-080502
West	B4	WS-B04-080626	ARSENIC	10.7	07/23/09	59738	Y	WS-B04-080626
West	B5	WS-B05-080626	ARSENIC	11.4	07/28/09	59840	Y	WS-B05-080626
West	C1	WS-C01-080501	ARSENIC	6.6	07/09/09	59250	Y	WS-C01-080501
West	C1	WS-C01-080501	ARSENIC	6.8	07/09/09	59250	Y	DUP-3
West	C2	WS-C02-080428	ARSENIC	8.1	07/28/09	59841	Y	WS-C02-080428
West	C3	WS-C03-080620	ARSENIC	14.9	07/28/09	59841	Y	WS-C03-080620
West	C4	WS-C04-080623	ARSENIC	11.3	07/28/09	59841	Y	WS-C04-080623
West	C5	WS-C05-080620	ARSENIC	10.5	07/28/09	59840	Y	WS-C05-080620
West	C6	WS-C06-080624	ARSENIC	9.2	07/28/09	59840	Y	WS-C06-080624
West	D1	WS-D01-080430	ARSENIC	7.4	07/09/09	59250	Y	WS-D01-080430
West	D2	WS-D02-080429	ARSENIC	11.6	07/23/09	59738	Y	DUP-2
West	D2	WS-D02-080429	ARSENIC	11.9	07/28/09	59841	Y	WS-D02-080429
West	D3	WS-D03-080620	ARSENIC	13.9	07/28/09	59841	Y	WS-D03-080620
West	D4	WS-D04-080623	ARSENIC	14.3	08/17/09	60446	Y	WS-D04-080623
West	D5	WS-D05-080620	ARSENIC	9	07/28/09	59840	Y	WS-D05-080620
West	D6	WS-D06-080619	ARSENIC	10	07/28/09	59840	Y	WS-D06-080619
West	D7	WS-D07-080619	ARSENIC	10	07/28/09	59840	Y	WS-D07-080619
West	E1	WS-E01-080430	ARSENIC	8.3	07/09/09	59250	Y	WS-E01-080430
West	E2	WS-E02-080428	ARSENIC	11.7	07/23/09	59738	Y	DUP-1
West	E2	WS-E02-080428	ARSENIC	13.7	07/28/09	59841	Y	WS-E02-080428
West	E3	WS-E03-080619	ARSENIC	14	07/28/09	59841	Y	WS-E03-080619
West	E4	WS-E04-080613	ARSENIC	12.3	07/28/09	59840	Y	WS-E04-080613
West	E5	WS-E05-080613	ARSENIC	9.9	07/28/09	59840	Y	WS-E05-080613
West	E6	WS-E06-080613	ARSENIC	10.9	07/28/09	59840	Y	WS-E06-080613
West	E7	WS-E07-080613	ARSENIC	9.8	07/28/09	59840	Y	WS-E07-080613
West	F1	WS-F01-080429	ARSENIC	11	07/09/09	59250	Y	WS-F01-080429
West	F2	WS-F02-080429	ARSENIC	12.8	07/28/09	59841	Y	WS-F02-080429
West	F3	WS-F03-080619	ARSENIC	13.4	07/28/09	59841	Y	WS-F03-080619
West	F4	WS-F04-080616	ARSENIC	13.7	08/07/09	60228	Y	WS-F04-080616
West	F5	WS-F05-080612	ARSENIC	12.1	08/17/09	60446	Y	WS-F05-080612
West	F6	WS-F06-080612	ARSENIC	15.9	08/07/09	60228	Y	WS-F06-080612
West	F7	WS-F07-080617	ARSENIC	11.9	07/14/09	59472	Y	WS-F07-080617
West	F8	WS-F08-080618	ARSENIC	9.7	07/14/09	59472	Y	WS-F08-080618

ARSENIC Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch_id	detect _flag	sample_name
West	G1	WS-G01-080501	ARSENIC	11.3	07/09/09	59250	Y	DUP-4
West	G1	WS-G01-080501	ARSENIC	10.8	07/14/09	59472	Y	WS-G01-080501
West	G2	WS-G02-080618	ARSENIC	15	07/28/09	59841	Y	WS-G02-080618
West	G3	WS-G03-080619	ARSENIC	13.9	07/28/09	59841	Y	WS-G03-080619
West	G4	WS-G04-080616	ARSENIC	13.4	08/07/09	60228	Y	WS-G04-080616
West	G6	WS-G06-080616	ARSENIC	13.7	08/07/09	60228	Y	WS-G06-080616
West	G7	WS-G07-080617	ARSENIC	9.2	07/14/09	59472	Y	WS-G07-080617
West	H1	WS-H01-080501	ARSENIC	10.8	07/14/09	59472	Y	WS-H01-080501
West	H2	WS-H02-080618	ARSENIC	12.5	07/28/09	59841	Y	WS-H02-080618
West	H3	WS-H03-080619	ARSENIC	12.4	08/07/09	60228	Y	WS-H03-080619
West	H4	WS-H04-080616	ARSENIC	13.8	08/07/09	60228	Y	WS-H04-080616
West	H6	WS-H06-080617	ARSENIC	11.8	07/14/09	59472	Y	WS-H06-080617
West	I1	WS-I01-080501	ARSENIC	9.4	07/14/09	59472	Y	DUP-5
West	I1	WS-I01-080501	ARSENIC	9.3	07/14/09	59472	Y	WS-I01-080501
West	I2	WS-I02-080618	ARSENIC	8.3	07/28/09	59840	Y	WS-I02-080618
West	I3	WS-I03-080618	ARSENIC	13.1	08/07/09	60228	Y	WS-I03-080618
West	I4	WS-I04-080617	ARSENIC	13.4	08/07/09	60228	Y	WS-I04-080617
West	I5	WS-I05-080617	ARSENIC	11.5	07/14/09	59472	Y	WS-I05-080617
West	I6	WS-I06-080617	ARSENIC	8.9	07/14/09	59472	Y	WS-I06-080617
West	J1	WS-J01-080505	ARSENIC	9	07/14/09	59472	Y	DUP-6
West	J1	WS-J01-080505	ARSENIC	9.1	07/14/09	59472	Y	WS-J01-080505
West	J2	WS-J02-080624	ARSENIC	12.2	07/14/09	59472	Y	WS-J02-080624
West	J3	WS-J03-080620	ARSENIC	12.8	07/14/09	59473	Y	WS-J03-080620
West	J4	WS-J04-080617	ARSENIC	11.2	07/14/09	59473	Y	WS-J04-080617
West	J5	WS-J05-080618	ARSENIC	10.8	07/14/09	59473	Y	WS-J05-080618
West	K1	WS-K01-080505	ARSENIC	8.7	07/14/09	59473	Y	WS-K01-080505
West	K2	WS-K02-080509	ARSENIC	11.3	07/14/09	59473	Y	WS-K02-080509
West	K3	WS-K03-080509	ARSENIC	10	07/14/09	59473	Y	WS-K03-080509
West	K4	WS-K04-080513	ARSENIC	10.2	07/14/09	59473	Y	WS-K04-080513
West	K4	WS-K04-080513	ARSENIC	8.2	07/28/09	59840	Y	DUP-10
West	K5	WS-K05-080509	ARSENIC	9.6	07/14/09	59473	Y	WS-K05-080509
West	L1	WS-L01-080505	ARSENIC	10.4	07/14/09	59473	Y	WS-L01-080505
West	L2	WS-L02-080508	ARSENIC	10.2	07/14/09	59473	Y	WS-L02-080508
West	L3	WS-L03-080508	ARSENIC	8.4	07/14/09	59473	Y	WS-L03-080508
West	L4	WS-L04-080508	ARSENIC	13.9	07/14/09	59473	Y	WS-L04-080508
West	L4	WS-L04-080508	ARSENIC	13.1	07/15/09	59473	Y	DUP-9
West	M1	WS-M01-080505	ARSENIC	9.4	07/15/09	59473	Y	WS-M01-080505
West	M1	WS-M01-080505	ARSENIC	10.1	07/15/09	59473	Y	DUP-7
West	M2	WS-M02-080507	ARSENIC	8.6	07/28/09	59840	Y	WS-M02-080507
West	M3	WS-M03-080507	ARSENIC	9.4	07/28/09	59841	Y	DUP-8
West	M3	WS-M03-080507	ARSENIC	7.9	08/07/09	60229	Y	WS-M03-080507
West	M4	WS-M04-080507	ARSENIC	6.6	08/07/09	60229	Y	WS-M04-080507
West	N1	WS-N01-080506	ARSENIC	9.4	08/07/09	60229	Y	WS-N01-080506
West	N2	WS-N02-080506	ARSENIC	10.9	07/22/09	59738	Y	WS-N02-080506
West	N3	WS-N03-080507	ARSENIC	8.1	07/14/09	59472	Y	WS-N03-080507
West	O1	WS-O01-080506	ARSENIC	9.4	07/23/09	59738	Y	WS-O01-080506

ARSENIC Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch_id	detect _flag	sample_name
West	O2	WS-O02-080506	ARSENIC	7.9	07/23/09	59738	Y	WS-O02-080506

Table Ba-1: Barium Data Quality Summary

Laboratory Performance Criteria	Criteria	Measured		Comment
Minimum LCS Recovery	greater than 80%		95%	
Minimum Matrix Spike Recovery	greater than 70%		86%	
Average LCS Recovery	N/A		96%	
Average Matrix Spike Recovery	N/A		98%	
Maximum LCS RPD	less than 20%		14%	
Maximum Laboratory Duplicate RPD	less than 20%		21%	
Average LCS RPD	N/A		3%	
Average Laboratory Duplicate RPD	N/A		5%	
Measurement Quality Objectives	**Critera**	**Measured**		
NPS CRM	Recovery greater than 339 ı	Minimum Recovery =		352 mg/kg
EQIS CRM	N/A	See Note 1		
CVS Split Analysis RPD	RPD less than 35%	Maximum RPD =		14.8 %
CRM Split Analysis RPD	RPD less than 35%	Maximum RPD =		10.8 %
Overall QC Indicator Measurements	**Criteria**	**Measured**		
NPS CRM "Made to" (Bias measure)	N/A	Average Recovery =		91.5 %
NPS Replicate Test (Precision measure)	N/A	Standard Deviation =		5.97 mg/kg
Data Quality Relative to Remediation Goals				
Tier 1 Remediation Goal	210 mg/kg			
Tier 2 Remediation Goal	220 mg/kg			
QC Derived reliance Level	235 mg/kg	See Note 2		

Comments: Barium QC measurements attained all laboratory performance criteria and measurement performance criteria except for a single occurrence of the maximum laboratory duplicate RPD (21%) exceeding the laboratory performance criteria (20%). As desired, the derived reliance level (235 mg/kg) for barium is greater than the RG, reflecting the generally good precision and accuracy in barium measurements. Therefore, it is concluded that barium CVS measurements are of acceptable quality and may be used to determine RG achievement.

.

Note 1: The QAPP required CRMs have only 4 analytes from each analyte group. Barium is not one of these analytes.

Note 2: Derived reliance level is calculated as: (Tier 2 RG)(1.2)(Average Recovery)-(0.84)(Standard deviation) = (220)(1.2)(.91)-(0.84)(5.97) = 235

Table Ba-1: Barium Data Quality Summary			
Laboratory Performance Criteria	Criteria	Measured	Comment
Minimum LCS Recovery	greater than 80%	95%	
Minimum Matrix Spike Recovery	greater than 70%	86%	
Average LCS Recovery	N/A	96%	
Average Matrix Spike Recovery	N/A	98%	
Maximum LCS RPD	less than 20%	14%	
Maximum Laboratory Duplicate RPD	less than 20%	21%	
Average LCS RPD	N/A	3%	
Average Laboratory Duplicate RPD	N/A	5%	
Measurement Quality Objectives	Critera	Measured	
NPS CRM	Recovery greater than 339 ı	Minimum Recovery =	352 mg/kg
EQIS CRM	N/A	See Note 1	
CVS Split Analysis RPD	RPD less than 35%	Maximum RPD =	14.8 %
CRM Split Analysis RPD	RPD less than 35%	Maximum RPD =	10.8 %
Overall QC Indicator Measurements	Criteria	Measured	
NPS CRM "Made to" (Bias measure)	N/A	Average Recovery =	91.5 %
NPS Replicate Test (Precision measure)	N/A	Standard Deviation =	5.97 mg/kg
Data Quality Relative to Remediation Goals			
Tier 1 Remediation Goal	210 mg/kg		
Tier 2 Remediation Goal	220 mg/kg		
QC Derived reliance Level	235 mg/kg	See Note 2	

Comments: Barium QC measurements attained all laboratory performance criteria and measurement performance criteria except for a single occurrence of the maximum laboratory duplicate RPD (21%) exceeding the laboratory performance criteria (20%). As desired, the derived reliance level (235 mg/kg) for barium is greater than the RG, reflecting the generally good precision and accuracy in barium measurements. Therefore, it is concluded that barium CVS measurements are of acceptable quality and may be used to determine RG achievement.

.

Note 1: The QAPP required CRMs have only 4 analytes from each analyte group. Barium is not one of theses analytes.

Note 2: Derived reliance level is calculated as: (Tier 2 RG)(1.2)(Average Recovery)-(0.84)(Standard deviation) = (220)(1.2)(.91)-(0.84)(5.97) = 235

Table Ba-2: Barium - NPS CRMs

Blind NPS CRM Results

Sample	Result	Analysis Date	Batch	Detect
BOR Sample 1-BOR 56	391	5/3/09	57225	Y
BOR Sample 4-BOR 82	365	5/6/09	57448	Y
BOR 83	380	5/27/09	57791	Y
BOR Sample 3-BOR 58	373	5/27/09	57791	Y
BOR 84	409	5/28/09	57849	Y
BOR Sample 7-BOR 105	420	5/28/09	57849	Y
BOR 85	352	6/5/09	58138	Y
BOR Sample 8-BOR 106	365	6/5/09	58138	Y
BOR 86	371	6/11/09	58214	Y
BOR 108	378	6/22/09	58564	Y
BOR 87	389	6/22/09	58564	Y
BOR 109	417	6/30/09	58730	Y
BOR 110	402	7/13/09	59383	Y
BOR Sample 9-BOR 107	401	7/24/09	59759	Y
BOR 111	369	7/30/09	59891	Y
BOR Sample 6-BOR 81	365	5/4/09	57431	Y

CRMs		Vendor Supplied Information
Mean	384.19	*"Made to"*
Standard Error	5.15	*420 mg/kg*
Median	379.00	
Standard Deviation	20.61	*Upper Acceptance Limit*
Sample Variance	424.70	*471 mg/kg*
Kurtosis	-0.98	
Skewness	0.39	*Lower Acceptance Limit*
Range	68	*339 mg/kg*
Minimum	352	
Maximum	420	
Sum	6147	
Count	16	
Largest(2)	417	
Smallest(2)	365	

Table Ba-3: Barium- NPS Replicate Test on Background Sample

Results of Replicate Analyses of a Single Sample

Sample	Result	Analysis Date	Batch	Detect
BOR 112	101	5/4/09	57225	Y
BOR 59	83.3	5/4/09	57431	Y
BOR 60	80.5	5/6/09	57448	Y
BOR 113	81.8	5/27/09	57791	Y
BOR 61	78.7	5/27/09	57791	Y
BOR 62	82	6/11/09	58214	Y
BOR 63	78.3	6/22/09	58564	Y
BOR 89	80.9	6/22/09	58564	Y
BOR 115	91	6/30/09	58730	Y
BOR 64	86.3	7/8/09	59166	Y
BOR 91	84.7	7/8/09	59166	Y
BOR 116	86.1	7/13/09	59383	Y
BOR 92	89.5	7/13/09	59383	Y
BOR 65	84.5	7/24/09	59622	Y
BOR 88	78.3	7/30/09	59891	Y

Replicate analyses of Single Sample	
Mean	84.46
Standard Error	1.54
Median	83.30
Standard Deviation	5.97
Sample Variance	35.70
Kurtosis	3.29
Skewness	1.60
Range	22.70
Minimum	78.30
Maximum	101
Sum	1267
Count	15
Largest(2)	91
Smallest(2)	78

Table Ba-4: Barium NPS and EQIS Duplicates

Sample	Result	Analysis Date	Batch	Split	Result	Analysis Date	RPD
BOR 503	91.7	5/4/09	57431	ES-T11-080530	82.3	6/11/2009	11
BOR 506	79.9	5/6/09	57448	ES-S10-080523	82.6	6/11/2009	3
BOR 504	88.6	5/27/09	57791	ES-M05-080527	88.8	5/28/2009	0
BOR 507	74	6/5/09	58138	ES-O09-080610			
BOR 508	98.6	6/22/09	58564	ES-Q11-080606	99.5	5/6/2009	1
BOR 510	73.4	6/30/09	58730	OU-8HR-080605	68.1	5/3/2009	7
BOR 501	92	7/8/09	59166	WS-L04-080508	93.6	7/8/2009	2
BOR 502	70.4	7/24/09	59759	WS-F05-080612	65	8/18/2009	8
BOR 505	68.8	7/24/09	59622	WS-K03-080509	79.8	7/8/2009	15
BOR 509	101	7/24/09	59759	WS-E06-080613	99.1	7/24/2009	2
DUP-11	56.4	5/3/09	57101	ES-J03-080513	58.6	6/22/2009	4
DUP-17	75.8	5/4/09	57431	ES-F01-080529	80.1	5/6/2009	6
DUP-15	95.4	5/6/09	57448	ES-J02-080527	105	5/27/2009	10
DUP-18	60.6	5/6/09	57448	ES-J04-080530	64.1	5/27/2009	6
DUP-12	113	5/27/09	57791	ES-P06-080515	102	6/5/2009	10
DUP-16	66.2	5/27/09	57791	ES-P04-080528	68.3	6/5/2009	3
DUP-19	62.7	5/28/09	57849	ES-K05-080605	63.1	5/28/2009	1
DUP-13	63.4	6/5/09	58138	ES-T08-080522	66.1	6/11/2009	4
DUP-14	74	6/11/09	58214	ES-T10-080523	74.9	6/11/2009	1
DUP-3	77.6	6/22/09	58564	WS-C01-080501	80.3	6/22/2009	3
DUP-4	89.1	6/22/09	58564	WS-G01-080501	89.4	6/30/2009	0
DUP-5	76.4	6/30/09	58730	WS-I01-080501	81.6	6/30/2009	7
DUP-6	100	6/30/09	58730	WS-J01-080505	101	6/30/2009	1
DUP-7	95	7/8/09	59166	WS-M01-080505	94.8	7/8/2009	0
DUP-9	93.6	7/8/09	59166	WS-L04-080508	93.6	7/8/2009	0
DUP-1	87.7	7/13/09	59383	WS-E02-080428	91.7	7/24/2009	4
DUP-2	110	7/13/09	59383	WS-D02-080429	108	7/24/2009	2
DUP-10	65.5	7/24/09	59759	WS-K04-080513	72.2	7/8/2009	10
DUP-8	58	7/24/09	59622	WS-M03-080507	50.3	8/11/2009	14

RPD of Sample Splits	
Mean	4.8
Standard Error	0.8
Median	3.6
Standard Deviation	4.3
Sample Variance	18.6
Kurtosis	-0.1
Skewness	0.9
Range	14.8
Minimum	0.0
Maximum	14.8
Sum	134.9
Count	28.0
Largest(2)	14.2
Smallest(2)	0.2

Table Ba-5: Barium EQIS CRMs

Results of Duplicate Analysis of EQIS CRMs

Sample	Result	Date	Batch	Detect	Average	RPD
ES-Z11-080605A	441	5/3/09	57101	Y		
ES-Z11-080605B	411	5/3/09	57101	Y	426	7
ES-Z09-080529A	422	5/4/09	57431	Y		
ES-Z09-080529B	425	5/4/09	57431	Y	423.5	1
ES-Z12-080606A	417	5/4/09	57431	Y		
ES-Z12-080606B	436	5/4/09	57431	Y	426.5	4
ES-Z05-080519A	422	5/6/09	57448	Y		
ES-Z05-080519B	408	5/6/09	57448	Y	415	3
ES-Z06-080520A	408	5/6/09	57448	Y		
ES-Z06-080520B	397	5/6/09	57448	Y	402.5	3
ES-Z07-080522A	445	5/27/09	57791	Y		
ES-Z07-080522B	440	5/27/09	57791	Y	442.5	1
ES-Z13-080610A	447	5/28/09	57849	Y		
ES-Z13-080610B	418	5/28/09	57849	Y	432.5	7
ES-Z10-080602A	399	6/5/09	58138	Y		
ES-Z10-080602B	400	6/5/09	58138	Y	399.5	0
ES-Z08-080527A	424	6/11/09	58214	Y		
ES-Z08-080527B	430	6/11/09	58214	Y	427	1
ES-Z14-080611A	465	6/22/09	58564	Y		
ES-Z14-080611B	436	6/22/09	58564	Y	450.5	6
ES-Z06-080520C	498	6/30/09	58730	Y		
ES-Z06-080520D	489	6/30/09	58730	Y	493.5	2
ES-Z05-080519C	449	7/8/09	59166	Y		
ES-Z05-080519D	403	7/8/09	59166	Y	426	11
ES-Z19-080624A	478	7/13/09	59383	Y		
ES-Z19-080624B	482	7/13/09	59383	Y	480	1
WS-Z17-080618A	473	7/13/09	59383	Y		
WS-Z17-080618B	480	7/13/09	59383	Y	476.5	1
WS-Z15-080613A	471	7/24/09	59622	Y		
WS-Z15-080613B	472	7/24/09	59622	Y	471.5	0
WS-Z18-080620A	463	7/24/09	59622	Y		
WS-Z18-080620B	456	7/24/09	59622	Y	459.5	2
WS-Z16-080617A	433	7/30/09	59891	Y		
WS-Z16-080617B	441	7/30/09	59891	Y	437	2

Analysis of EQIS CRMs		*RPD of EQIS CRMs*	
Mean	440.56	Mean	3.10
Standard Error	4.8977	Standard Error	
Median	438	Median	1.82
Standard Deviation	28.558	Standard Deviation	2.99
Sample Variance	815.59	Sample Variance	8.97
Kurtosis	-0.9659	Kurtosis	1.20
Skewness	0.2706	Skewness	1.33
Range	101	Range	10.59
Minimum	397	Minimum	0.21
Maximum	498	Maximum	10.80
Sum	14979	Sum	52.73
Count	34	Count	17
Largest(2)	489	Largest(2)	7.04
Smallest(2)	399	Smallest(2)	0.25

Table Ba-6: Barium Laboratory MS and LCS

Matrix Spike Recovery %	Batch	Order	LCS Recovery %	Batch	Order
99	7160081	1	98	49187	2
113	7160081	1	94	49189	3
103	49187	2	108	49537	4
104	49189	3	107	49539	5
114	49537	4	98	54626-62	6
119	49539	5	95	54821-82	7
103	54626-627	6	95	54891-89	8
95	54821-822	7	99	54915-91	9
97	54891-892	8	94	57101	10
104	54915-916	9	96	57225	11
89	57101	10	93	57448	12
93	57225	11	88	57791	13
92	57448	12	93	57849	14
87	57791	13	87	58138	15
87	57849	14	91	58214	16
86	58138	15	89	58564	17
93	58214	16	100	58730	18
91	58564	17	86	59166	19
105	58730	18	103	59383	20
88	59166	19	99	59622	21
103	59383	20	94	59759	22
102	59622	21	91	59891	23
98	59759	22	93	60090	24
91	59891	23	91	60441	25
102	60090	24			
97	60441	25			

Average MS Recovery = 98 % Average LCS Recovery = 95 %

Minimum MS Recovery = 86 % Minimum LCS Recovery = 86 %

Barium Laboratory Control Samples and MS Recoveries (June 2007 through August 2009)

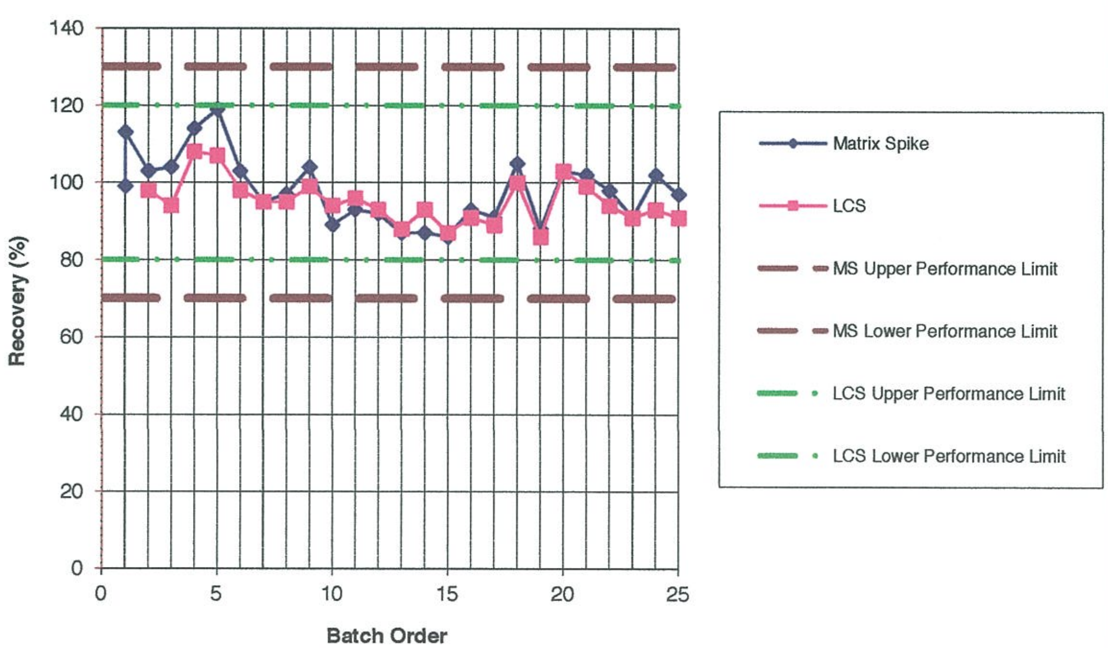
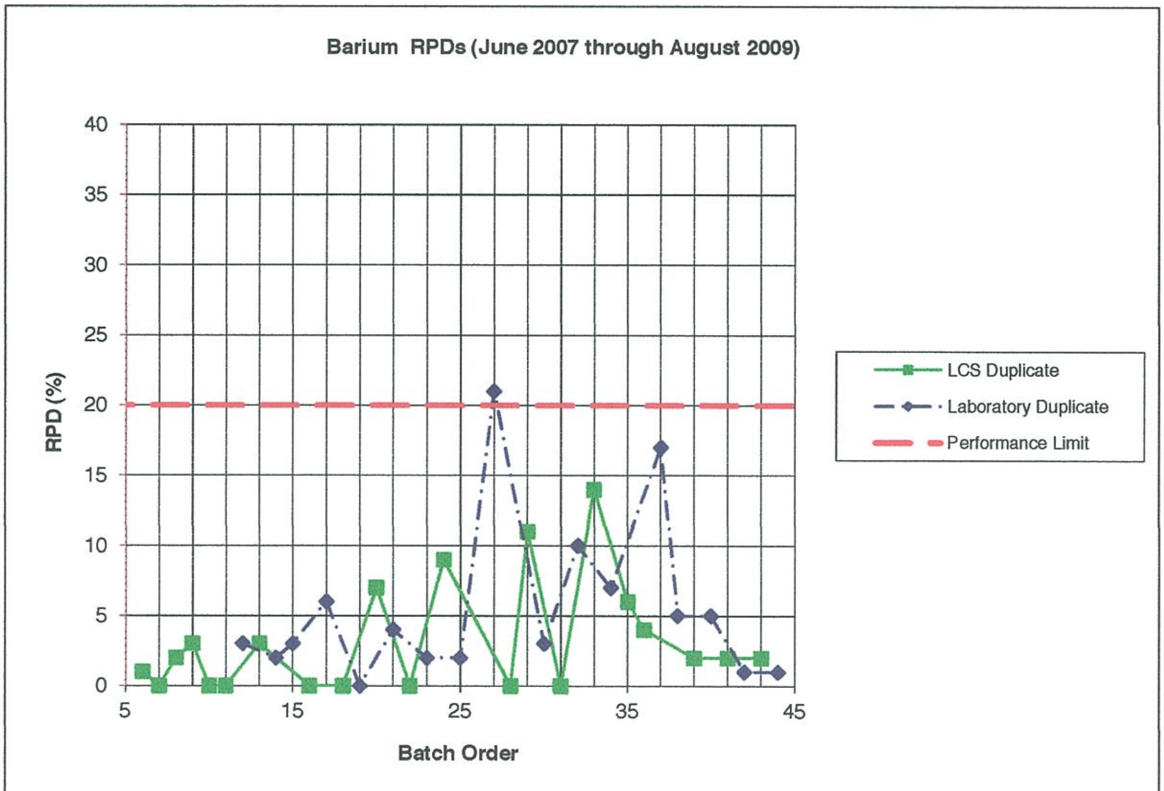


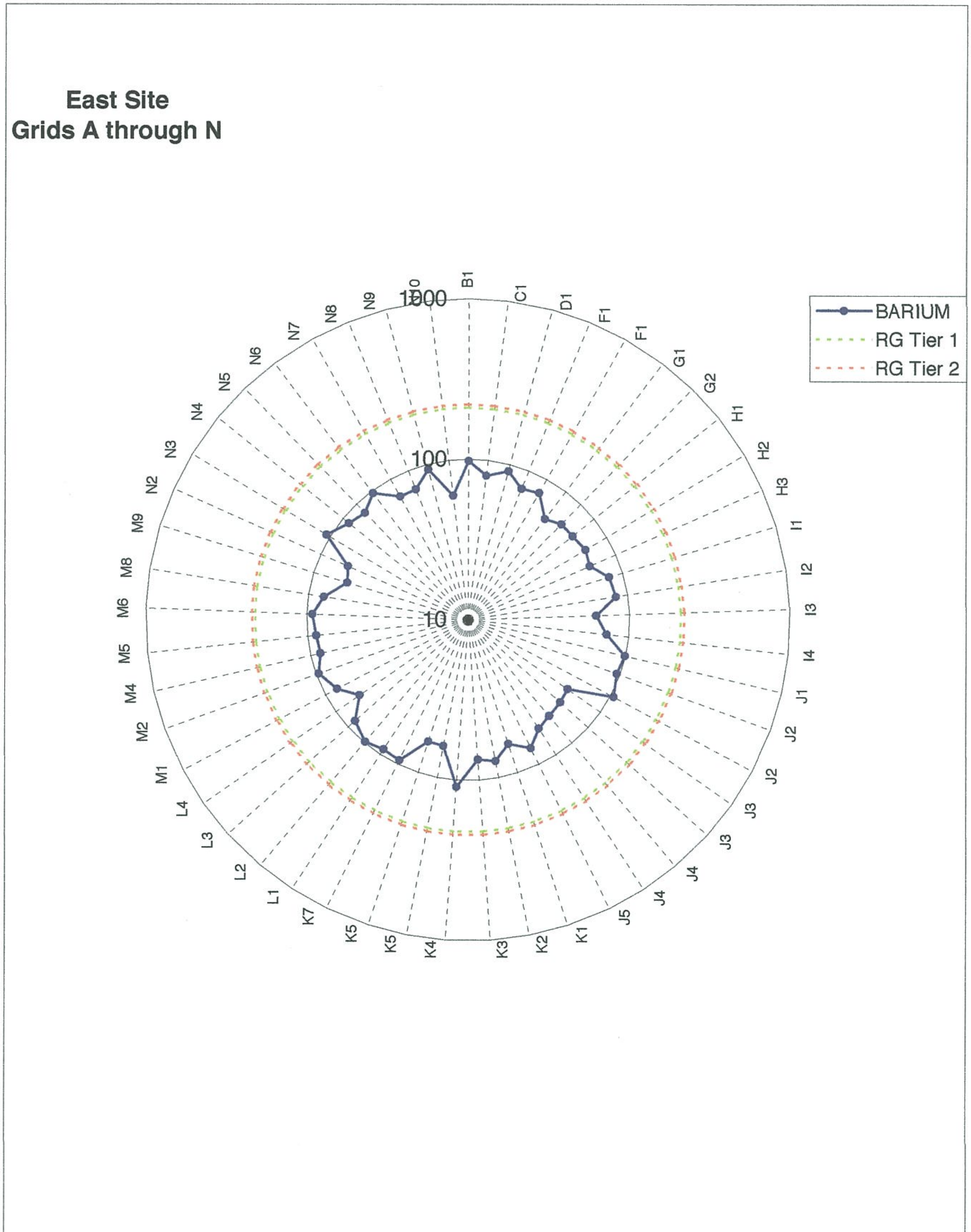
Table Ba-7: Barium - Laboratory Duplicates and LCS Duplicates

Laboratory Duplicate RPD		Batch Order	LCS Duplicate RPD		Batch Order
3	57101	12	1	54626-627	6
2	57225	14	0.0001	54821-822	7
3	57431	15	2	54891-892	8
6	57448	17	3	54915-916	9
0.0001	57791	19	0.0001	57101	10
4	57849	21	0.0001	57225	11
2	58138	23	3	57431	13
2	58214	25	0.0001	57448	16
21	58564	27	0.0001	57791	18
3	58730	30	7	57849	20
10	59166	32	0.0001	58138	22
7	59383	34	9	58214	24
17	59622	37	0.0001	58564	28
5	59759	38	11	58730	29
5	59891	40	0.0001	59166	31
1	60090	42	14	59383	33
1	60441	44	6	59622	35
			4	59759	36
			2	59891	39
			2	60090	41
			2	60441	43

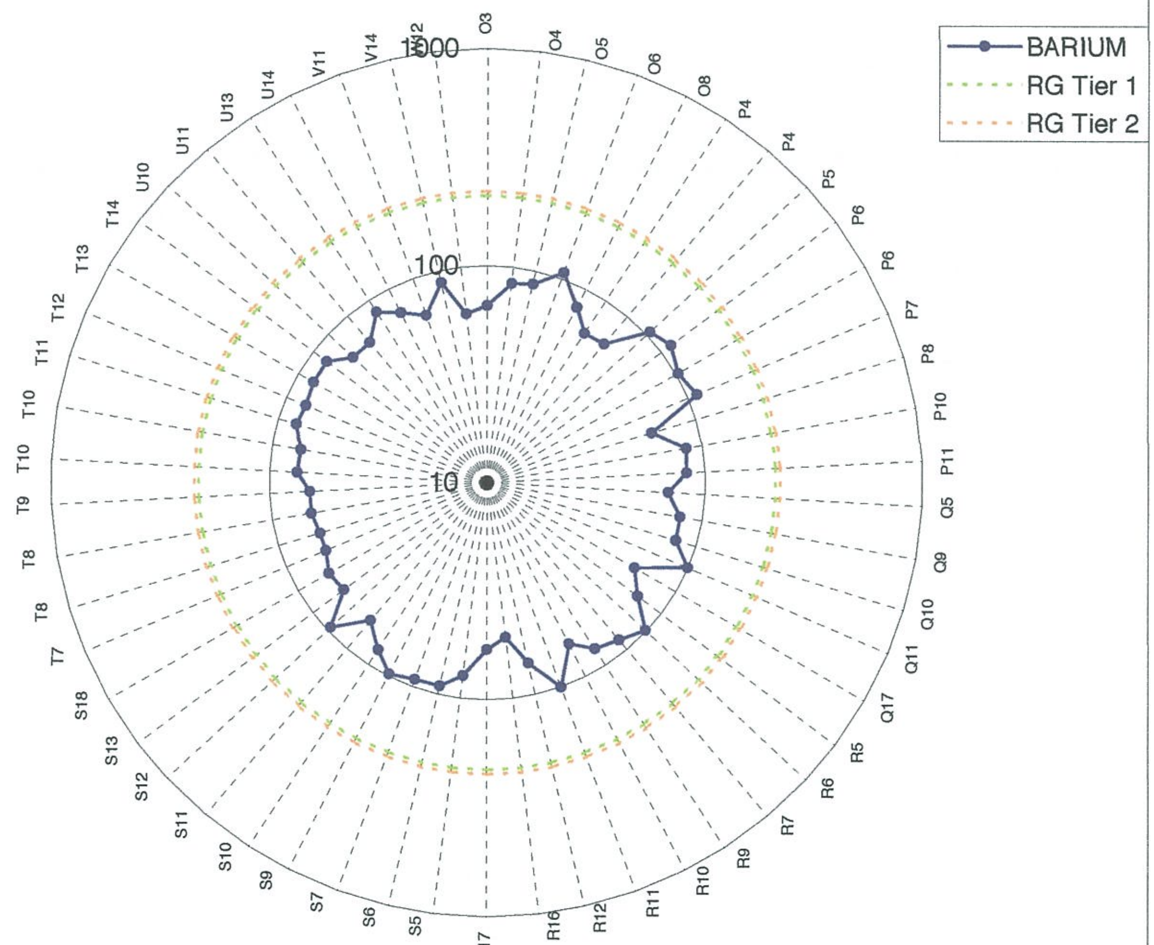
Average Duplicate RPD = 5 %   Average LCS RPD = 3 %

Maximum Duplicate RPD = 21 %   Maximum LCS RPD = 14 %

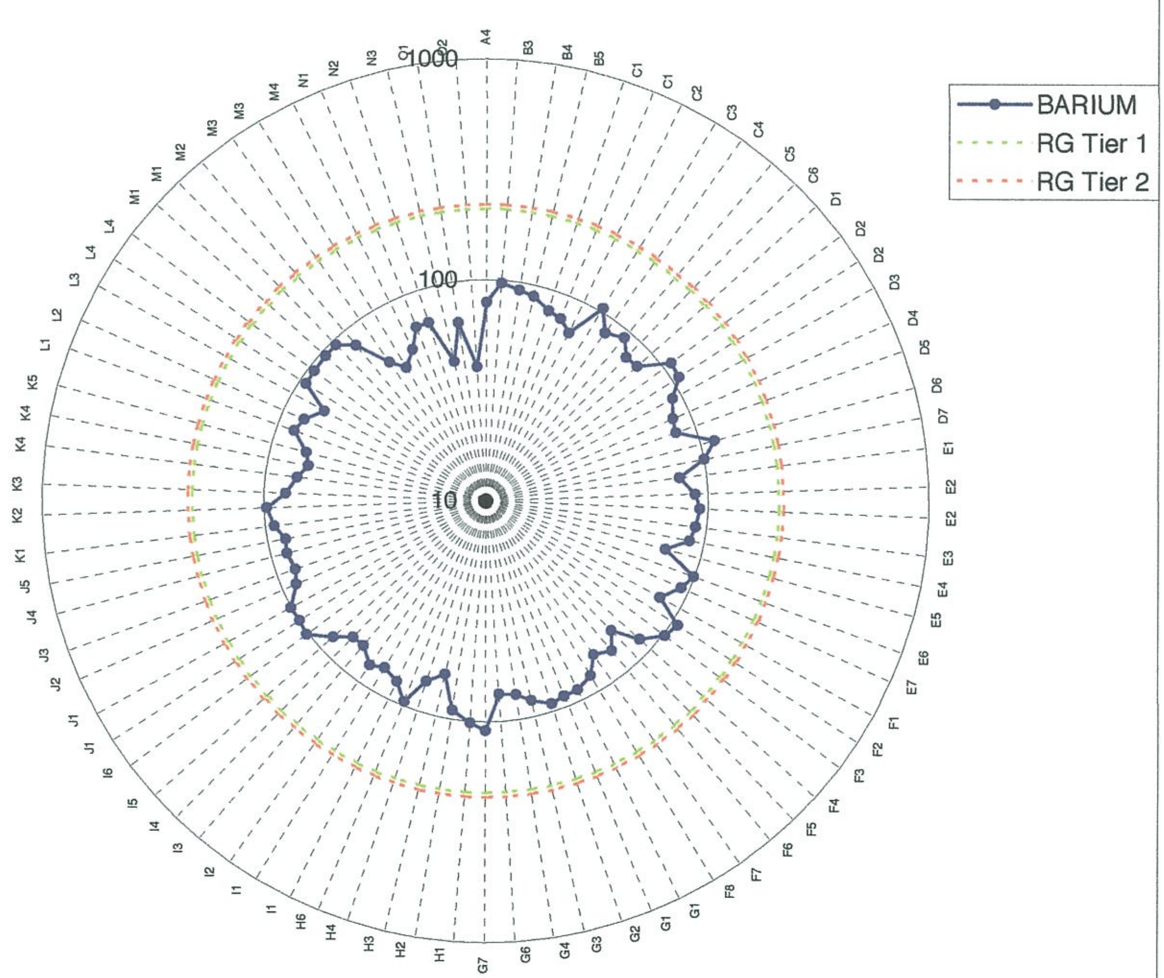



East Site
Grids A through N
BARIUM
RG Tier 1
RG Tier 2
1000
100
10
B1
C1
D1
F1
F1
G1
G2
H1
H2
H3
I1
I2
I3
I4
J1
J2
J2
J3
J3
J4
J4
J5
K1
K2
K3
K4
K5
K5
K7
L1
L2
L3
L4
M1
M2
M4
M5
M6
M8
M9
N2
N3
N4
N5
N6
N7
N8
N9

East Site
Grids O through W



West Site



BARIUM CVS Results from 09/11/09 database								
Site	quarter_acre_grid	sample_location	chemical_name	result_value	analysis_date	batch_id	detect_flag	sample_name
East	B1	ES-B01-080623	BARIUM	97.8	05/03/09	57101	Y	ES-B01-080623
East	C1	ES-C01-080624	BARIUM	80.4	05/03/09	57101	Y	ES-C01-080624
East	D1	ES-D01-080624	BARIUM	91	06/05/09	58138	Y	ES-D01-080624
East	F1	ES-F01-080529	BARIUM	75.8	05/04/09	57431	Y	DUP-17
East	F1	ES-F01-080529	BARIUM	80.1	05/06/09	57448	Y	ES-F01-080529
East	G1	ES-G01-080529	BARIUM	61.3	05/06/09	57448	Y	ES-G01-080529
East	G2	ES-G02-080605	BARIUM	67.2	05/06/09	57448	Y	ES-G02-080605
East	H1	ES-H01-080528	BARIUM	67.6	05/06/09	57448	Y	ES-H01-080528
East	H2	ES-H02-080515	BARIUM	70.2	05/06/09	57448	Y	ES-H02-080515
East	H3	ES-H03-080605	BARIUM	66.6	05/27/09	57791	Y	ES-H03-080605
East	I1	ES-I01-080529	BARIUM	81.9	05/27/09	57791	Y	ES-I01-080529
East	I2	ES-I02-080514	BARIUM	84.6	05/27/09	57791	Y	ES-I02-080514
East	I3	ES-I03-080513	BARIUM	62	05/27/09	57791	Y	ES-I03-080513
East	I4	ES-I04-080602	BARIUM	72.6	05/27/09	57791	Y	ES-I04-080602
East	J1	ES-J01-080529	BARIUM	99.4	05/27/09	57791	Y	ES-J01-080529
East	J2	ES-J02-080527	BARIUM	95.4	05/06/09	57448	Y	DUP-15
East	J2	ES-J02-080527	BARIUM	105	05/27/09	57791	Y	ES-J02-080527
East	J3	ES-J03-080513	BARIUM	56.4	05/03/09	57101	Y	DUP-11
East	J3	ES-J03-080513	BARIUM	58.6	06/22/09	58564	Y	ES-J03-080513
East	J4	ES-J04-080530	BARIUM	60.6	05/06/09	57448	Y	DUP-18
East	J4	ES-J04-080530	BARIUM	64.1	05/27/09	57791	Y	ES-J04-080530
East	J5	ES-J05-080602	BARIUM	77.4	05/27/09	57791	Y	ES-J05-080602
East	K1	ES-K01-080602	BARIUM	65	05/27/09	57791	Y	ES-K01-080602
East	K2	ES-K02-080602	BARIUM	78.6	05/06/09	57448	Y	ES-K02-080602
East	K3	ES-K03-080514	BARIUM	74.6	05/27/09	57791	Y	ES-K03-080514
East	K4	ES-K04-080527	BARIUM	111	05/28/09	57849	Y	ES-K04-080527
East	K5	ES-K05-080605	BARIUM	63.1	05/28/09	57849	Y	ES-K05-080605
East	K5	ES-K05-080605	BARIUM	62.7	05/28/09	57849	Y	DUP-19
East	K7	ES-K07-080611	BARIUM	94.4	05/04/09	57431	Y	ES-K07-080611
East	L1	ES-L01-080625	BARIUM	91.6	05/28/09	57849	Y	ES-L01-080625
East	L2	ES-L02-080625	BARIUM	98.6	05/28/09	57849	Y	ES-L02-080625
East	L3	ES-L03-080604	BARIUM	87.9	05/28/09	57849	Y	ES-L03-080604
East	L4	ES-L04-080604	BARIUM	66.4	06/22/09	58564	Y	ES-L04-080604
East	M1	ES-M01-080527	BARIUM	82.9	05/28/09	57849	Y	ES-M01-080527
East	M2	ES-M02-080519	BARIUM	96.8	05/28/09	57849	Y	ES-M02-080519
East	M4	ES-M04-080515	BARIUM	87.3	05/28/09	57849	Y	ES-M04-080515
East	M5	ES-M05-080527	BARIUM	88.8	05/28/09	57849	Y	ES-M05-080527
East	M6	ES-M06-080520	BARIUM	92.6	05/28/09	57849	Y	ES-M06-080520
East	M8	ES-M08-080610	BARIUM	80.5	05/04/09	57431	Y	ES-M08-080610
East	M9	ES-M09-080611	BARIUM	61	05/04/09	57431	Y	ES-M09-080611
East	N2	ES-N02-080528	BARIUM	65.6	05/28/09	57849	Y	ES-N02-080528
East	N3	ES-N03-080520	BARIUM	106	05/28/09	57849	Y	ES-N03-080520
East	N4	ES-N04-080519	BARIUM	89.8	05/28/09	57849	Y	ES-N04-080519
East	N5	ES-N05-080519	BARIUM	84.1	05/28/09	57849	Y	ES-N05-080519

BARIUM CVS Results from 09/11/09 database								
Site	quarter_acre_grid	sample_location	chemical_name	result_value	analysis_date	batch_id	detect_flag	sample_name
East	N6	ES-N06-080527	BARIUM	97.1	06/05/09	58138	Y	ES-N06-080527
East	N7	ES-N07-080530	BARIUM	75.3	06/05/09	58138	Y	ES-N07-080530
East	N8	ES-N08-080610	BARIUM	75	05/04/09	57431	Y	ES-N08-080610
East	N9	ES-N09-080610	BARIUM	93.1	05/04/09	57431	Y	ES-N09-080610
East	N10	ES-N10-080610	BARIUM	60.1	05/04/09	57431	Y	ES-N10-080610
East	O3	ES-O03-080528	BARIUM	65.5	06/05/09	58138	Y	ES-O03-080528
East	O4	ES-O04-080515	BARIUM	84.1	06/05/09	58138	Y	ES-O04-080515
East	O5	ES-O05-080520	BARIUM	86.8	06/05/09	58138	Y	ES-O05-080520
East	O6	ES-O06-080529	BARIUM	107	06/05/09	58138	Y	ES-O06-080529
East	O8	ES-O08-080530	BARIUM	80.9	07/24/09	59759	Y	ES-O08-080530
East	P4	ES-P04-080528	BARIUM	66.2	05/27/09	57791	Y	DUP-16
East	P4	ES-P04-080528	BARIUM	68.3	06/05/09	58138	Y	ES-P04-080528
East	P5	ES-P05-080513	BARIUM	105	06/05/09	58138	Y	ES-P05-080513
East	P6	ES-P06-080515	BARIUM	113	05/27/09	57791	Y	DUP-12
East	P6	ES-P06-080515	BARIUM	102	06/05/09	58138	Y	ES-P06-080515
East	P7	ES-P07-080519	BARIUM	111	05/28/09	57849	Y	ES-P07-080519
East	P8	ES-P08-080530	BARIUM	61.6	06/05/09	58138	Y	ES-P08-080530
East	P10	ES-P10-080606	BARIUM	84.2	05/04/09	57431	Y	ES-P10-080606
East	P11	ES-P11-080606	BARIUM	82.2	05/04/09	57431	Y	ES-P11-080606
East	Q5	ES-Q05-080520	BARIUM	67.7	06/05/09	58138	Y	ES-Q05-080520
East	Q9	ES-Q09-080612	BARIUM	79	06/05/09	58138	Y	ES-Q09-080612
East	Q10	ES-Q10-080606	BARIUM	80.2	05/06/09	57448	Y	ES-Q10-080606
East	Q11	ES-Q11-080606	BARIUM	99.5	05/06/09	57448	Y	ES-Q11-080606
East	Q17	ES-Q17-080609	BARIUM	60.4	05/03/09	57101	Y	ES-Q17-080609
East	R5	ES-R05-080521	BARIUM	73.5	06/05/09	58138	Y	ES-R05-080521
East	R6	ES-R06-080521	BARIUM	99	06/22/09	58564	Y	ES-R06-080521
East	R7	ES-R07-080521	BARIUM	87.7	06/11/09	58214	Y	ES-R07-080521
East	R9	ES-R09-080520	BARIUM	81.5	06/11/09	58214	Y	ES-R09-080520
East	R10	ES-R10-080602	BARIUM	67.9	06/11/09	58214	Y	ES-R10-080602
East	R11	ES-R11-080605	BARIUM	100	05/06/09	57448	Y	ES-R11-080605
East	R12	ES-R12-080611	BARIUM	71.2	05/06/09	57448	Y	ES-R12-080611
East	R16	ES-R16-080605	BARIUM	52.3	05/03/09	57101	Y	ES-R16-080605
East	R17	ES-R17-080606	BARIUM	58.7	05/03/09	57101	Y	ES-R17-080606
East	S5	ES-S05-080521	BARIUM	78.8	06/11/09	58214	Y	ES-S05-080521
East	S6	ES-S06-080521	BARIUM	91.3	06/11/09	58214	Y	ES-S06-080521
East	S7	ES-S07-080521	BARIUM	92.2	06/11/09	58214	Y	ES-S07-080521
East	S9	ES-S09-080522	BARIUM	97.5	06/11/09	58214	Y	ES-S09-080522
East	S10	ES-S10-080523	BARIUM	82.6	06/11/09	58214	Y	ES-S10-080523
East	S11	ES-S11-080528	BARIUM	67.7	06/11/09	58214	Y	ES-S11-080528
East	S12	ES-S12-080609	BARIUM	95.5	05/03/09	57101	Y	ES-S12-080609
East	S13	ES-S13-080610	BARIUM	66.5	05/03/09	57101	Y	ES-S13-080610
East	S18	ES-S18-080606	BARIUM	69	05/03/09	57101	Y	ES-S18-080606
East	T7	ES-T07-080612	BARIUM	63.7	06/11/09	58214	Y	ES-T07-080612
East	T8	ES-T08-080522	BARIUM	63.4	06/05/09	58138	Y	DUP-13

BARIUM CVS Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_ name	result_value	analysis _date	batch_id	detect _flag	sample_name
East	T8	ES-T08-080522	BARIUM	66.1	06/11/09	58214	Y	ES-T08-080522
East	T9	ES-T09-080522	BARIUM	65.4	06/11/09	58214	Y	ES-T09-080522
East	T10	ES-T10-080523	BARIUM	74.9	06/11/09	58214	Y	ES-T10-080523
East	T10	ES-T10-080523	BARIUM	74	06/11/09	58214	Y	DUP-14
East	T11	ES-T11-080530	BARIUM	82.3	06/11/09	58214	Y	ES-T11-080530
East	T12	ES-T12-080609	BARIUM	80	05/03/09	57101	Y	ES-T12-080609
East	T13	ES-T13-080609	BARIUM	83.4	05/03/09	57101	Y	ES-T13-080609
East	T14	ES-T14-080610	BARIUM	83.8	05/03/09	57101	Y	ES-T14-080610
East	U10	ES-U10-080523	BARIUM	69.9	06/11/09	58214	Y	ES-U10-080523
East	U11	ES-U11-080602	BARIUM	69.3	06/22/09	58564	Y	ES-U11-080602
East	U13	ES-U13-080610	BARIUM	86.2	05/04/09	57431	Y	ES-U13-080610
East	U14	ES-U14-080610	BARIUM	75.5	05/04/09	57431	Y	ES-U14-080610
East	V11	ES-V11-080529	BARIUM	66.2	06/22/09	58564	Y	ES-V11-080529
East	V14	ES-V14-080605	BARIUM	88.1	05/04/09	57431	Y	ES-V14-080605
East	W12	ES-W12-080527	BARIUM	60.6	06/22/09	58564	Y	ES-W12-080527
West	A4	WS-A04-080626	BARIUM	79.2	07/13/09	59383	Y	WS-A04-080626
West	B3	WS-B03-080502	BARIUM	97.3	07/13/09	59383	Y	WS-B03-080502
West	B4	WS-B04-080626	BARIUM	92.1	07/13/09	59383	Y	WS-B04-080626
West	B5	WS-B05-080626	BARIUM	89.1	07/24/09	59759	Y	WS-B05-080626
West	C1	WS-C01-080501	BARIUM	80.3	06/22/09	58564	Y	WS-C01-080501
West	C1	WS-C01-080501	BARIUM	77.6	06/22/09	58564	Y	DUP-3
West	C2	WS-C02-080428	BARIUM	70.3	07/24/09	59622	Y	WS-C02-080428
West	C3	WS-C03-080620	BARIUM	104	07/24/09	59622	Y	WS-C03-080620
West	C4	WS-C04-080623	BARIUM	84.9	07/24/09	59622	Y	WS-C04-080623
West	C5	WS-C05-080620	BARIUM	92.3	07/24/09	59759	Y	WS-C05-080620
West	C6	WS-C06-080624	BARIUM	80.4	07/24/09	59759	Y	WS-C06-080624
West	D1	WS-D01-080430	BARIUM	81.8	06/22/09	58564	Y	WS-D01-080430
West	D2	WS-D02-080429	BARIUM	110	07/13/09	59383	Y	DUP-2
West	D2	WS-D02-080429	BARIUM	108	07/24/09	59622	Y	WS-D02-080429
West	D3	WS-D03-080620	BARIUM	91.1	07/24/09	59622	Y	WS-D03-080620
West	D4	WS-D04-080623	BARIUM	83.2	08/17/09	60441	Y	WS-D04-080623
West	D5	WS-D05-080620	BARIUM	81	07/24/09	59759	Y	WS-D05-080620
West	D6	WS-D06-080619	BARIUM	116	07/24/09	59759	Y	WS-D06-080619
West	D7	WS-D07-080619	BARIUM	100	07/24/09	59759	Y	WS-D07-080619
West	E1	WS-E01-080430	BARIUM	75.5	06/22/09	58564	Y	WS-E01-080430
West	E2	WS-E02-080428	BARIUM	87.7	07/13/09	59383	Y	DUP-1
West	E2	WS-E02-080428	BARIUM	91.7	07/24/09	59622	Y	WS-E02-080428
West	E3	WS-E03-080619	BARIUM	88.9	07/24/09	59622	Y	WS-E03-080619
West	E4	WS-E04-080613	BARIUM	85.5	07/24/09	59759	Y	WS-E04-080613
West	E5	WS-E05-080613	BARIUM	68.4	07/24/09	59759	Y	WS-E05-080613
West	E6	WS-E06-080613	BARIUM	99.1	07/24/09	59759	Y	WS-E06-080613
West	E7	WS-E07-080613	BARIUM	91.7	07/24/09	59759	Y	WS-E07-080613
West	F1	WS-F01-080429	BARIUM	78.8	06/22/09	58564	Y	WS-F01-080429
West	F2	WS-F02-080429	BARIUM	107	07/24/09	59622	Y	WS-F02-080429

BARIUM CVS Results from 09/11/09 database								
Site	quarter_acre_grid	sample_location	chemical_name	result_value	analysis_date	batch_id	detect_flag	sample_name
West	F3	WS-F03-080619	BARIUM	102	07/24/09	59622	Y	WS-F03-080619
West	F4	WS-F04-080616	BARIUM	85.6	07/30/09	59891	Y	WS-F04-080616
West	F5	WS-F05-080612	BARIUM	65	08/18/09	60441	Y	WS-F05-080612
West	F6	WS-F06-080612	BARIUM	76.4	07/30/09	59891	Y	WS-F06-080612
West	F7	WS-F07-080617	BARIUM	70.5	06/30/09	58730	Y	WS-F07-080617
West	F8	WS-F08-080618	BARIUM	83.2	06/30/09	58730	Y	WS-F08-080618
West	G1	WS-G01-080501	BARIUM	89.1	06/22/09	58564	Y	DUP-4
West	G1	WS-G01-080501	BARIUM	89.4	06/30/09	58730	Y	WS-G01-080501
West	G2	WS-G02-080618	BARIUM	92.2	07/24/09	59622	Y	WS-G02-080618
West	G3	WS-G03-080619	BARIUM	84.5	07/24/09	59622	Y	WS-G03-080619
West	G4	WS-G04-080616	BARIUM	77.1	07/30/09	59891	Y	WS-G04-080616
West	G6	WS-G06-080616	BARIUM	75.4	07/30/09	59891	Y	WS-G06-080616
West	G7	WS-G07-080617	BARIUM	110	06/30/09	58730	Y	WS-G07-080617
West	H1	WS-H01-080501	BARIUM	102	06/30/09	58730	Y	WS-H01-080501
West	H2	WS-H02-080618	BARIUM	91.1	07/24/09	59622	Y	WS-H02-080618
West	H3	WS-H03-080619	BARIUM	63.9	07/30/09	59891	Y	WS-H03-080619
West	H4	WS-H04-080616	BARIUM	72.4	07/30/09	59891	Y	WS-H04-080616
West	H6	WS-H06-080617	BARIUM	96	06/30/09	58730	Y	WS-H06-080617
West	I1	WS-I01-080501	BARIUM	81.6	06/30/09	58730	Y	WS-I01-080501
West	I1	WS-I01-080501	BARIUM	76.4	06/30/09	58730	Y	DUP-5
West	I2	WS-I02-080618	BARIUM	81.3	07/24/09	59759	Y	WS-I02-080618
West	I3	WS-I03-080618	BARIUM	71.9	07/30/09	59891	Y	WS-I03-080618
West	I4	WS-I04-080617	BARIUM	72.6	07/30/09	59891	Y	WS-I04-080617
West	I5	WS-I05-080617	BARIUM	84	06/30/09	58730	Y	WS-I05-080617
West	I6	WS-I06-080617	BARIUM	102	06/30/09	58730	Y	WS-I06-080617
West	J1	WS-J01-080505	BARIUM	100	06/30/09	58730	Y	DUP-6
West	J1	WS-J01-080505	BARIUM	101	06/30/09	58730	Y	WS-J01-080505
West	J2	WS-J02-080624	BARIUM	85.9	06/30/09	58730	Y	WS-J02-080624
West	J3	WS-J03-080620	BARIUM	81.9	07/08/09	59166	Y	WS-J03-080620
West	J4	WS-J04-080617	BARIUM	84.4	07/08/09	59166	Y	WS-J04-080617
West	J5	WS-J05-080618	BARIUM	82.9	07/08/09	59166	Y	WS-J05-080618
West	K1	WS-K01-080505	BARIUM	91.2	07/08/09	59166	Y	WS-K01-080505
West	K2	WS-K02-080509	BARIUM	97.2	07/08/09	59166	Y	WS-K02-080509
West	K3	WS-K03-080509	BARIUM	79.8	07/08/09	59166	Y	WS-K03-080509
West	K4	WS-K04-080513	BARIUM	72.2	07/08/09	59166	Y	WS-K04-080513
West	K4	WS-K04-080513	BARIUM	65.5	07/24/09	59759	Y	DUP-10
West	K5	WS-K05-080509	BARIUM	68.9	07/08/09	59166	Y	WS-K05-080509
West	L1	WS-L01-080505	BARIUM	83.2	07/08/09	59166	Y	WS-L01-080505
West	L2	WS-L02-080508	BARIUM	79	07/08/09	59166	Y	WS-L02-080508
West	L3	WS-L03-080508	BARIUM	68.3	07/08/09	59166	Y	WS-L03-080508
West	L4	WS-L04-080508	BARIUM	93.1	07/08/09	59166	Y	WS-L04-080508
West	L4	WS-L04-080508	BARIUM	93.6	07/08/09	59166	Y	DUP-9
West	M1	WS-M01-080505	BARIUM	94.8	07/08/09	59166	Y	WS-M01-080505
West	M1	WS-M01-080505	BARIUM	95	07/08/09	59166	Y	DUP-7

BARIUM CVS Results from 09/11/09 database								
Site	quarter_acre_grid	sample_location	chemical_name	result_value	analysis_date	batch_id	detect_flag	sample_name
West	M2	WS-M02-080507	BARIUM	82.6	07/24/09	59759	Y	WS-M02-080507
West	M3	WS-M03-080507	BARIUM	58	07/24/09	59622	Y	DUP-8
West	M3	WS-M03-080507	BARIUM	50.3	08/11/09	60090	Y	WS-M03-080507
West	M4	WS-M04-080507	BARIUM	57.7	08/11/09	60090	Y	WS-M04-080507
West	N1	WS-N01-080506	BARIUM	70.2	08/11/09	60090	Y	WS-N01-080506
West	N2	WS-N02-080506	BARIUM	70.3	07/13/09	59383	Y	WS-N02-080506
West	N3	WS-N03-080507	BARIUM	44.3	06/30/09	58730	Y	WS-N03-080507
West	O1	WS-O01-080506	BARIUM	65.4	07/13/09	59383	Y	WS-O01-080506
West	O2	WS-O02-080506	BARIUM	40.5	07/13/09	59383	Y	WS-O02-080506

Table Be-1: Beryllium Data Quality Summary			
Laboratory Performance Criteria	Critera	Measured	Comment
Minimum LCS Recovery	greater than 80%	82%	
Minimum Matrix Spike Recovery	greater than 70%	62%	
Average LCS Recovery	N/A	93%	
Average Matrix Spike Recovery	N/A	85%	
Maximum LCS RPD	less than 20%	12%	
Maximum Laboratory Duplicate RPD	less than 20%	15%	
Average LCS RPD	N/A	4%	
Average Laboratory Duplicate RPD	N/A	6%	
Measurement Quality Objectives	Critera	Measured	
NPS CRM	Recovery greater than 3.21	Minimum Recovery =	1.6 mg/kg
EQIS CRM	N/A	See Note 1	
CVS Split Analysis RPD	RPD less than 35%	Maximum RPD =	39.1 %
CRM Split Analysis RPD	RPD less than 35%	Maximum RPD =	7.8 %
Overall QC Indicator Measurements	Criteria	Measured	
NPS CRM "Made to" (Bias measure)	N/A	Average Recovery =	50 %
NPS Replicate Test (Precision measure)	N/A	Standard Deviation =	0.11 mg/kg
Data Quality Relative to Remediation Goals			
Tier 1 Remediation Goal	2.1 mg/kg		
Tier 2 Remediation Goal	none		
QC Derived reliance Level	1.2 mg/kg	See Note 2	

Comments: Low average matrix spike recovery (85%) and an NPS CRM recovery (1.6 mg/kg) that is less than the vendor supplied lower acceptance limit (3.21 mg/kg) indicate a measurement bias for beryllium favoring low concentrations. Also, a high maximum CVS split RPD (39.1%) indicates a precision problem.The derived reliance level (1.2 mg/kg) is lower than the beryllium RG due to bias and imprecision. However, in nearly all instances, the CVS-measured beryllium concentrations that are above the derived reliance level also exceed the RG, so these measurements would not be used to determine achievement of the beryllium RG in any case. There are two grids in which the CVS-measured concentrations of beryllium exceeded the derived reliance level without also exceeding the RG -- East Site grids M08 and N09. Use of these measurements to determine that these two grids have achieved the beryllium RG would not be desirable. Fortunately, these data were not needed. These grids failed to achieve copper RG, so they were resampled and the new CVS samples were used to evaluate beryllium RG achievement. [The new CVS measurements are evaluated in DUR 2.] Therefore, it is concluded that the beryllium CVS measurements are of acceptable quality and may be used to determine RG achievement (except for the data related to the two above-identified grids).

Note 1: The QAPP required CRMs have only 4 analytes from each analyte group, and beryllium is not one of those analytes.

Note 2: Derived reliance level is calculated as: (Tier 1 RG)(1.2)(Average Recovery)-(0.84)(Standard deviation) = (2.1)(1.2)(.5)-(0.84)(.11) = 1.2 mg/kg

Table Be-2: Beryllium - NPS CRMs

Blind NPS CRM Results

Sample	Result	Analysis Date	Batch	Detect
BOR Sample 1-BOR 56	2.1	5/3/09	57225	Y
BOR Sample 4-BOR 82	2.1	5/6/09	57448	Y
BOR 83	1.6	5/27/09	57791	Y
BOR Sample 3-BOR 58	1.6	5/27/09	57791	Y
BOR 84	2.1	5/28/09	57849	Y
BOR Sample 7-BOR 105	2.1	5/28/09	57849	Y
BOR 85	1.9	6/5/09	58138	Y
BOR Sample 8-BOR 106	1.9	6/5/09	58138	Y
BOR 86	2.1	6/11/09	58214	Y
BOR 108	2.3	6/22/09	58564	Y
BOR 87	2.5	6/22/09	58564	Y
BOR 109	2.1	6/30/09	58730	Y
BOR 110	2.4	7/13/09	59383	Y
BOR Sample 9-BOR 107	2	7/24/09	59759	Y
BOR 111	2.1	7/30/09	59891	Y
BOR Sample 6-BOR 81	2.7	5/4/09	57431	Y

CRMs		Vendor Supplied Information
Mean	2.10	*"Made to"*
Standard Error	0.07	*4.20 mg/kg*
Median	2.10	
Standard Deviation	0.29	*Upper Acceptance Limit*
Sample Variance	0.083	*4.56 mg/kg*
Kurtosis	0.57	
Skewness	0.15	*Lower Acceptance Limit*
Range	1.1	*3.21 mg/kg*
Minimum	1.6	
Maximum	2.7	
Sum	33.6	
Count	16	
Largest(2)	2.5	
Smallest(2)	1.6	

Table Be-3: Beryllium - NPS Replicate Tests on a Background Sample

Results of Replicate Analyses of a Single Sample

Sample	Result	Analysis Date	Batch	Detect
BOR 112	0.66	5/4/09	57225	Y
BOR 59	0.9	5/4/09	57431	Y
BOR 60	0.65	5/6/09	57448	Y
BOR 113	0.5	5/27/09	57791	Y
BOR 61	0.51	5/27/09	57791	Y
BOR 62	0.63	6/11/09	58214	Y
BOR 63	0.7	6/22/09	58564	Y
BOR 89	0.73	6/22/09	58564	Y
BOR 115	0.64	6/30/09	58730	Y
BOR 64	0.68	7/8/09	59166	Y
BOR 91	0.65	7/8/09	59166	Y
BOR 116	0.85	7/13/09	59383	Y
BOR 92	0.79	7/13/09	59383	Y
BOR 65	0.62	7/24/09	59622	Y
BOR 88	0.65	7/30/09	59891	Y

Replicate analyses of Single Sample	
Mean	0.68
Standard Error	0.028
Median	0.65
Standard Deviation	0.11
Sample Variance	0.012
Kurtosis	0.47
Skewness	0.46
Range	0.40
Minimum	0.50
Maximum	0.90
Sum	10.16
Count	15
Largest(2)	0.85
Smallest(2)	0.51

Table Be-4: Beryllium NPS and EQIS Homogenized Duplicates

Sample	Result	Analysis Date	Batch	Split	Result	Analysis Date	RPD
BOR 503	1.1	5/4/09	57431	ES-T11-080530	0.74	6/11/2009	39
BOR 506	0.89	5/6/09	57448	ES-S10-080523	0.88	6/11/2009	1
BOR 504	0.64	5/27/09	57791	ES-M05-080527	0.73	5/28/2009	13
BOR 507	0.76	6/5/09	58138	ES-O09-080610			
BOR 508	0.97	6/22/09	58564	ES-Q11-080606	0.87	5/6/2009	11
BOR 510	0.69	6/30/09	58730	OU-8HR-080605	0.71	5/3/2009	3
BOR 501	0.87	7/8/09	59166	WS-L04-080508	0.85	7/8/2009	2
BOR 502	0.55	7/24/09	59759	WS-F05-080612	0.55	8/18/2009	0
BOR 505	0.49	7/24/09	59622	WS-K03-080509	0.51	7/8/2009	4
BOR 509	0.79	7/24/09	59759	WS-E06-080613	0.82	7/24/2009	4
DUP-11	0.46	5/3/09	57101	ES-J03-080513	0.59	6/22/2009	25
DUP-17	0.84	5/4/09	57431	ES-F01-080529	0.71	5/6/2009	17
DUP-15	0.86	5/6/09	57448	ES-J02-080527	0.76	5/27/2009	12
DUP-18	0.64	5/6/09	57448	ES-J04-080530	0.51	5/27/2009	23
DUP-12	0.78	5/27/09	57791	ES-P06-080515	0.86	6/5/2009	10
DUP-16	0.65	5/27/09	57791	ES-P04-080528	0.79	6/5/2009	19
DUP-19	0.51	5/28/09	57849	ES-K05-080605	0.52	5/28/2009	2
DUP-13	0.69	6/5/09	58138	ES-T08-080522	0.75	6/11/2009	8
DUP-14	0.74	6/11/09	58214	ES-T10-080523	0.73	6/11/2009	1
DUP-3	0.59	6/22/09	58564	WS-C01-080501	0.6	6/22/2009	2
DUP-4	1	6/22/09	58564	WS-G01-080501	0.79	6/30/2009	23
DUP-5	0.5	6/30/09	58730	WS-I01-080501	0.56	6/30/2009	11
DUP-6	0.61	6/30/09	58730	WS-J01-080505	0.63	6/30/2009	3
DUP-7	0.62	7/8/09	59166	WS-M01-080505	0.62	7/8/2009	0
DUP-9	0.85	7/8/09	59166	WS-L04-080508	0.85	7/8/2009	0
DUP-1	0.92	7/13/09	59383	WS-E02-080428	0.8	7/24/2009	14
DUP-2	1.1	7/13/09	59383	WS-D02-080429	0.98	7/24/2009	12
DUP-10	0.53	7/24/09	59759	WS-K04-080513	0.54	7/8/2009	2
DUP-8	0.29	7/24/09	59622	WS-M03-080507	0.3	8/11/2009	3

RPD of Sample Splits	
Mean	9.462377
Standard Error	1.818795
Median	6.166667
Standard Deviation	9.624158
Sample Variance	92.62442
Kurtosis	1.834343
Skewness	1.334346
Range	39.13043
Minimum	0
Maximum	39.13043
Sum	264.9466
Count	28
Largest(2)	24.7619
Smallest(2)	0

Table Be-5: Beryllium EQIS CRMs						
Results of Duplicate Analysis of EQIS CRMs						
Sample	Result	Date	Batch	Detect	Average	RPD
ES-Z11-080605A	4.2	5/3/09	57101	Y		
ES-Z11-080605B	4	5/3/09	57101	Y	4.1	5
ES-Z09-080529A	4.7	5/4/09	57431	Y		
ES-Z09-080529B	4.7	5/4/09	57431	Y	4.7	0
ES-Z12-080606A	4.6	5/4/09	57431	Y		
ES-Z12-080606B	4.7	5/4/09	57431	Y	4.65	2
ES-Z05-080519A	4.2	5/6/09	57448	Y		
ES-Z05-080519B	4	5/6/09	57448	Y	4.1	5
ES-Z06-080520A	4.1	5/6/09	57448	Y		
ES-Z06-080520B	4	5/6/09	57448	Y	4.05	2
ES-Z07-080522A	4.1	5/27/09	57791	Y		
ES-Z07-080522B	4	5/27/09	57791	Y	4.05	2
ES-Z13-080610A	4	5/28/09	57849	Y		
ES-Z13-080610B	3.7	5/28/09	57849	Y	3.85	8
ES-Z10-080602A	3.9	6/5/09	58138	Y		
ES-Z10-080602B	3.9	6/5/09	58138	Y	3.9	0
ES-Z08-080527A	4.2	6/11/09	58214	Y		
ES-Z08-080527B	4.2	6/11/09	58214	Y	4.2	0
ES-Z14-080611A	5	6/22/09	58564	Y		
ES-Z14-080611B	4.8	6/22/09	58564	Y	4.9	4
ES-Z06-080520C	4.1	6/30/09	58730	Y		
ES-Z06-080520D	4.1	6/30/09	58730	Y	4.1	0
ES-Z05-080519C	3.8	7/8/09	59166	Y		
ES-Z05-080519D	4	7/8/09	59166	Y	3.9	5
ES-Z19-080624A	4.3	7/13/09	59383	Y		
ES-Z19-080624B	4.4	7/13/09	59383	Y	4.35	2
WS-Z17-080618A	4.4	7/13/09	59383	Y		
WS-Z17-080618B	4.4	7/13/09	59383	Y	4.4	0
WS-Z15-080613A	4.3	7/24/09	59622	Y		
WS-Z15-080613B	4.3	7/24/09	59622	Y	4.3	0
WS-Z18-080620A	4.3	7/24/09	59622	Y		
WS-Z18-080620B	4.2	7/24/09	59622	Y	4.25	2
WS-Z16-080617A	4	7/30/09	59891	Y		
WS-Z16-080617B	4.1	7/30/09	59891	Y	4.05	2

Analysis of EQIS CRMs	
Mean	4.2265
Standard Error	0.0514
Median	4.2
Standard Deviation	0.2998
Sample Variance	0.0899
Kurtosis	0.2687
Skewness	0.7824
Range	1.3
Minimum	3.7
Maximum	5
Sum	143.7
Count	34
Largest(2)	4.8
Smallest(2)	3.8

RPD of EQIS CRMs	
Mean	2.41
Standard Error	
Median	2.35
Standard Deviation	2.32
Sample Variance	5.39
Kurtosis	0.03
Skewness	0.72
Range	7.79
Minimum	0.00
Maximum	7.79
Sum	40.97
Count	17
Largest(2)	5.13
Smallest(2)	0.00

Table Be-6: Beryllium MS and LCS

Matrix Spike Recovery %		Batch Order	LCS Recovery %		Batch Order
102	7160081	1	94	49188	2
89	7160081	1	100	49191	3
91	49188	2	86	49538	4
93	49191	3	87	49540	5
80	49538	4	96	54626-627	6
79	49540	5	95	54821-822	7
92	54626-627	6	96	54891-892	8
91	54821-822	7	97	54915-916	9
85	54891-892	8	96	57147	10
81	54915-916	9	94	57223	11
84	57147	10	97	57543	12
92	57223	11	88	57792	13
78	57543	12	83	57847	14
72	57792	13	82	58135	15
72	57847	14	109	58212	16
62	58135	15	100	58565	17
105	58212	16	91	58728	18
87	58565	17	96	59163	19
81	58728	18	96	59163	19
82	59163	19	90	59381	20
81	59381	20	92	59621	21
84	59621	21	91	59757	22
84	59757	22	92	59889	23
79	59889	23	96	60088	24
89	60088	24	83	60439	25

Average MS Recovery = 85 % Average LCS Recovery = 93 %
Minimum MS Recovery = 62 % Minimum LCS Recovery = 82 %

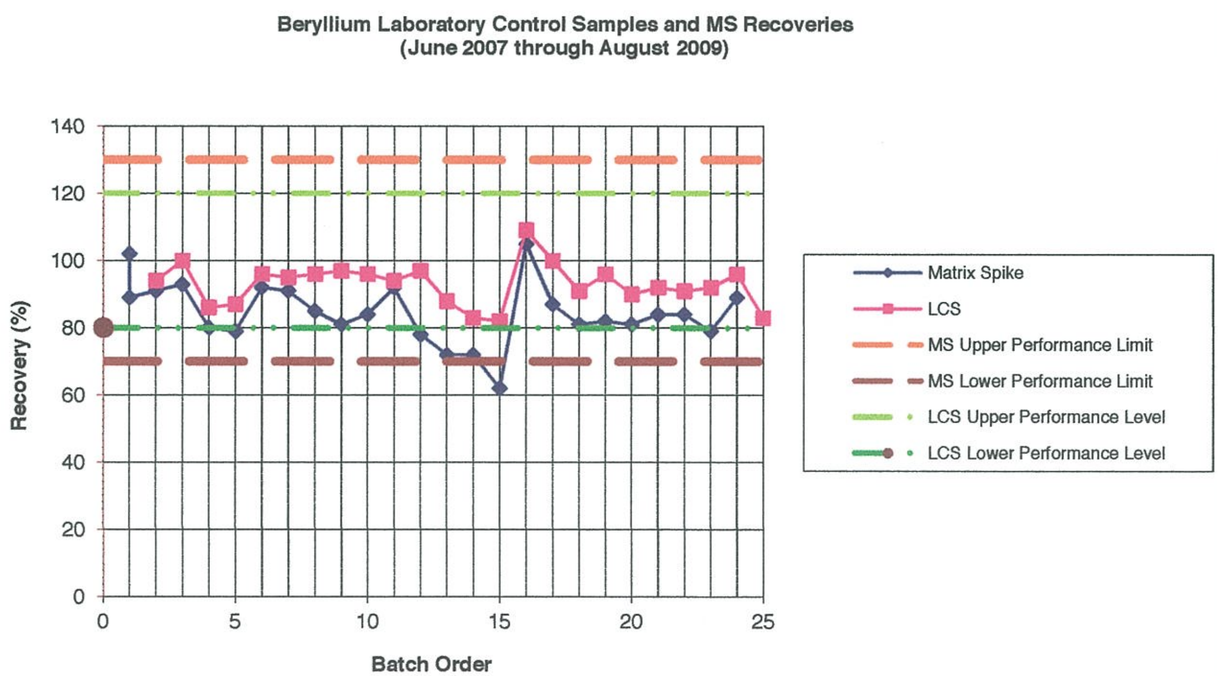
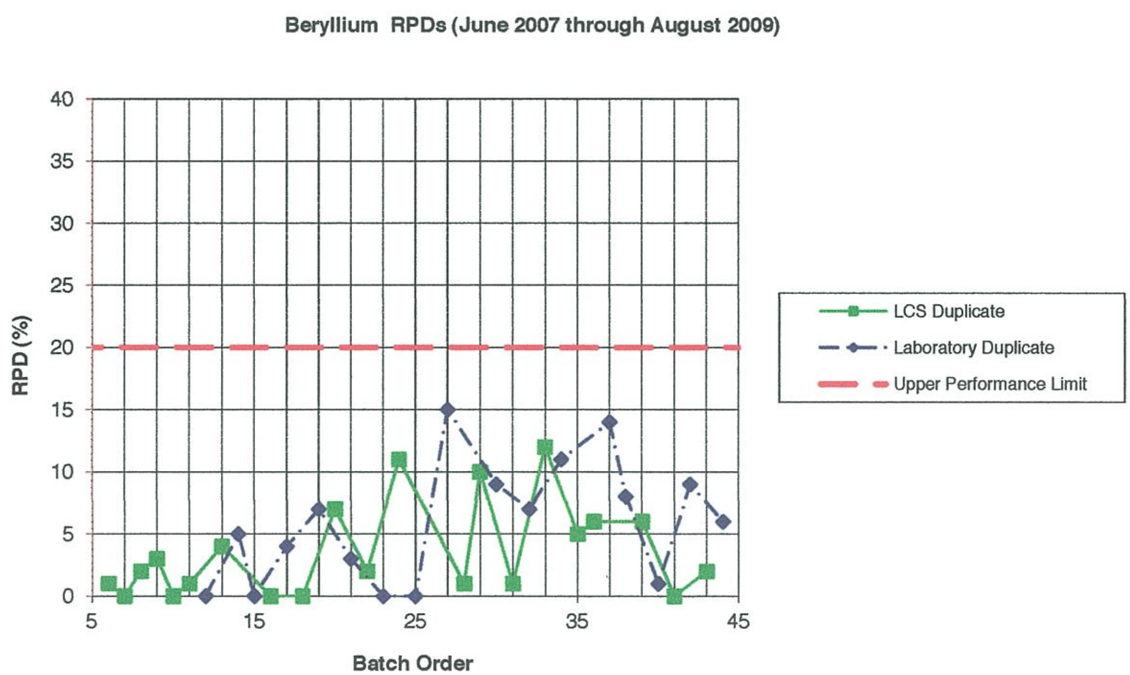
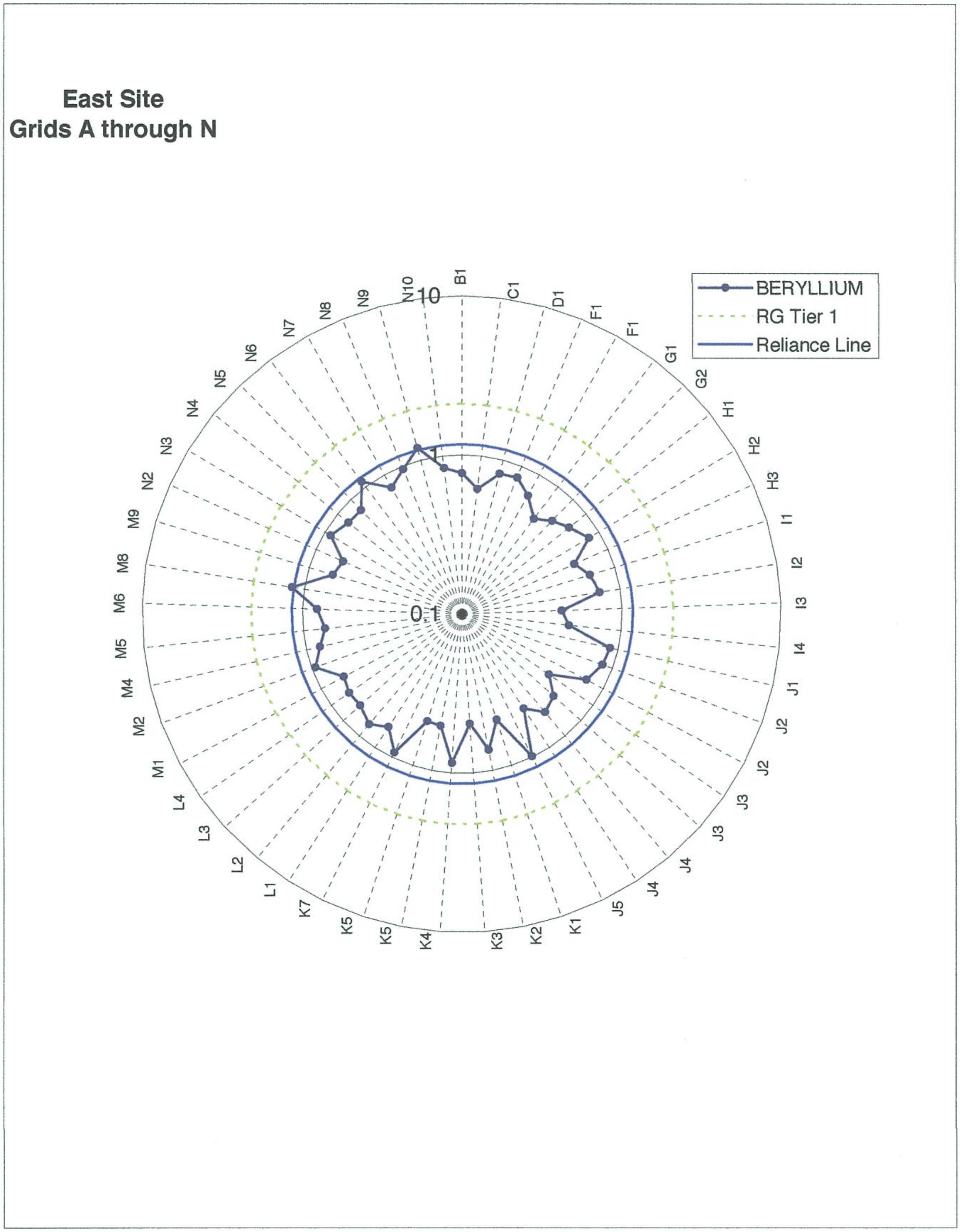


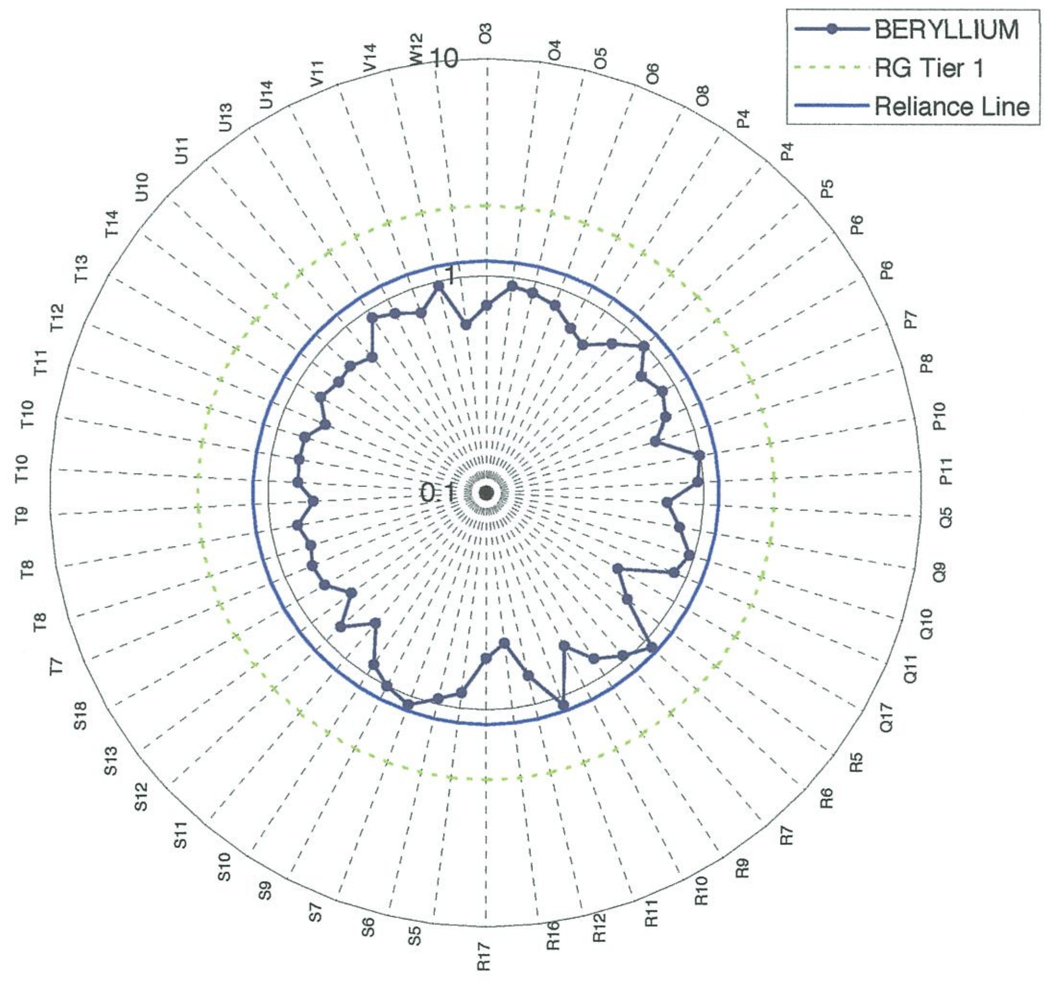
Table Be-7: Beryllium- Laboratory Duplicates and MSDs					
Laboratory Duplicate RPD	Batch	Order	LCS Duplicate RPD	Batch	Order
0	57101	12	1	54626-627	6
5	57225	14	0	54821-822	7
0	57431	15	2	54891-892	8
4	57448	17	3	54915-916	9
7	57791	19	0	57101	10
3	57849	21	1	57225	11
0	58138	23	4	57431	13
0	58214	25	0	57448	16
15	58564	27	0	57791	18
9	58730	30	7	57849	20
7	59166	32	2	58138	22
11	59383	34	11	58214	24
14	59622	37	1	58564	28
8	59759	38	1	59166	31
1	59891	40	12	59383	33
9	60090	42	5	59622	35
6	60441	44	6	59759	36
			6	59891	39
			0	60090	41
			2	60441	43

Average Duplicate RPD = 6 % Average LCS RPD = 3 %
Maximum Duplicate RPD = 15 % Maximum LCS RPD = 12 %

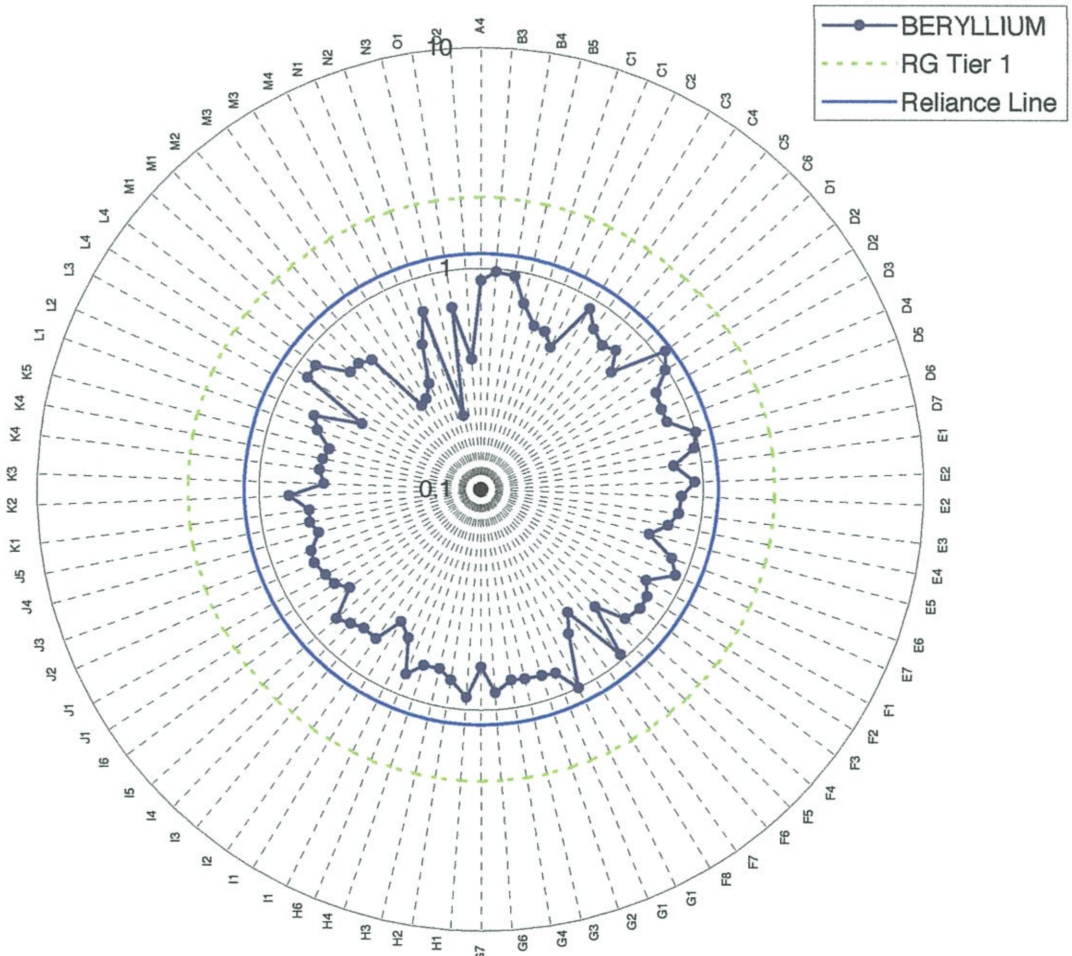



East Site
Grids A through N
BERYLLIUM
RG Tier 1
Reliance Line
10
1
0.1
B1
C1
D1
F1
F1
G1
G2
H1
H2
H3
I1
I2
I3
I4
J1
J2
J2
J3
J3
J4
J4
J5
K1
K2
K3
K4
K5
K5
K7
L1
L2
L3
L4
M1
M2
M4
M5
M6
M8
M9
N2
N3
N4
N5
N6
N7
N8
N9
N10

East Site
Grids O through W



West Site


BERYLLIUM
RG Tier 1
Reliance Line
10
1
0.1
A4
B3
B4
B5
C1
C1
C2
C3
C4
C5
C6
D1
D2
D2
D3
D4
D5
D6
D7
E1
E2
E2
E3
E4
E5
E6
E7
F1
F2
F3
F4
F5
F6
F7
F8
G1
G1
G2
G3
G4
G6
G7
H1
H2
H3
H4
H6
I1
I1
I2
I3
I4
I5
I6
J1
J1
J2
J3
J4
J5
K1
K2
K3
K4
K4
K5
L1
L2
L3
L4
L4
M1
M1
M2
M3
M3
M4
N1
N2
N3
O1
O2

BERYLLIUM CVS Results from 09/11/09 database								
Site	quarter_acre_grid	sample_location	chemical_name	result_value	analysis_date	batch_id	detect_flag	sample_name
East	B1	ES-B01-080623	BERYLLIUM	0.77	05/03/09	57101	Y	ES-B01-080623
East	C1	ES-C01-080624	BERYLLIUM	0.62	05/03/09	57101	Y	ES-C01-080624
East	D1	ES-D01-080624	BERYLLIUM	0.82	06/05/09	58138	Y	ES-D01-080624
East	F1	ES-F01-080529	BERYLLIUM	0.84	05/04/09	57431	Y	DUP-17
East	F1	ES-F01-080529	BERYLLIUM	0.71	05/06/09	57448	Y	ES-F01-080529
East	G1	ES-G01-080529	BERYLLIUM	0.56	05/06/09	57448	Y	ES-G01-080529
East	G2	ES-G02-080605	BERYLLIUM	0.65	05/06/09	57448	Y	ES-G02-080605
East	H1	ES-H01-080528	BERYLLIUM	0.73	05/06/09	57448	Y	ES-H01-080528
East	H2	ES-H02-080515	BERYLLIUM	0.85	05/06/09	57448	Y	ES-H02-080515
East	H3	ES-H03-080605	BERYLLIUM	0.59	05/27/09	57791	Y	ES-H03-080605
East	I1	ES-I01-080529	BERYLLIUM	0.69	05/27/09	57791	Y	ES-I01-080529
East	I2	ES-I02-080514	BERYLLIUM	0.74	05/27/09	57791	Y	ES-I02-080514
East	I3	ES-I03-080513	BERYLLIUM	0.42	05/27/09	57791	Y	ES-I03-080513
East	I4	ES-I04-080602	BERYLLIUM	0.47	05/27/09	57791	Y	ES-I04-080602
East	J1	ES-J01-080529	BERYLLIUM	0.89	05/27/09	57791	Y	ES-J01-080529
East	J2	ES-J02-080527	BERYLLIUM	0.86	05/06/09	57448	Y	DUP-15
East	J2	ES-J02-080527	BERYLLIUM	0.76	05/27/09	57791	Y	ES-J02-080527
East	J3	ES-J03-080513	BERYLLIUM	0.46	05/03/09	57101	Y	DUP-11
East	J3	ES-J03-080513	BERYLLIUM	0.59	06/22/09	58564	Y	ES-J03-080513
East	J4	ES-J04-080530	BERYLLIUM	0.64	05/06/09	57448	Y	DUP-18
East	J4	ES-J04-080530	BERYLLIUM	0.51	05/27/09	57791	Y	ES-J04-080530
East	J5	ES-J05-080602	BERYLLIUM	0.99	05/27/09	57791	Y	ES-J05-080602
East	K1	ES-K01-080602	BERYLLIUM	0.5	05/27/09	57791	Y	ES-K01-080602
East	K2	ES-K02-080602	BERYLLIUM	0.74	05/06/09	57448	Y	ES-K02-080602
East	K3	ES-K03-080514	BERYLLIUM	0.49	05/27/09	57791	Y	ES-K03-080514
East	K4	ES-K04-080527	BERYLLIUM	0.87	05/28/09	57849	Y	ES-K04-080527
East	K5	ES-K05-080605	BERYLLIUM	0.51	05/28/09	57849	Y	ES-K05-080605
East	K5	ES-K05-080605	BERYLLIUM	0.52	05/28/09	57849	Y	DUP-19
East	K7	ES-K07-080611	BERYLLIUM	0.93	05/04/09	57431	Y	ES-K07-080611
East	L1	ES-L01-080625	BERYLLIUM	0.7	05/28/09	57849	Y	ES-L01-080625
East	L2	ES-L02-080625	BERYLLIUM	0.8	05/28/09	57849	Y	ES-L02-080625
East	L3	ES-L03-080604	BERYLLIUM	0.72	05/28/09	57849	Y	ES-L03-080604
East	L4	ES-L04-080604	BERYLLIUM	0.73	06/22/09	58564	Y	ES-L04-080604
East	M1	ES-M01-080527	BERYLLIUM	0.69	05/28/09	57849	Y	ES-M01-080527
East	M2	ES-M02-080519	BERYLLIUM	0.95	05/28/09	57849	Y	ES-M02-080519
East	M4	ES-M04-080515	BERYLLIUM	0.82	05/28/09	57849	Y	ES-M04-080515
East	M5	ES-M05-080527	BERYLLIUM	0.73	05/28/09	57849	Y	ES-M05-080527
East	M6	ES-M06-080520	BERYLLIUM	0.81	05/28/09	57849	Y	ES-M06-080520
East	M8	ES-M08-080610	BERYLLIUM	1.2	05/04/09	57431	Y	ES-M08-080610
East	M9	ES-M09-080611	BERYLLIUM	0.7	05/04/09	57431	Y	ES-M09-080611
East	N2	ES-N02-080528	BERYLLIUM	0.65	05/28/09	57849	Y	ES-N02-080528

BERYLLIUM CVS Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch_id	detect _flag	sample_name
East	N3	ES-N03-080520	BERYLLIUM	0.91	05/28/09	57849	Y	ES-N03-080520
East	N4	ES-N04-080519	BERYLLIUM	0.82	05/28/09	57849	Y	ES-N04-080519
East	N5	ES-N05-080519	BERYLLIUM	0.81	05/28/09	57849	Y	ES-N05-080519
East	N6	ES-N06-080527	BERYLLIUM	1.1	06/05/09	58138	Y	ES-N06-080527
East	N7	ES-N07-080530	BERYLLIUM	0.81	06/05/09	58138	Y	ES-N07-080530
East	N8	ES-N08-080610	BERYLLIUM	0.96	05/04/09	57431	Y	ES-N08-080610
East	N9	ES-N09-080610	BERYLLIUM	1.2	05/04/09	57431	Y	ES-N09-080610
East	N10	ES-N10-080610	BERYLLIUM	0.84	05/04/09	57431	Y	ES-N10-080610
East	O3	ES-O03-080528	BERYLLIUM	0.73	06/05/09	58138	Y	ES-O03-080528
East	O4	ES-O04-080515	BERYLLIUM	0.91	06/05/09	58138	Y	ES-O04-080515
East	O5	ES-O05-080520	BERYLLIUM	0.88	06/05/09	58138	Y	ES-O05-080520
East	O6	ES-O06-080529	BERYLLIUM	0.83	06/05/09	58138	Y	ES-O06-080529
East	O8	ES-O08-080530	BERYLLIUM	0.71	07/24/09	59759	Y	ES-O08-080530
East	P4	ES-P04-080528	BERYLLIUM	0.65	05/27/09	57791	Y	DUP-16
East	P4	ES-P04-080528	BERYLLIUM	0.79	06/05/09	58138	Y	ES-P04-080528
East	P5	ES-P05-080513	BERYLLIUM	0.98	06/05/09	58138	Y	ES-P05-080513
East	P6	ES-P06-080515	BERYLLIUM	0.78	05/27/09	57791	Y	DUP-12
East	P6	ES-P06-080515	BERYLLIUM	0.86	06/05/09	58138	Y	ES-P06-080515
East	P7	ES-P07-080519	BERYLLIUM	0.79	05/28/09	57849	Y	ES-P07-080519
East	P8	ES-P08-080530	BERYLLIUM	0.65	06/05/09	58138	Y	ES-P08-080530
East	P10	ES-P10-080606	BERYLLIUM	0.99	05/04/09	57431	Y	ES-P10-080606
East	P11	ES-P11-080606	BERYLLIUM	0.94	05/04/09	57431	Y	ES-P11-080606
East	Q5	ES-Q05-080520	BERYLLIUM	0.68	06/05/09	58138	Y	ES-Q05-080520
East	Q9	ES-Q09-080612	BERYLLIUM	0.8	06/05/09	58138	Y	ES-Q09-080612
East	Q10	ES-Q10-080606	BERYLLIUM	0.95	05/06/09	57448	Y	ES-Q10-080606
East	Q11	ES-Q11-080606	BERYLLIUM	0.87	05/06/09	57448	Y	ES-Q11-080606
East	Q17	ES-Q17-080609	BERYLLIUM	0.5	05/03/09	57101	Y	ES-Q17-080609
East	R5	ES-R05-080521	BERYLLIUM	0.65	06/05/09	58138	Y	ES-R05-080521
East	R6	ES-R06-080521	BERYLLIUM	1.1	06/22/09	58564	Y	ES-R06-080521
East	R7	ES-R07-080521	BERYLLIUM	0.95	06/11/09	58214	Y	ES-R07-080521
East	R9	ES-R09-080520	BERYLLIUM	0.81	06/11/09	58214	Y	ES-R09-080520
East	R10	ES-R10-080602	BERYLLIUM	0.62	06/11/09	58214	Y	ES-R10-080602
East	R11	ES-R11-080605	BERYLLIUM	1.1	05/06/09	57448	Y	ES-R11-080605
East	R12	ES-R12-080611	BERYLLIUM	0.73	05/06/09	57448	Y	ES-R12-080611
East	R16	ES-R16-080605	BERYLLIUM	0.5	05/03/09	57101	Y	ES-R16-080605
East	R17	ES-R17-080606	BERYLLIUM	0.58	05/03/09	57101	Y	ES-R17-080606
East	S5	ES-S05-080521	BERYLLIUM	0.85	06/11/09	58214	Y	ES-S05-080521
East	S6	ES-S06-080521	BERYLLIUM	0.94	06/11/09	58214	Y	ES-S06-080521
East	S7	ES-S07-080521	BERYLLIUM	1.1	06/11/09	58214	Y	ES-S07-080521
East	S9	ES-S09-080522	BERYLLIUM	1	06/11/09	58214	Y	ES-S09-080522
East	S10	ES-S10-080523	BERYLLIUM	0.88	06/11/09	58214	Y	ES-S10-080523

BERYLLIUM CVS Results from 09/11/09 database								
Site	quarter_acre _grid	sample_location	chemical_name	result_value	analysis _date	batch_id	detect _flag	sample_name
East	S11	ES-S11-080528	BERYLLIUM	0.61	06/11/09	58214	Y	ES-S11-080528
East	S12	ES-S12-080609	BERYLLIUM	0.81	05/03/09	57101	Y	ES-S12-080609
East	S13	ES-S13-080610	BERYLLIUM	0.59	05/03/09	57101	Y	ES-S13-080610
East	S18	ES-S18-080606	BERYLLIUM	0.71	05/03/09	57101	Y	ES-S18-080606
East	T7	ES-T07-080612	BERYLLIUM	0.73	06/11/09	58214	Y	ES-T07-080612
East	T8	ES-T08-080522	BERYLLIUM	0.69	06/05/09	58138	Y	DUP-13
East	T8	ES-T08-080522	BERYLLIUM	0.75	06/11/09	58214	Y	ES-T08-080522
East	T9	ES-T09-080522	BERYLLIUM	0.62	06/11/09	58214	Y	ES-T09-080522
East	T10	ES-T10-080523	BERYLLIUM	0.74	06/11/09	58214	Y	ES-T10-080523
East	T10	ES-T10-080523	BERYLLIUM	0.73	06/11/09	58214	Y	DUP-14
East	T11	ES-T11-080530	BERYLLIUM	0.74	06/11/09	58214	Y	ES-T11-080530
East	T12	ES-T12-080609	BERYLLIUM	0.63	05/03/09	57101	Y	ES-T12-080609
East	T13	ES-T13-080609	BERYLLIUM	0.75	05/03/09	57101	Y	ES-T13-080609
East	T14	ES-T14-080610	BERYLLIUM	0.7	05/03/09	57101	Y	ES-T14-080610
East	U10	ES-U10-080523	BERYLLIUM	0.71	06/11/09	58214	Y	ES-U10-080523
East	U11	ES-U11-080602	BERYLLIUM	0.65	06/22/09	58564	Y	ES-U11-080602
East	U13	ES-U13-080610	BERYLLIUM	0.91	05/04/09	57431	Y	ES-U13-080610
East	U14	ES-U14-080610	BERYLLIUM	0.84	05/04/09	57431	Y	ES-U14-080610
East	V11	ES-V11-080529	BERYLLIUM	0.76	06/22/09	58564	Y	ES-V11-080529
East	V14	ES-V14-080605	BERYLLIUM	0.95	05/04/09	57431	Y	ES-V14-080605
East	W12	ES-W12-080527	BERYLLIUM	0.6	06/22/09	58564	Y	ES-W12-080527
West	A4	WS-A04-080626	BARIUM	79.2	07/13/09	59383	Y	WS-A04-080626
West	B3	WS-B03-080502	BARIUM	97.3	07/13/09	59383	Y	WS-B03-080502
West	B4	WS-B04-080626	BARIUM	92.1	07/13/09	59383	Y	WS-B04-080626
West	B5	WS-B05-080626	BARIUM	89.1	07/24/09	59759	Y	WS-B05-080626
West	C1	WS-C01-080501	BARIUM	80.3	06/22/09	58564	Y	WS-C01-080501
West	C1	WS-C01-080501	BARIUM	77.6	06/22/09	58564	Y	DUP-3
West	C2	WS-C02-080428	BARIUM	70.3	07/24/09	59622	Y	WS-C02-080428
West	C3	WS-C03-080620	BARIUM	104	07/24/09	59622	Y	WS-C03-080620
West	C4	WS-C04-080623	BARIUM	84.9	07/24/09	59622	Y	WS-C04-080623
West	C5	WS-C05-080620	BARIUM	92.3	07/24/09	59759	Y	WS-C05-080620
West	C6	WS-C06-080624	BARIUM	80.4	07/24/09	59759	Y	WS-C06-080624
West	D1	WS-D01-080430	BARIUM	81.8	06/22/09	58564	Y	WS-D01-080430
West	D2	WS-D02-080429	BARIUM	110	07/13/09	59383	Y	DUP-2
West	D2	WS-D02-080429	BARIUM	108	07/24/09	59622	Y	WS-D02-080429
West	D3	WS-D03-080620	BARIUM	91.1	07/24/09	59622	Y	WS-D03-080620
West	D4	WS-D04-080623	BARIUM	83.2	08/17/09	60441	Y	WS-D04-080623
West	D5	WS-D05-080620	BARIUM	81	07/24/09	59759	Y	WS-D05-080620
West	D6	WS-D06-080619	BARIUM	116	07/24/09	59759	Y	WS-D06-080619
West	D7	WS-D07-080619	BARIUM	100	07/24/09	59759	Y	WS-D07-080619
West	E1	WS-E01-080430	BARIUM	75.5	06/22/09	58564	Y	WS-E01-080430

BERYLLIUM CVS Results from 09/11/09 database								
Site	quarter_acre_grid	sample_location	chemical_name	result_value	analysis_date	batch_id	detect_flag	sample_name
West	E2	WS-E02-080428	BARIUM	87.7	07/13/09	59383	Y	DUP-1
West	E2	WS-E02-080428	BARIUM	91.7	07/24/09	59622	Y	WS-E02-080428
West	E3	WS-E03-080619	BARIUM	88.9	07/24/09	59622	Y	WS-E03-080619
West	E4	WS-E04-080613	BARIUM	85.5	07/24/09	59759	Y	WS-E04-080613
West	E5	WS-E05-080613	BARIUM	68.4	07/24/09	59759	Y	WS-E05-080613
West	E6	WS-E06-080613	BARIUM	99.1	07/24/09	59759	Y	WS-E06-080613
West	E7	WS-E07-080613	BARIUM	91.7	07/24/09	59759	Y	WS-E07-080613
West	F1	WS-F01-080429	BARIUM	78.8	06/22/09	58564	Y	WS-F01-080429
West	F2	WS-F02-080429	BARIUM	107	07/24/09	59622	Y	WS-F02-080429
West	F3	WS-F03-080619	BARIUM	102	07/24/09	59622	Y	WS-F03-080619
West	F4	WS-F04-080616	BARIUM	85.6	07/30/09	59891	Y	WS-F04-080616
West	F5	WS-F05-080612	BARIUM	65	08/18/09	60441	Y	WS-F05-080612
West	F6	WS-F06-080612	BARIUM	76.4	07/30/09	59891	Y	WS-F06-080612
West	F7	WS-F07-080617	BARIUM	70.5	06/30/09	58730	Y	WS-F07-080617
West	F8	WS-F08-080618	BARIUM	83.2	06/30/09	58730	Y	WS-F08-080618
West	G1	WS-G01-080501	BARIUM	89.1	06/22/09	58564	Y	DUP-4
West	G1	WS-G01-080501	BARIUM	89.4	06/30/09	58730	Y	WS-G01-080501
West	G2	WS-G02-080618	BARIUM	92.2	07/24/09	59622	Y	WS-G02-080618
West	G3	WS-G03-080619	BARIUM	84.5	07/24/09	59622	Y	WS-G03-080619
West	G4	WS-G04-080616	BARIUM	77.1	07/30/09	59891	Y	WS-G04-080616
West	G6	WS-G06-080616	BARIUM	75.4	07/30/09	59891	Y	WS-G06-080616
West	G7	WS-G07-080617	BARIUM	110	06/30/09	58730	Y	WS-G07-080617
West	H1	WS-H01-080501	BARIUM	102	06/30/09	58730	Y	WS-H01-080501
West	H2	WS-H02-080618	BARIUM	91.1	07/24/09	59622	Y	WS-H02-080618
West	H3	WS-H03-080619	BARIUM	63.9	07/30/09	59891	Y	WS-H03-080619
West	H4	WS-H04-080616	BARIUM	72.4	07/30/09	59891	Y	WS-H04-080616
West	H6	WS-H06-080617	BARIUM	96	06/30/09	58730	Y	WS-H06-080617
West	I1	WS-I01-080501	BARIUM	81.6	06/30/09	58730	Y	WS-I01-080501
West	I1	WS-I01-080501	BARIUM	76.4	06/30/09	58730	Y	DUP-5
West	I2	WS-I02-080618	BARIUM	81.3	07/24/09	59759	Y	WS-I02-080618
West	I3	WS-I03-080618	BARIUM	71.9	07/30/09	59891	Y	WS-I03-080618
West	I4	WS-I04-080617	BARIUM	72.6	07/30/09	59891	Y	WS-I04-080617
West	I5	WS-I05-080617	BARIUM	84	06/30/09	58730	Y	WS-I05-080617
West	I6	WS-I06-080617	BARIUM	102	06/30/09	58730	Y	WS-I06-080617
West	J1	WS-J01-080505	BARIUM	100	06/30/09	58730	Y	DUP-6
West	J1	WS-J01-080505	BARIUM	101	06/30/09	58730	Y	WS-J01-080505
West	J2	WS-J02-080624	BARIUM	85.9	06/30/09	58730	Y	WS-J02-080624
West	J3	WS-J03-080620	BARIUM	81.9	07/08/09	59166	Y	WS-J03-080620
West	J4	WS-J04-080617	BARIUM	84.4	07/08/09	59166	Y	WS-J04-080617
West	J5	WS-J05-080618	BARIUM	82.9	07/08/09	59166	Y	WS-J05-080618
West	K1	WS-K01-080505	BARIUM	91.2	07/08/09	59166	Y	WS-K01-080505