1215817

WCH-489
Rev. 2

[0092150]

River Corridor Closure Contract

100-K Remedial Investigation/Feasibility Study Data Quality Assessment Report

June 2012

RECEIVED
AUG 02 2012
EDMC

For Public Release

Washington Closure Hanford

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Assistant Manager for River Corridor

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

WCH-489
Rev. 2

STANDARD APPROVAL PAGE

Title: 100-K Remedial Investigation/Feasibility Study Data Quality Assessment Report

DOCUMENT CONTROL 6/11/12 a 3

Author Name: R. P. Wells

Approval: R. W. Ovink, Environmental Protection

Signature

6-11-2012
Date

The approval signature on this page indicates that this document has been authorized for information release to the public through appropriate channels. No other forms or signatures are required to document this information release.

WCH-489
Rev. 2

River Corridor
Closure Contract

100-K Remedial Investigation/ Feasibility Study Data Quality Assessment Report

June 2012

Author:
R. P. Wells

For Public Release

Washington Closure Hanford

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Assistant Manager for River Corridor

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

2.0 LABORATORY QUALITY CONTROL PARAMETERS DISCUSSION 2-1

2.1 HOLDING TIMES 2-8

2.2 DETECTION LIMITS 2-10

2.3 METHOD BLANK 2-10

2.4 FIELD EQUIPMENT BLANK RESULTS 2-11

2.5 FIELD TRIP BLANK RESULTS 2-11

2.6 MATRIX SPIKE RECOVERIES 2-11

2.7 LABORATORY CONTROL SAMPLE 2-12

2.8 MATRIX SPIKE DUPLICATES 2-12

2.9 LABORATORY DUPLICATE RESULTS 2-12

2.10 FIELD DUPLICATE RESULTS 2-12

3.0 DATA USABILITY 3-1

4.0 REFERENCES 4-1

APPENDIX

A RELATIVE PERCENT DIFFERENCE CALCULATION ..... A-i

TABLES

1. Analytical Laboratories. 1-1
2. Laboratory Analytical Methods 1-1
3. 100-K Sample Delivery Groups Reviewed 2-1
4. Holding Times 2-8
5. Field Duplicate/Split Quality Control Review 2-13
6. 100-K Review Qualifiers for Metals and pH 3-2
7. 100-K Review Qualifiers for Anion Analysis 3-14
8. 100-K Data Qualifiers for Volatile Organic Analysis 3-15
9. 100-K Data Qualifiers for Total Petroleum Hydrocarbons and Polynuclear Aromatic Hydrocarbons. 3-17
10. 100-K Data Qualifiers for Special Extraction Analysis 3-18
11. 100-K Data Qualifiers for Radionuclide Analysis 3-27

1.0 INTRODUCTION

This Data Quality Assessment (DQA) has been prepared to support the vadose zone characterization component of the 100-K remedial investigation and feasibility study (RI/FS). The DQA was performed in accordance with EPA/240/B-06/002, *Data Quality Assessment: A Reviewer's Guide*, and EPA/240/B-06/003, *Data Quality Assessment: Statistical Methods for Practitioners*. The contents of this DQA specifically address laboratory quality control (QC) results. The laboratory QC results were evaluated against the requirements and guidelines provided in DOE/RL-2009-41, *Sampling and Analysis Plan for the 100-K Decision Unit Remedial Investigation/Feasibility Study* (SAP) and the associated change notice (TPA-CN-357).

Table 1 presents information on the analytical laboratories whose work was reviewed. Table 2 presents a summary of the analytical methods.

Table 1. Analytical Laboratories.

Name	Address
Lionville Laboratory, Inc.	208 Welsh Pond Road, Exton, Pennsylvania 19341
Eberline Analytical Corporation/Eberline Services	2030 Wright Avenue, Richmond, California 94804
Test America Laboratories	2800 George Washington Way, Richland, Washington 99354
	13715 Rider Trail North, Earth City, Missouri 63045

Table 2. Laboratory Analytical Methods. (2 Pages)

Parameter	Analytical Method
ICP Metals	EPA Method 6010 [a] EPA Method 6020
Mercury	EPA Method 7471B
Hexavalent chromium (Cr-VI)	EPA Method 7196A
Anions	EPA Method 300.0
Nitrate/nitrite	EPA Method 353.1 EPA Method 353.2
Volatile organic compounds	EPA Method 8260B
pH	EPA Method 9045 (soil) EPA Method 9040 (water)
Polynuclear aromatic hydrocarbons	EPA Method 8310
Total petroleum hydrocarbons (WTPH-D)	EPA Method 8015M
Gamma-emitting radioisotopes	Gamma energy analysis
Carbon-14	LSC - C-14

Table 2. Laboratory Analytical Methods. (2 Pages)

Parameter	Analytical Method
Tritium	LSC - tritium
Total radiostrontium	Gas-flow proportional counting
Nickel-63	LSC - Ni-63
Technetium-99	LSC - Tc-99
Plutonium-238, -239/240	Alpha energy analysis

[a] Analysis was performed for the expanded list of ICP metals including aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium (total), cobalt, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, phosphorous, potassium, selenium, silicon, silver, sodium, strontium, thallium, tin, vanadium, and zinc.

EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
LSC = liquid scintillation counting
WTPH-D= Washington total petroleum hydrocarbons-diesel range

2.0 LABORATORY QUALITY CONTROL PARAMETERS DISCUSSION

A total of 176 sample deliver groups (SDGs) were reviewed with a combined 569 field samples among them.

Each SDG that was assessed contained at least one, and often several, different analytical methods that were assessed as part of the DQA. Table 3 presents the reviewed SDGs, sorted by sample authorization forms. Also shown in Table 3 are the laboratory analyses that were performed for each SDG.

Data assessment was not conducted for certain wet chemistry parameters (e.g., total solids and percent moisture) or physical property parameters (e.g., particle size distribution, percent moisture, porosity, bulk density, and saturated hydraulic conductivity), but these analyses are listed in Table 3 for completeness.

The QC parameters evaluated in each SDG included the following as appropriate and applicable for each analytical method:

- Holding time
- Method detection limits
- Method blank results
- Field equipment blank results
- Field trip blank results
- Matrix spikes/matrix spike duplicates
- Laboratory control sample (LCS) results
- Laboratory duplicate results
- Field duplicate results
- Field split results.

Table 3. 100-K Sample Delivery Groups Reviewed. (7 Pages)

SDG Number	Number of Samples in SDG	Analyses Performed										
		Cr-VI	Radionuclides	Metals	pH	Physical Properties	Special Extraction	TPH	PAH	Anions	Nitrate/Nitrite	VOA
Sample Authorization Form RC-139 (Soil)												
J00799	1	X	X	X								
K2056	2					X						
K2060	8	X	X	X	X							
K2061	8	X	X	X								
K2078	6					X						

Table 3. 100-K Sample Delivery Groups Reviewed. (7 Pages)

SDG Number	Number of Samples in SDG	Analyses Performed										
		Cr-VI	Radionuclides	Metals	pH	Physical Properties	Special Extraction	TPH	PAH	Anions	Nitrate/Nitrite	VOA
K2109	5	X	X	X	X	X						
K2111	5	X	X	X	X							
K2112	2	X	X	X	X	X						
K2113	4					X						
K2122	8	X	X	X	X	X						
K2147	1		X									
K2151	1	X		X	X							
K2155	13		X									
K2156	11		X									
K2158	5	X		X	X	X						
K2159	11	X		X	X	X						
K2161	2	X		X	X	X						
K2164	12	X		X	X	X						
K2166	2		X									
K2169	2	X		X	X							
K2172	2	X		X	X							
K2178	1		X									
K2185	1	X		X	X							
K2200	1		X									
K2207	2		X									
K2223	3	X		X	X							
K2244	1		X									
K2261	2					X						
K2268	1	X		X	X							
K2294	1		X									
K2303	2		X									
K2308	2		X									
K2310	2		X									
K2314	1	X		X	X							
K2319	4	X		X	X	X						
K2326	2	X		X	X							

Table 3. 100-K Sample Delivery Groups Reviewed. (7 Pages)

SDG Number	Number of Samples in SDG	Analyses Performed										
		Cr-VI	Radionuclides	Metals	pH	Physical Properties	Special Extraction	TPH	PAH	Anions	Nitrate/Nitrite	VOA
K2330	2	X		X	X							
K2343	4	X	X	X	X	X						
K2346	3	X	X	X	X							
K2403	2	X	X	X	X							
K2474	1		X									
K2484	1		X									
K2507	1	X		X								
K2512	7		X									
K2545	6		X									
K2552	6		X									
K2556	3	X		X	X	X						
K2606	6	X		X	X							
K2611	5						X					
K2619	3	X		X	X	X						
K2623	3						X					
K2651	3	X		X	X							
K2652	5	X		X	X	X						
K2663	1		X									
K2676	3						X					
K2716	8		X				X					
K2727	1	X		X								
K2730	4		X									
K2739	4	X		X	X							
K2744	2	X		X	X							
K2748	3						X					
K2749	4	X		X	X	X						
K2750	1						X					
K2765	5		X									
K2770	1		X									
K2774	2						X					
K2777	6	X		X	X	X		X	X			

Table 3. 100-K Sample Delivery Groups Reviewed. (7 Pages)

SDG Number	Number of Samples in SDG	Analyses Performed										
		Cr-VI	Radionuclides	Metals	pH	Physical Properties	Special Extraction	TPH	PAH	Anions	Nitrate/Nitrite	VOA
K2789	6	X		X	X	X		X	X			
K2790	2						X					
K2803	9		X									
K2811	10	X		X	X	X						
K2816	5						X					
K2817	3						X					
K2839	2						X					
K2841	5	X		X	X							
K2844	2						X					
K2854	4						X					
K2855	1						X					
K2856	4	X		X	X							
K2857	1	X		X	X							
K2868	12		X									
K2870	3		X									
K2874	13		X									
K2878	2		X									
K2881	1		X									
K2892	5	X		X	X							
K2895	1	X		X	X							
K2896	2	X		X	X							
K2897	1	X		X	X							
K2902	1	X		X	X							
K2903	1	X		X	X							
K2910	5	X		X	X							
K2911	3	X		X	X							
K2917	2	X		X	X							
K2929	1	X		X	X							
K2930	1		X									
K2932	4		X									
K2935	6	X		X	X	X						

Table 3. 100-K Sample Delivery Groups Reviewed. (7 Pages)

SDG Number	Number of Samples in SDG	Analyses Performed										
		Cr-VI	Radionuclides	Metals	pH	Physical Properties	Special Extraction	TPH	PAH	Anions	Nitrate/Nitrite	VOA
K2939	3						X					
K2947	2	X		X	X							
K2961	5	X		X	X	X						
K2963	4						X					
K2972	14	X	X	X	X	X						
K2979	1		X									
K2981	1	X		X	X							
K2989	1						X					
K2997	1						X					
K3000	1	X		X	X							
Sample Authorization Form RC-140 (Water)												
J00794	1	X										
J00810	1	X										
J00816	1	X										
J00826	1	X										
J00844	2	X										
J00848	1	X										
J00861	2	X										
J00865	1	X										
J00878	1	X										
J00932	1	X										
J00960	1	X										
J00964	1	X										
J00971	1	X										
J00973	1	X										
J01001	1	X										
J01002	1	X										
K2076	1			X	X							
K2077	1			X								
K2116	1			X	X							
K2134	1			X	X							

Table 3. 100-K Sample Delivery Groups Reviewed. (7 Pages)

SDG Number	Number of Samples in SDG	Analyses Performed										
		Cr-VI	Radionuclides	Metals	pH	Physical Properties	Special Extraction	TPH	PAH	Anions	Nitrate/Nitrite	VOA
K2162	1			X	X							
K2221	1			X	X							
K2313	2			X	X							
K2316	1			X	X							
K2376	1			X	X							
K2378	2			X	X							
K2388	1			X	X							
K2618	1			X	X							
K2863	1			X	X							
K2924	1			X	X							
K2982	1			X	X							
K2983	1			X	X							
K3105	2			X	X							
Sample Authorization Form RC-178 (Soil)												
J00851	1	X	X									
J00853	1											X
J00866	1			X						X	X	
K2203	1		X									
K2209	1		X									
K2212	1	X		X						X	X	
K2225	5											X
K2226	1											X
K2227	2	X			X		X			X	X	
K2229	4		X									
K2242	2		X									
K2245	1		X									
K2248	7	X		X	X	X	X			X	X	
K2249	3											X
K2265	2											X
K2269	4	X		X	X		X			X	X	
K2281	2	X		X			X			X	X	

Table 3. 100-K Sample Delivery Groups Reviewed. (7 Pages)

SDG Number	Number of Samples in SDG	Analyses Performed										
		Cr-VI	Radionuclides	Metals	pH	Physical Properties	Special Extraction	TPH	PAH	Anions	Nitrate/Nitrite	VOA
K2282	1											X
K2283	1	X		X						X	X	
K2296	2		X									
K2304	5		X									
K2311	3											X
K2312	2	X			X		X			X	X	
K2318	1											X
K2323	15	X		X	X		X			X	X	X
K2329	2											X
K2332	1											X
K2333	6		X									
K2334	7		X									
K2340	4		X									
K2350	17	X		X	X	X	X			X	X	X
K2353	19	X		X	X		X			X	X	X
K2365	4											X
K2370	4	X		X	X					X	X	
K2371	4						X					

CR-VI = hexavalent chromium
PAH = polynuclear aromatic hydrocarbons
pH = hydrogen ion concentration
SDG = sample delivery group
TPH = total petroleum hydrocarbons
VOA = volatile organic analysis

Each QC parameter was assessed and noncompliant results were summarized on DQA worksheets. Reviewer qualifications applied to the data were also noted on the worksheets.

Minor and major deficiencies were identified in the data packages. Minor deficiencies noted by the reviewer resulted in a "J" flag being assigned to the laboratory reported result. Major deficiencies resulted in an "R" flag being assigned to the laboratory result. In addition to the data qualifiers that have been assigned by the analytical laboratory, the following data qualifiers were assigned during data assessment:

- UJ – The compound or analyte was analyzed for and detected in the sample. However, due to a minor QA deficiency associated with method blank results, the associated results are labeled as estimated quantitation limits. The data are considered usable for decision-making purposes.

- J – Due to a minor QC deficiency identified during the data assessment, the associated concentration is an estimate. The data are considered usable for decision-making purposes.

- UR – Indicates that the constituent was analyzed for and not detected; however, due to an identified major QA deficiency, the data are not considered usable for decision-making purposes (i.e., rejected).

Due to the large volume of data that were reviewed, it is not possible to discuss in detail each of the qualifiers that were applied to the individual results. The following sections provide a general discussion of the data quality issues identified.

2.1 HOLDING TIMES

Holding times that comply with the established limit are in compliance with the requirement. Holding times between one and two times the limit defined by the method are considered minor deficiencies with all associated sample results qualified as estimated and flagged "J" for detects and "UJ" for nondetects. Holding times greater than two times the limit are considered major deficiencies with all associated detectable sample results qualified as estimates and flagged "J" and all nondetects are rejected and flagged "UR." Table 4 lists the holding times applicable to the analytical methods by matrix.

Table 4. Holding Times. (2 Pages)

Parameter	Method	Soil Holding Time	Water Holding Time
ICP metals	EPA Method 6010B EPA Method 6020	6 months	6 months
Mercury	EPA Method 7471A	28 days	[a]
Hexavalent chromium	EPA Method 7196A	30 days	24 hours
Anions	EPA Method 300.0	28 days/48 hours [b]	[a]
Nitrate/nitrite	EPA Method 353.1 EPA Method 353.2	28 days	[a]
Volatile organic compounds	EPA Method 8260B	14 days	[a]
pH	EPA Method 9045 (soil) EPA Method 9040 (water)	As soon as possible	As soon as possible
Total petroleum hydrocarbons – diesel range organics	EPA Method 8015	14 days/40 days [c]	[a]
Polynuclear aromatic hydrocarbons	EPA Method 8310	14 days/40 days	[a]
Gamma-emitting radioisotopes	Gamma energy analysis	6 months	[a]

Table 4. Holding Times. (2 Pages)

Parameter	Method	Soil Holding Time	Water Holding Time
Carbon-14	LSC – C-14	6 months	[a]
Tritium	LSC – tritium	6 months	[a]
Total radiostrontium	Gas-flow proportional counting	6 months	6 months
Nickel-63	LSC – Ni-63	6 months	[a]
Technetium-99	LSC – Tc-99	6 months	[a]
Plutonium isotopes	Alpha energy analysis	6 months	[a]

[a] Samples did not undergo this particular analysis.
[b] Holding time for anions is 28 days except for nitrate, nitrite, and phosphate for which the holding time is 48 hours.
[c] Holding time is 14 days to extraction, then 40 days to analysis.
EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
LSC = liquid scintillation counter
pH = hydrogen ion concentration

Holding times were met for all metals, volatile organic analyses (VOAs), and radionuclide analyses. Anions with a 48-hour holding time (nitrate, nitrite, and phosphate) frequently exceeded the requirement by more than double, resulting in the qualification of data as "J" if the result is a detectable concentration or "UR" if the result is a nondetect. The delays in analyses were attributed to the delays between sample collection and analysis because of shipping preparation, sample screening for radionuclides, and shipping time. This was a consistent problem with the data that affected all nitrate, nitrite, and phosphate analytical results. The pH analyses were performed as soon as possible by the laboratory, which recognized that there would be a delay between sample collection and analysis because of the same problems experienced for the nitrate, nitrite, and phosphate analyses. Ideally, pH analysis would be performed within 24 hours of sample collection. Because this was never achieved, the pH results for all samples requiring analysis were flagged "J" as estimated quantities.

The hexavalent chromium holding time presented an occasional but significant QC issue in the reviewed data packages. The holding time for hexavalent chromium as defined by the EPA Method 3060A extraction procedure for soils to be analyzed by EPA Method 7196 is 30 days. A significant number of SDGs had holding times greater than 30 days with some having holding times greater than 60 days. Based on established data qualification protocols, the hexavalent chromium (Cr-VI) analyses detected results should be qualified as estimates ("J" flagged) and numerous nondetected results should be rejected ("UR" flagged). Rather than reject the data based on the above criteria, the nondetected results will instead by flagged with an "undetected-estimated value" ("UJ") flag. The technical basis supporting this decision is found in EPA/600/R-05/124, *Sample Holding Time Reevaluation* (EPA 2005). Among other findings reported in this study, a 5% decrease in Cr-VI was estimated to require at least 140 days, regardless of soil type or holding temperature, which is five times longer than the SW-846 prescribed maximum holding time of 30 days.

2.2 DETECTION LIMITS

Estimated quantitation limits (EQLs) for individual analytes and tables for specific methods are defined in Section 2 and Appendix A of the SAP (DOE/RL-2009-42). Reported analytical detection levels for undetected analytes are compared against the EQLs to ensure that laboratory detection levels met the required criteria.

For most analytes, the EQLs were met. However, the EQL was occasionally exceeded for several gamma-emitting radionuclides. The EQL being exceeded was minor in absolute terms, with the minimum detectable activity (MDA) achieved for the analyses being below the action levels provided in the SAP (DOE/RL-2009-42). No qualification of the gamma-emitting radionuclide results is required for exceeding the EQL, and none were applied.

Similarly, the EQLs for iron and zinc were frequently exceeded with the quantitation limits achieved by the laboratory being below the action levels provided in the SAP. For both iron and zinc, the concentrations in the field samples always were at detectable levels; therefore, the fact that the EQLs were exceeded was inconsequential. For field quality assurance samples such as field blanks, the iron and zinc concentrations were frequently below detection; however, this does not affect the overall quality of the data generated for the field samples themselves.

The EQLs for anions were occasionally exceeded; however, as with the gamma-emitting radionuclides and the metals, the quantitation limits achieved by the laboratory were below the action levels provided in the SAP. Again, no qualification of the data is required.

2.3 METHOD BLANK

Method blank samples are analyzed to determine if positive results may be attributed to laboratory reagent, sample container, or detector contamination. At least 1 acceptable method blank analysis must be conducted for every 20 samples. If the method blank analysis results indicate the presence of an analyte above the method detection limit or MDA, the following qualifiers are applied:

- All positive sample results less than five times the highest blank concentration are qualified as estimates and flagged "J"
- Sample results below the EQL or MDA are qualified as undetected and flagged "UJ"
- Sample results above the EQL or MDA and greater than five times the highest blank concentration are not qualified.

Method blank contamination was regularly observed in inductively-coupled plasma metal analyses, primarily for tin. Generally, the amount observed in the blank was between the detection level and the reporting level. Because the concentration of tin detected in the sample was usually low, the method blank contamination usually required applying a "UJ" flag to the results.

Occasionally, blank contamination was encountered for other analyses, as noted in the worksheets. The analytical data were flagged appropriately in accordance with the above criteria.

2.4 FIELD EQUIPMENT BLANK RESULTS

Field equipment blank samples are analyzed to determine if positive results may be attributed to contaminants introduced as a result of the field sampling process. If the field equipment blank analysis results indicate the presence of an analyte above the method detection limit or MDA, notation was made in the individual worksheets and the discrepancy is discussed herein. For two SDGs undergoing hexavalent chromium analysis (SDGs K2122 and K2164), the equipment blank samples provided concentrations of 0.13 mg/kg and 0.08 mg/kg, respectively. Both of these concentrations are below the estimated quantitation limit of 0.5 mg/kg, as provided in DOE/RL-2009-41 and border on the method detection limit. Similar concentrations were seen in the field samples undergoing analysis in the same SDG and should be viewed with some skepticism.

2.5 FIELD TRIP BLANK RESULTS

Field trip blank samples are analyzed to determine if positive results may be attributed to contaminants introduced as a result of the transfer of samples from the field to the laboratory. In addition to field trip blanks, field transfer blanks were collected specifically for volatile organic analysis (VOA) samples. The only volatile organic analyte detected in two of the field transfer blanks was methylene chloride at concentrations of 2.66 µg/kg and 2.37 µg/kg. This is a common laboratory contaminant and is frequently detected in the laboratory method blanks. The presence of methylene chloride in the field transfer blanks did not correspond to any detectable concentrations of the contaminant in the field samples; therefore, it did not indicate an adverse impact on the analytical results.

2.6 MATRIX SPIKE RECOVERIES

Matrix spike recoveries allow for evaluation of accuracy. Measured concentrations or activities are compared to the known added amounts. The SAP (DOE/RL-2009-40) defines the acceptable recovery range as 70% to 130%, with data falling outside this range being flagged "J."

The accuracy criteria provided in the SAP (DOE/RL-2009-42) are based on the initial guidance values for percent recoveries as defined in SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition.* As per SW-846 Method 8000 and applicable to all SW-846 organic analyses, it is essential that laboratories calculate in-house performance criteria for matrix spike recoveries and surrogate recoveries. It may also be useful to calculate such in-house criteria for LCS recoveries and for the initial demonstration of proficiency when experience indicates that the criteria recommended in specific methods are frequently missed for some analytes or matrices. The development of in-house performance criteria and the use of control charts or similar procedures to track laboratory performance cannot be over-emphasized. Many data systems and commercially-available software packages support the use of control charts. The SW-846 outlines the procedures for the calculation of in-house performance criteria for matrix spike recovery and surrogate recovery. The procedures may also be applied to the development of in-house criteria for the initial demonstration of proficiency and for LCS recoveries. For organic analyses where the laboratory has defined acceptance criteria for matrix spike recoveries, these criteria will be used to assess the quality of the data rather than the 70% to 130% limits provided in the SAP (DOE/RL-2009-42).

For tritium and carbon-14 analyses, matrix spikes are required by the method validation procedure but are not routinely included by the analytical method for soil samples. Therefore, the tritium and carbon-14 data from soil analyses are flagged "J" as estimated quantities because matrix spikes were not analyzed with the SDGs.

2.7 LABORATORY CONTROL SAMPLE

Laboratory control samples allow for evaluation of accuracy. Measured concentrations or activities are compared to the known added amounts. The acceptable recovery range is 70% to 130%. Results less than 70% or greater than 130% will be flagged "J" as estimated quantities. As discussed above, laboratory established criteria were used to assess LCS results for organic analyses where such criteria are provided.

2.8 MATRIX SPIKE DUPLICATES

Analytical precision is expressed by the relative percent difference (RPD) between the recoveries of duplicate matrix spike analyses performed on a sample in the analytical batch. If both the sample and replicate concentrations are greater than five times the EQL and the RPD is less than 30%, no qualification is required. If either concentration is less than five times the EQL, the RPD control limit is less than or equal to two times the EQL. If the RPD is outside the applicable control limit, associated results are qualified as estimated detects or estimated nondetects and flagged "J" accordingly. Sample results greater than five times the spike concentration require no qualification.

2.9 LABORATORY DUPLICATE RESULTS

Laboratory duplicate results are a second method by which to assess analytical precision. Precision may be assessed using unspiked duplicate analyses performed on a sample in the analytical batch. If both the sample and replicate concentrations are greater than five times the EQL and the RPD is less than 30%, no qualification is required. If either concentration is less than five times the EQL, the RPD control limit is less than or equal to two times the EQL. If the RPD is outside the applicable control limit, associated results are qualified as estimated detects or estimated nondetects and flagged "J" accordingly.

Out-of-compliance laboratory duplicate analyses were one of the most common deficiencies noted in the reviewed data sets. All of the laboratory duplicates that were out of compliance were minor and required applying a "J" flag to the appropriate results. No results were rejected based on the laboratory duplicates.

2.10 FIELD DUPLICATE RESULTS

Field duplicate results are a method by which to assess field precision. Precision is assessed from the analysis of a primary sample and its duplicate collected in the field. If both the sample and its field duplicate concentrations are greater than five times the EQL and the RPD is less than 30%, no qualification is required. Where direct evaluation of the sample data showed that a given analyte was not detected in the primary, duplicate, or split sample, further evaluation of the RPD was not performed.

When an analyte is detected in the primary or duplicate/split sample but is quantified at less than five times the EQL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate/split results exceeds a control limit of two times the EQL, further assessment regarding the usability of the data is performed whereby the RPD control limit will be considered as less than or equal to two times the EQL.

If the RPD is outside the applicable control limit, associated results are qualified as estimated detects or estimated nondetects and flagged "J" accordingly.

A calculation was prepared to assess the RPD between duplicate and split sample pairs (Calculation No. 0100K-CA-V0080). This calculation is presented as Appendix A.

Twenty sample pairs were evaluated including 2 split samples and 18 field duplicates. Based on the methodology explained in the calculation, RPDs were calculated for 295 analyte pairs. Of these 295 RPDs, 22 exceeded the 30% guidance. Of the 22, 11 were for duplicate pairs of contaminants not of interest (i.e., calcium, silicon, phosphorous, and potassium-40). The remaining 11 RPDs were further assessed as required by the method. Further assessment showed that none were below the secondary parameter being quantified at less than five times the EQL with the RPD control limit considered to be two times the EQL. The remaining 12 listed in Table 5 were reviewed for laboratory QC issues, such as matrix spikes or duplicate analyses that were out of specification. Those analytes with laboratory QC issues have been qualified as estimated by the laboratory, the analytical data validator, and/or the DQA reviewer.

Table 5. Field Duplicate/Split Quality Control Review.

Location	Analyte	Relative Percent Difference	Laboratory Quality Control Issue
C7683 I-005	Chromium Lead	66.0% 137.6%	Yes Yes
C7683 I-006	Lead	36.8%	Yes
C7684 I-009	Strontium	73.0%	Yes
C7686 I-016	Strontium	30.3%	No
C7688 I-008	Vanadium	30.4%	No
C7689 I-004	Chromium	57.2%	Yes
C7691 I-009	Lead	32.9%	No
C7694 I-008	Strontium	35.7%	No
C7831 I-008	Strontium	54.4%	No
C7832 I-004	Chromium	82.8%	Yes

Further assessment showed that 6 of the 11 analyte pairs had laboratory QC issues in one or both (e.g., matrix spikes or duplicate analyses that were out of specification). Those analytes with laboratory QC issues have been qualified as estimate by the laboratory, the validator, and/or the data reviewer. The remaining five analyte pairs associated have no apparent laboratory QC issues.

Duplicate and split sample pair analyses results that exceed guidelines are considered a minor deficiency. No qualification of the data is required.

3.0 DATA USABILITY

Based on the results of this DQA, all of the laboratory analytical results that were not qualified as rejected are considered useable for their intended purposes. Table 6 presents the reviewer qualifiers that were applied to the sample results for metals and pH. Tables 7 and 8 provide the qualifiers for anions and VOAs, respectively. Table 9 lists the qualifiers for total petroleum hydrocarbons and polynuclear aromatic hydrocarbons. The data qualifiers for the special extraction (batch leach) analyses are presented in Table 10 with radionuclides presented in Table 11.

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
Sample Authorization Form RC-139 (Soil)																																
K2060	B25LC9		J							J		J		J								J					UJ					J
	B25LD0		J							J		J		J								J					UJ					J
	B25LD1		J							J		J		J								J					UJ					J
	B25LD2		J							J		J		J								J					UJ					J
	B25LD3		J							J		J		J								J					UJ					J
	B25LD4		J							J		J		J								J					UJ					J
	B25LD5		J							J		J		J								J					UJ					J
	B25LK7		J							J		J		J	UJ					UJ	J	J					UJ					J
K2061	B25L27		J						J	J				J		J			J		J	J					UJ					
	B25L28		J						J	J				J		J			J		J	J					UJ					
	B25L29		J						J	J				J		J			J		J	J					UJ					
	B25L30		J						J	J				J		J			J		J	J					UJ					
	B25L31		J						J	J				J		J			J		J	J					UJ					
	B25L32		J						J	J				J		J			J		J	J					UJ					
	B25LC2		J						J	J				J		J			J		J	J					UJ					
	B25L39		J						UJ	J				J	UJ	J			J	UJ	J	J					UJ					
K2109	B25N91	J	J							J												J					UJ					J
	B25N93	J	J							J												J					UJ					J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2111	B25N92	J	J						J	J											J	J		J			UJ	J				J
	B25N94	J	J						J			J		J						J							UJ	J				J
	B25N95	J	J						J			J		J						J							UJ	J				J
	B25N96	J	J						J	J											J	J		J			UJ	J				J
	B25N97	J	J						J	J											J	J		J			UJ	J				J
K2112	B26479	J	J						J													J					UJ					J
	B26480	J	J						J													J					UJ					J
K2122	B263Y2	J	J						J	J		J				J	J			J		J					UJ	J				J
	B26481	J	J						J	J		J				J	J			J		J					UJ	J				J
	B26482	J	J						J	J		J				J	J			J		J					UJ	J				J
	B26483	J	J						J	J		J				J	J			J		J					UJ	J				J
	B26484	J	J						J	J		J				J	J			J		J					UJ	J				J
	B26485	J	J						J	J		J				J	J			J		J					UJ	J				J
K2151	B26WD7	J											J									J										J
K2158	B26VB2		J		J					J									J			J										J
	B26VB3		J		J					J									J			J										J
	B26VB4		J		J					J									J			J										J
	B26VB6		J		J					J									J			J										J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2159	B26WD6		J		J					J												J										J
	B26WD8		J		J					J												J										J
	B26WD9		J		J					J												J										J
	B26WF0		J		J					J												J										J
	B26WF1		J		J					J												J										J
	B26WF2		J		J					J												J										J
	B26WF3		J		J					J												J										J
	B26WF4		J		J					J												J										J
K2161	B26WF7		J											J						J												J
K2164	B26VB0		J						J			J	J			J	J			J												J
	B26VB1		J						J			J	J			J	J			J												J
	B26VB7		J						J			J	J			J	J			J												J
	B26VC1		J						J			J	J			J	J			J												J
	B26V94		J						J			J	J			J	J			J												J
	B26V95		J						J			J	J			J	J			J												J
	B26V97		J						J			J	J			J	J			J												J
	B26V98		J						J			J	J			J	J			J												J
	B26V99		J						J			J	J			J	J			J												J
K2169	B26WF5		J						J	J		J		J		J			J									J			J	J
	B26WF6		J						J	J		J		J		J			J									J			J	J
K2172	B26WF8		J						J	J				J																		J
	B26WF9		J						J	J				J																		J
K2185	B26WH0		J							J		J																				J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2223	B26WH2		J	J	J					J			J				J			J		J						J				J
	B26WH3		J	J	J					J			J				J			J		J						J				J
	B26WH1		J	J	J					J			J				J			J		J						J				J
K2268	B276W1	J							J				J									J										J
K2314	B27788		J		J							J		J			J			J												J
K2319	B276V9		J																													J
	B276W0		J																													J
K2326	B276W4		J						J																							J
	B276W5		J						J																							J
K2330	B276W2		J							J		J							J												J	J
	B276W3		J							J		J							J													J
K2343	B25YL5		J																													J
	B25YL6		J																													J
K2346	B25YK8		J							J		J					J		J			J										J
	B25YK9		J							J		J					J		J			J										J
	B25YL0		J							J		J					J		J			J										J
K2403	B25YL3		J		J				J	J										J		J			J		UJ					J
	B25YL4		J		J				J	J										J		J			J		UJ					J
K2507	B28VX1	J											J									J					UJ					
K2556	B28VX4		J																	J		J										J
	B28VX6		J																	J		J										J
	B28VX7		J																	J		J										J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2606	B27H26		J							J									J			J					UJ				J	J
	B27H35		J							J									J			J					UJ				J	J
	B27H36		J							J									J			J					UJ				J	J
	B27H37		J							J									J			J					UJ				J	J
	B27H38		J							J									J			J					UJ				J	J
	B27H48		J							J									J			J					UJ				J	J
K2619	B27H33		J		J				J	J	J									J							UJ	J	J		J	J
	B27H34		J		J				J	J	J									J							UJ	J	J		J	J
	B27H39		J		J				J	J	J									J							UJ	J	J		J	J
K2651	B27H40		J							J	J	J	J				J	J	J	J							UJ	J			J	J
	B27H41		J							J	J	J	J				J	J	J	J							UJ	J			J	J
	B27H42		J							J	J	J	J				J	J	J	J							UJ	J			J	J
K2652	B28VX0		J														J					J	J			J	UJ	J	J			J
	B28VX2		J														J					J	J			J		J	J			J
	B28VX3		J														J					J	J			J		J	J			J
	B28VX5		J														J					J	J			J		J	J			J
	B28VX8		J														J					J	J			J		J	J			J
K2727	B29LB9	J											J		UJ							J					UJ				J	
K2739	B29L99	J	J						J	J												J					J				J	J
	B29LB3	J	J						J	J												J					J				J	J
	B29LB6	J	J						J	J												J					J				J	J
	B29LC2	J	J						J	J												J					J				J	J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2744	B29LC5	J	J						J											J		J					J				J	J
	B29LC9	J	J						J											J		J					J				J	J
K2749	B29LD0																															J
	B29LD5	J	J							J		J							J			J									J	J
	B29LD8																															J
	B29LF3	J	J							J		J							J			J									J	J
K2777	B29LH1																															J
	B29LH9	J	J																			J					UJ					J
	B29LJ3	J	J																			J					UJ					J
	B29LJ5	J	J																			J					UJ					J
	B29X08																															J
	B29X10																															J
K2789	B29LF5																															J
	B29LH0	J	J		J	J	J		J	J	J	J				J			J	J		J		J	J		UJ	J	J		J	J
	B29LH6	J	J		J	J	J		J	J	J	J				J			J	J		J		J	J		UJ	J	J		J	J
	B29X07																															J
	B29X09																															J
	B29X12																															J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2811	B27L68		J						J	J							J										UJ	J			J	J
	B27L69		J						J	J							J										UJ	J			J	J
	B27L70		J						J	J							J										UJ	J			J	J
	B27L71		J						J	J							J										UJ	J			J	J
	B27L72		J						J	J							J										UJ	J			J	J
	B27L73		J						J	J							J										UJ	J			J	J
	B27L74		J						J	J							J										UJ	J			J	J
	B27L75		J						J	J							J										UJ	J			J	J
	B27L76		J						J	J							J										UJ	J			J	J
	B27LB1		J						J	J						J	J										UJ	J			J	J
K2841	B27L77		J		J				J	J										J		J			J		UJ				J	J
	B27L78		J		J				J	J										J		J			J		UJ				J	J
	B27L79		J		J				J	J										J		J			J		UJ				J	J
	B27L80		J		J				J	J										J		J			J		UJ				J	J
	B27L81		J		J				J	J										J		J			J		UJ				J	J
K2856	B27L82		J							J		J															UJ				J	J
	B27L83		J							J		J															UJ				J	J
	B27L90		J							J		J															UJ				J	J
	B27LB5		J							J		J															UJ				J	J
K2857	B28F19		J									J		J						J							UJ		J		J	J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2892	B28F21	J	J							J										J							UJ					J
	B28F22	J	J							J										J							UJ					J
	B28F23	J	J							J										J							UJ					J
	B28F24	J	J							J										J							UJ					J
	B28F25	J	J							J										J							UJ					J
K2895	B27L84	J	J							J												J			J		UJ					J
K2896	B29LJ8	J	J						J	J												J					UJ					J
	B29LK2	J	J						J	J												J					UJ					J
K2897	B28F20	J	J							J				J							J						UJ					J
K2902	B28F30	J											J									J					UJ				J	J
K2903	B29LL9		J						J								J				J										J	J
K2910	B29LK5	J	J							J																	UJ					J
	B29LK9	J	J							J																	UJ					J
	B29LL2	J	J							J																	UJ					J
	B29LL6	J	J							J																	UJ					J
	B29LM3	J	J							J																	UJ					J
K2911	B28F26		J						J	J					J							J										J
	B28F27		J						J	J												J										J
	B28F28		J						J	J												J										J
K2917	B28F29		J							J									J	J		J					UJ					J
	B28F31		J							J									J	J		J					UJ					J
K2929	B28FB3	J			J								J									J					UJ					J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2935	B28F32		J						J			J		J													UJ					J
	B28F33		J						J			J		J													UJ					J
	B28F34		J						J			J		J													UJ					J
	B28F83																															J
	B28F84																															J
	B28F85																															J
K2947	B28F36		J						J	J		J				J				J							UJ					J
	B28F37		J						J	J		J				J				J							UJ					J
K2961	B28F35		J						J	J						J	J		J			J					UJ		J			J
	B28F38		J						J	J						J	J		J			J					UJ		J			J
	B28F39		J						J	J						J	J		J			J					UJ		J			J
	B28F41		J						J	J						J	J		J			J					UJ		J			J
	B28F86																															J
K2972	B26097																															J
	B26098																															J
	B26099																															J
	B260B0		J						J			J				J											UJ					J
	B260B5		J						J	J						J					J						UJ					J
	B260B6		J						J	J						J					J						UJ					J
	B26T03		J						J	J						J					J						UJ					J
K2981	B28FB2		J						J													J					UJ				J	J
K3000	B28F40		J						J			J								J							UJ					J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
Sample Authorization Form RC-140 (Water)																																
K2076	B25LK6																															J
K2116	B25NB4	J								J			J						J													J
K2134	B264N9									UJ			J																			J
K2162	B26VD3																											J				J
K2221	B26WP4	J																														J
K2313	B272J0																					J										J
	B272J1																					J										J
K2316	B27775																															J
K2376	B283D4	UJ																				J										J
K2378	B27336	UJ																														J
	B27338	UJ																														J
K2388	B25YM0																															J
K2618	B27HP0																															J
K2863	B27LN5																															J
K2924	B29LM7	J																														J
K2982	B28FH0	J																														J
K2983	B260C3-A	UJ																														J
K3105	B2BHJ9																												J			J
	B2BHK4																												J			J
Sample Authorization Form RC-178 (Soil)																																
J00851	B27272																														J	
J00866	B272D2						J															J										

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2212	B272B8	J											J			UJ						J										
K2227	B272C5		J									J										J										J
K2248	B272B7		J							J								J				J										
	B272C1		J							J								J				J										J
	B272C2		J							J								J				J										J
	B272C3		J							J								J				J										J
K2269	B272D4	J	J							J		J					J					J										J
	B272D8	J	J							J		J					J					J										J
K2281	B272C7	J	J																			J								UJ		J
K2283	B272W9	J							J				J									J										
K2312	B272D1		J																													J
K2323	B272C4		J							J		J																				
	B272C8		J							J		J																				J
	B272C9		J							J		J																				J
	B272D3		J							J		J																				J
	B272D0		J							J		J																				J
K2350	B27RT2		J					J		J		J				J			J	J		J						J	J	J		J
	B272X1		J					J		J		J				J			J	J		J						J	J	J		J
	B272X2		J					J		J		J				J			J	J		J						J	J	J		J
	B272X3		J					J		J		J				J			J	J		J						J	J	J		J
	B272X4		J					J		J		J				J			J	J		J						J	J	J		J
	B272X6		J					J		J		J				J			J	J		J						J	J	J		J

Table 6. 100-K Review Qualifiers for Metals and pH. (12 Pages)

Sample Delivery Group	Sample Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Vanadium	Zinc	Mercury	Cr-VI	pH
K2353	B27RT3		J							J												J								J		J
	B27RT4		J							J												J								J		J
	B272X0		J							J												J								J		J
	B272X7		J							J												J								J		J
	B272X8		J							J												J								J		J
	B273X2		J							J												J								J		J
	B272W8		J							J												J								J		J
K2370	B272X9		J						J							J	J															J
	B272Y0		J						J							J	J															J
	B272Y1		J						J							J	J															J
	B272Y2		J						J							J	J															J

J = Due to a minor quality control deficiency identified during the data assessment, the associated concentration is an estimate. The data are considered usable for decision-making purposes.

UJ = The compound or analyte was analyzed for and detected in the sample. However, due to a minor quality control deficiency associated with method blank results, the associated results are labeled as estimated quantitation limits. The data are considered usable for decision-making purposes.

Table 7. 100-K Review Qualifiers for Anion Analysis. (2 Pages)

Sample Delivery Group	Sample Number	Nitrate[a]	Nitrite[a]	Orthophosphate[a]	Nitrate/Nitrite
Sample Authorization Form RC-178 (Soil)					
J00866	B272D2			UR	J
K2212	B272B8	UR	UR	UR	
K2227	B272C5	J	UR	UR	
K2248	B272C1	J	UR	UR	
	B272C3	J	UR	UR	
K2269	B272D4	J	UR	UR	
	B272D8	J	UR	UR	
K2281	B272C7	UR	UR	UR	
K2283	B272W9	UR	UR	UR	
K2312	B272D1	J	UR	UR	
K2323	B272C4	J	UR	UR	
	B272C8	J	UR	UR	
	B272C9	UR	UR	UR	
	B272D3	J	UR	UR	
	B272D0	UR	UR	UR	
K2350	B272P7	J	UR	UR	
	B272X1	J	UR	UR	
	B272X2	J	UR	UR	
	B272X3	J	UR	UR	
	B272X4	J	UR	UR	
	B272X6	J	UR	UR	
K2353	B27RT3	J	UR	UR	
	B27RT4	J	UR	UR	
	B272X0	UR	UR	UR	
	B272X7	J	UR	UR	
	B272X8	J	UR	UR	
	B273X2	J	UR	UR	
	B272W8	J	UR	UR	

Table 7. 100-K Review Qualifiers for Anion Analysis. (2 Pages)

Sample Delivery Group	Sample Number	Nitrate[a]	Nitrite[a]	Orthophosphate[a]	Nitrate/Nitrite
K2370	B272X9	J	UR	UR	
	B272Y0	UR	UR	UR	
	B272Y1	J	UR	UR	
	B272Y2	UR	UR	UR	

[a] The data flags for nitrate, nitrite, and orthophosphate are primarily attributed to the hold time being exceeded as discussed in Section 2.1.

J = Due to a minor quality control deficiency identified during the data assessment, the associated concentration is an estimate. The data are considered usable for decision-making purposes.

UR = Indicates that the constituent was analyzed for and not detected; however, due to an identified quality control issue, the data should be considered unusable for decision-making purposes.

Table 8. 100-K Data Qualifiers for Volatile Organic Analysis. (2 Pages)

Sample Delivery Group	Sample Number	1,1,2,2-Tetrachloroethane	1,2-Dichloroethane	2-Butanone	2-Hexanone	Acetone	Methylene Chloride	Styrene
Sample Authorization Form RC-178 (Soil)								
J00853	B27296				J	J	UJ	
K2265	B27242		J			J		
	B27243		J			J		
K2282	B272P5		J			J		
K2318	B27267	J						

Table 8. 100-K Data Qualifiers for Volatile Organic Analysis. (2 Pages)

Sample Delivery Group	Sample Number	1,1,2,2-Tetrachloroethane	1,2-Dichloroethane	2-Butanone	2-Hexanone	Acetone	Methylene Chloride	Styrene
K2323	B27264	J		J		J		
	B27268	J		J		J		
	B27269	J		J		J		
	B27270	J		J		J		
	B27271	J		J		J		
	B27273	J		J		J		
K2350	B272P7	J						
	B272P8	J						
	B272P9	J						UJ
	B272R0	J						
	B272R2	J						
	B27RR6	J						
K2353	B27RR7					J		
	B27RR8					J		
	B272P4					J		
	B272R3					J		
	B272X5					J		
	B27279					J		

J = Due to a minor quality control deficiency identified during the data assessment, the associated concentration is an estimate. The data are considered usable for decision-making purposes.

UJ = The compound or analyte was analyzed for and detected in the sample. However, due to a minor quality control deficiency associated with method blank results, the associated results are labeled as estimated quantitation limits. The data are considered usable for decision-making purposes.

Table 9. 100-K Data Qualifiers for Total Petroleum Hydrocarbons and Polynuclear Aromatic Hydrocarbons.

Sample Delivery Group	Sample Number	Diesel Range Organics	Motor Oil	Acenaphthene	Acenaphthylene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Benzo[g,h,i]perylene	Indeno[1,2,3-cd]pyrene
Sample Authorization Form RC-139 (Soil)										
K2777	B29X08		J							
	B29X10	J	J							
K2789	B29X07		J	J	J	J	J	J	J	J
	B29X09		J	J	J	J	J	J	J	J
	B29X12		J	J	J	J	J	J	J	J

J = Due to a minor quality control deficiency identified during the data assessment, the associated concentration is an estimate. The data are considered usable for decision-making purposes.

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
Sample Authorization Form RC-139 (Soil)									
K2611	B27H01-1								J
	B27H01-2								J
	B27H01-3								J
	B27H01-4								J
	B27H02-1								J
	B27H02-2								J
	B27H02-3								J
	B27H02-4						UJ		J
	B27H03-1						UJ		J
	B27H03-2								J
	B27H03-3								J
	B27H03-4								J
	B27H04-1								J
	B27H04-2								J
	B27H04-3								J
	B27H04-4								J
	B27H14-1								J
	B27H14-2								J
	B27H14-3								J
	B27H14-4								J
K2623	B27H00-1	J		J	J				J
	B27H00-2	J		J	J				J
	B27H00-3	J		J	J				J
	B27H00-4	J		J	J				J
	B27H05-1			J	J				J
	B27H05-2			J	J				J
	B27H05-3			J	J				J
	B27H05-4			J	J				J
	B27FY9-1			J	J				J
	B27FY9-2			J	J				J
	B27FY9-3			J	J				J
	B27FY9-4			J	J				J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
K2676	B27H06-1				J				J
	B27H06-2				J				J
	B27H06-3				J				J
	B27H06-4				J				J
	B27H07-1				J				J
	B27H07-2				J				J
	B27H07-3				J				J
	B27H07-4				J				J
	B27H08-1		J		J				J
	B27H08-2		J		J				J
	B27H08-3		J		J				J
	B27H08-4		J		J				J
	B29L98-1					J			J
	B29L98-2					J			J
	B29L98-3					J			J
	B29L98-4					J			J
	B29LB2-1					J			J
	B29LB2-2					J			J
	B29LB2-3					J			J
	B29LB2-4					J			J
	B29LB5-1				J	J			J
	B29LB5-2				J	J			J
	B29LB5-3				J	J			J
	B29LB5-4				J	J			J
	B29LC1-1					J			J
	B29LC1-2					J			J
	B29LC1-3					J			J
	B29LC1-4					J			J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
K2748	B29LC4-1								J
	B29LC4-2								J
	B29LC4-3								J
	B29LC4-4						UJ		J
	B29LC8-1								J
	B29LC8-2						UJ		J
	B29LC8-3						UJ		J
	B29LC8-4						UJ		J
	B29LD4-1						UJ		J
	B29LD4-2						UJ		J
	B29LD4-3								J
	B29LD4-4								J
K2750	B29LF2-1	J	J	J	J	J	J	J	J
	B29LF2-2	J	J	J	J	J	J	J	J
	B29LF2-3	J	J	J	J	J	J	J	J
	B29LF2-4	J	J	J	J	J	J	J	J
K2774	B29LH8-1								J
	B29LH8-2								J
	B29LH8-3								J
	B29LH8-4								J
	B29LJ2-1				J				J
	B29LJ2-2				J				J
	B29LJ2-3				J				J
	B29LJ2-4				J				J
K2790	B29LF9-1								J
	B29LF9-2								J
	B29LF9-3								J
	B29LF9-4								J
	B29LH5-1								J
	B29LH5-2								J
	B29LH5-3								J
	B29LH5-4								J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
K2816	B27L45-1				J				J
	B27L45-2				J				J
	B27L45-3				J				J
	B27L45-4				J				J
	B27L46-1				J				J
	B27L46-2				J				J
	B27L46-3				J				J
	B27L46-4				J				J
	B27L47-1								J
	B27L47-2								J
	B27L47-3								J
	B27L47-4								J
	B27L48-1								J
	B27L48-2								J
	B27L48-3								J
	B27L48-4								J
	B27L49-1								J
	B27L49-2								J
	B27L49-3								J
	B27L49-4								J
K2817	B27L51-1	J	J	J	J	J	J	J	J
	B27L51-2	J	J	J	J	J	J	J	J
	B27L51-3	J	J	J	J	J	J	J	J
	B27L51-4	J	J	J	J	J	J	J	J
	B27L52-1	J	J	J	J	J	J	J	J
	B27L52-2	J	J	J	J	J	J	J	J
	B27L52-3	J	J	J	J	J	J	J	J
	B27L52-4	J	J	J	J	J	J	J	J
	B27L53-1	J	J	J	J	J	J	J	J
	B27L53-2	J	J	J	J	J	J	J	J
	B27L53-3	J	J	J	J	J	J	J	J
	B27L53-4	J	J	J	J	J	J	J	J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
K2839	B27L57-1								J
	B27L57-2								J
	B27L57-3								J
	B27L57-4								J
	B27L58-1								J
	B27L58-2								J
	B27L58-3								J
	B27L58-4								J
K2844	B27L54-1								J
	B27L54-2								J
	B27L54-3								J
	B27L54-4								J
	B27L56-1								J
	B27L56-2								J
	B27L56-3								J
	B27L56-4								J
K2854	B27L59-1								J
	B27L59-2								J
	B27L59-3								J
	B27L59-4								J
	B27L60-1								J
	B27L60-2								J
	B27L60-3								J
	B27L60-4								J
	B27L67-1								J
	B27L67-2								J
	B27L67-3								J
	B27L67-4								J
	B27LB4-1				J				J
	B27LB4-2				J				J
	B27LB4-3				J				J
	B27LB4-4				J				J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
K2855	B28F48-1					J			J
	B28F48-2					J			J
	B28F48-3					J			J
	B28F48-4					J			J
K2939	B28F61-1					J			J
	B28F61-2					J			J
	B28F61-3					J			J
	B28F61-4					J			J
	B28F62-1					J			J
	B28F62-2					J			J
	B28F62-3					J			J
	B28F62-4					J			J
	B28F63-1					J			J
	B28F63-2					J			J
	B28F63-3					J			J
	B28F63-4					J			J
K2963	B28F64-1				J				J
	B28F64-2				J				J
	B28F64-3				J				J
	B28F64-4				J				J
	B28F67-1								J
	B28F67-2								J
	B28F67-3								J
	B28F67-4								J
	B28F68-1				J				J
	B28F68-2				J				J
	B28F68-3				J				J
	B28F68-4				J				J
	B28F70-1								J
	B28F70-2								J
	B28F70-3								J
	B28F70-4								J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
K2989	B28FB1-1								J
	B28FB1-2								J
	B28FB1-3								J
	B28FB1-4								J
K2997	B28F69-1								J
	B28F69-2								J
	B28F69-3								J
	B28F69-4								J
Sample Authorization Form RC-178 (Soil)									
K2227	B27289-1				J				J
	B27289-2				J				J
	B27289-3				J				J
	B27289-4				J				J
K2248	B27285-1								J
	B27285-2								J
	B27285-3								J
	B27285-4								J
	B27286-1				J				J
	B27286-2				J				J
	B27286-3				J				J
	B27286-4				J				J
	B27287-1				J				J
	B27287-2				J				J
	B27287-3				J				J
	B27287-4				J				J
K2269	B27298-1				J				J
	B27298-2				J				J
	B27298-3				J				J
	B27298-4				J				J
	B272B2-1				J				J
	B272B2-2				J				J
	B272B2-3				J				J
	B272B2-4				J				J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
K2281	B27291-1				J				J
	B27291-2				J				J
	B27291-3				J				J
	B27291-4				J				J
K2312	B27295-1								J
	B27295-2								J
	B27295-3								J
	B27295-4								J
K2323	B27292-1								J
	B27292-2								J
	B27292-3								J
	B27292-4								J
	B27293-1								J
	B27293-2								J
	B27293-3								J
	B27293-4								J
	B27294-1				J				J
	B27294-2				J				J
	B27294-3				J				J
	B27294-4				J				J
	B27297-1				J				J
	B27297-2				J				J
	B27297-3				J				J
	B27297-4				J				J
K2350	B27RR9-1				J				J
	B27RR9-2				J				J
	B27RR9-3				J				J
	B27RR9-4				J				J
	B272T9-1				J				J
	B272T9-2				J				J
	B272T9-3				J				J
	B272T9-4				J				J
	B272V0-1	J			J				J
	B272V0-2	J			J				J
	B272V0-3	J			J				J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
	B272V0-4	J			J				J
	B272V2-1				J	J			J
	B272V2-2				J	J			J
	B272V2-3				J	J			J
	B272V2-4				J	J			J
	B272V4-1				J				J
	B272V4-2				J				J
	B272V4-3				J				J
	B272V4-4				J				J
K2353	B27RT0-1				J				J
	B27RT0-2				J				J
	B27RT0-3				J				J
	B27RT0-4				J				J
	B27RT1-1				J				J
	B27RT1-2				J				J
	B27RT1-3				J				J
	B27RT1-4				J				J
	B272T6-1				J				J
	B272T6-2				J				J
	B272T6-3				J				J
	B272T6-4				J				J
	B272V5-1				J				J
	B272V5-2				J				J
	B272V5-3				J				J
	B272V5-4				J				J
	B272V6-1				J				J
	B272V6-2				J				J
	B272V6-3				J				J
	B272V6-4				J				J
	B273X1-1				J				J
	B273X1-2				J				J
	B273X1-3				J				J
	B273X1-4				J				J

Table 10. 100-K Data Qualifiers for Special Extraction Analysis. (10 Pages)

Sample Delivery Group	Sample Number	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Cr-VI
K2371	B272W0-1				J				J
	B272W0-2				J				J
	B272W0-3				J				J
	B272W0-4				J				J
	B272V7-1								J
	B272V7-2								J
	B272V7-3								J
	B272V7-4								J
	B272V8-1								J
	B272V8-2								J
	B272V8-3								J
	B272V8-4								J
	B272V9-1								J
	B272V9-2								J
	B272V9-3								J
	B272V9-4								J

J = Due to a minor quality control deficiency identified during the data assessment, the associated concentration is an estimate. The data are considered usable for decision-making purposes.

UJ = The compound or analyte was analyzed for and detected in the sample. However, due to a minor quality control deficiency associated with method blank results, the associated results are labeled as estimated quantitation limits. The data are considered usable for decision-making purposes.

Table 11. 100-K Data Qualifiers for Radionuclide Analysis. (2 Pages)

Sample Delivery Group	Sample Number	Tritium	Carbon-14
Sample Authorization Form RC-178 (Soil)			
J00851	B27272	J	J
K2203	B273H3	J	J
K2209	B273H2	J	J

Table 11. 100-K Data Qualifiers for Radionuclide Analysis. (2 Pages)

Sample Delivery Group	Sample Number	Tritium	Carbon-14
K2229	B273F7	J	J
	B273F8	J	J
	B273F9	J	J
	B273H0	J	J
K2242	B272H0	J	J
	B27307	J	J
K2245	B272F8	J	J
K2296	B272F3	J	J
	B27301	J	J
K2304	B272F5	J	J
	B272F6	J	J
	B272F7	J	J
	B272F9	J	J
	B273H1	J	J
K2333	B27303	J	J
	B27304	J	J
	B27305	J	J
	B27306	J	J
	B27308	J	J
	B27RR3	J	J
K2334	B27300	J	J
	B27302	J	J
	B27309	J	J
	B27310	J	J
	B273X0	J	J
	B27RR4	J	J
	B27RR5	J	J
K2340	B27311	J	J
	B27312	J	J
	B27313	J	J
	B27314	J	J

J = Due to a minor quality control deficiency identified during the data assessment, the associated concentration is an estimate. The data are considered usable for decision-making purposes.

4.0 REFERENCES

DOE/RL-2009-41, 2009, *Sampling and Analysis Plan for the 100-K Decision Unit Remedial Investigation/Feasibility Study*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA/240/B-06/002, 2006, *Data Quality Assessment: A Reviewer's Guide*, EPA QA/G-9R, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

EPA/240/B-06/003, 2006, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

EPA/600/R-05/124, 2005, *Sample Holding Time Reevaluation*, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C.

APPENDIX A

RELATIVE PERCENT DIFFERENCE CALCULATION

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-K Remedial Investigation **Job No. 14655**

Area: 100-K

Discipline: Environmental *Calculation No: 0100K-CA-V0080

Subject: 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Computer Program: Excel Program No: Excel ~~2003~~ 2007 HMS 5/16/11

The attached calculations have been generated for a specific purpose and task. Use of the calculations by persons who do not have access to all pertinent facts may lead to incorrect conclusions and/or results. Before applying these calculations to your work, the underlying basis, rationale, and other pertinent information relevant to these calculations must be thoroughly reviewed with appropriate Washington Closure Hanford LLC (WCH) officials or other authorized personnel. WCH is not responsible for the use of a calculation not under its direct control.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 23 Total = 24	P. L. Benjamin	H. M. Sulloway	D. I. Rolloson	J. M. Capron	
		[illegible]	HM Sulloway	D.I. Rolloson	JMC	5/16/11

SUMMARY OF REVISION

WCH-DE-019 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB	**Date** 5/12/2011	**Calc. No.** 0100K-CA-V0080	**Rev. No.** 0
Project 100-K Remedial Investigation	**Job No.** 14655	**Checked** H. M. Sulloway	**Date** 5/16/11
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculation			**Sheet No.** 1 of 23

Summary

PURPOSE:

Provide documentation to support the calculation of the relative percent difference (RPD) for primary-duplicate and primary-split sample pairs from 100-K Area remedial investigation sample results, as necessary.

TABLE OF CONTENTS:

Sheets 1 to 3 – Summary
Sheet 4 - C7683 Interval 5 Soil Samples
Sheet 5 - C7683 Interval 6 Soil Samples
Sheet 6 - C7684 Interval 9 Soil Samples
Sheet 7 - C7685 Interval 5 Soil Samples
Sheet 8 - C7686 Interval 16 Soil Samples
Sheet 9 - C7687 Interval 5 Soil Samples
Sheet 10 - C7688 Interval 4 Soil Samples
Sheet 11 - C7688 Interval 8 Soil Samples
Sheet 12 - C7689 Interval 4 Soil Samples
Sheet 13 - C7690 Interval 4 Soil Samples
Sheet 14 - C7691 Interval 9 Soil Samples
Sheet 15 - C7692 Interval 9 Soil Samples
Sheet 16 - C7693 Interval 5 Soil Samples
Sheet 17 - C7694 Interval 8 Soil Samples
Sheet 18 - C7695 Interval 15 Soil Samples
Sheet 19 - C7831 Interval 7 Soil Samples
Sheet 20 - C7831 Interval 8 Soil Samples
Sheet 21 - C7831 Interval 16 Groundwater Samples
Sheet 22 - C7832 Interval 4 Soil Samples
Sheet 23 - C7832 Interval 21 Groundwater Samples

GIVEN/REFERENCES:

1) DOE-RL, 2009, *Sampling and Analysis Plan for the100-K Area Remedial Investigation/Feasibility Study*, DOE/RL-2009-41, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

SOLUTION: HMS 5/16/11

1) Use data ~~from~~ obtained from remedial investigation soil, aquifer sediment, and groundwater samples to perform the RPD calculations for primary-duplicate and primary-split sample pairs, as required.

METHODOLOGY:

The RPD is calculated when both the primary sample value and either the duplicate or split sample value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method. The 100-K SAP lists laboratory performance standards as estimated quantitation limits (EQLs) for soil/aquifer sediment samples from sampling targets in Tables 2-2, 2-3, and 2-4 of the SAP (DOE-RL 2009) for selected constituents. Where TDL values lower than those listed in the SAP were available, the lower values were used.

Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary, duplicate, and/or split sample, further evaluation of the RPD value was not performed.

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB	**Date** 5/12/2011	**Calc. No.** 0100K-CA-V0080	**Rev. No.** 0
Project 100-K Remedial Investigation	**Job No.** 14655	**Checked** H. M. Sulloway HMS	**Date** 5/16/11
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculation			**Sheet No.** 2 of 23

Summary

METHODOLOGY CONTINUED:

The RPD calculations use the following formula:

$$RPD = [\,|M-D|/((M+D)/2)]*100$$

where, M = main sample value D = duplicate (or split) sample value

When an analyte is detected in the primary or duplicate/split sample, but is quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate/split results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed as part of the overall quality assessment.

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. If the RPD is greater than 30%, further investigation regarding the usability of the data is performed. Additional discussion is provided in the data quality assessment.

RESULTS:

The results presented in the tables that follow include the summary of the results of the RPD calculations and are for use in data quality assessment of the remedial investigation sampling.

Washington Closure Hanford **CALCULATION SHEET**

Originator P. L. Benjamin PLB **Date** 5/12/2011 **Calc. No.** 0100K-CA-V0080 **Rev. No.** 0
Project 100-K Remedial Investigation **Job No.** 14665 **Checked** H. M Sullaway HMS **Date** 5/16/11
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations **Sheet No.** 3 of 23

Summary (continued)

Relative Percent Difference Results and QA/QC Analysis

Analyte	C7683, Soil, Interval 5	C7683, Soil, Interval 6	C7684, Soil, Interval 9	C7685, Soil, Interval 5	C7686, Soil, Interval 16	C7687, Soil, Interval 5	C7688, Soil, Interval 4	C7688, Soil, Interval 8	C7689, Soil, Interval 4	C7690, Soil, Interval 4	C7691, Soil, Interval 9	C7692, Soil, Interval 9	C7693, Soil, Interval 5	C7694, Soil, Interval 8	C7695, Soil, Interval 15	C7831, Soil, Interval 7	C7831, Soil, Interval 8	C7831, Groundwater, Interval 16	C7832, Soil, Interval 4	C7832, Groundwater, Interval 21
	Duplicate Analysis	Split Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis	Split Analysis	Duplicate Analysis	Duplicate Analysis	Duplicate Analysis
Potassium-40	14.8%	2.6%	7.6%	2.8%	2.1%	0.6%	3.9%	19.8%	2.3%	13.3%	9.2%	8.1%	0.0%	35.5%	7.8%	0.0%	1.2%	–	8.9%	–
Radium-226	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	14.5%	–	–	–
Aluminum	13.1%	7.0%	10.3%	10.0%	1.8%	1.6%	4.9%	5.9%	5.1%	2.4%	20.6%	5.6%	20.2%	9.2%	6.2%	12.5%	6.5%	–	10.5%	–
Barium	16.8%	16.3%	26.4%	22.2%	13.3%	7.1%	1.0%	16.1%	5.5%	24.2%	21.5%	11.1%	10.6%	27.2%	4.3%	67.6%	28.2%	0.5%	28.8%	3.2%
Calcium	14.7%	1.8%	30.7%	6.0%	6.4%	7.2%	2.9%	13.9%	10.0%	3.2%	23.8%	14.7%	14.0%	19.9%	1.8%	5.5%	7.1%	0.7%	1.6%	1.9%
Chromium	66.0%	4.2%	10.4%	23.3%	8.7%	14.7%	6.8%	28.6%	57.2%	11.2%	13.2%	6.6%	8.8%	20.9%	1.9%	26.5%	3.2%	–	82.8%	–
Cobalt	–	–	–	–	–	–	1.0%	–	–	–	–	–	–	–	–	–	–	–	–	–
Copper	12.3%	3.5%	11.2%	5.5%	0.4%	14.2%	6.2%	24.0%	1.2%	2.4%	10.1%	1.9%	15.0%	30.0%	7.2%	19.7%	0.9%	–	2.0%	–
Iron	7.9%	15.8%	6.8%	7.5%	6.6%	11.5%	2.7%	14.0%	6.3%	8.4%	8.3%	12.1%	16.6%	13.5%	8.7%	7.4%	7.2%	–	13.6%	–
Lead	137.6%	36.8%	20.6%	27.6%	14.9%	3.6%	27.6%	8.3%	–	14.1%	32.9%	3.7%	15.6%	–	7.3%	–	4.5%	–	–	–
Magnesium	9.5%	25.2%	7.8%	4.6%	3.2%	1.3%	2.6%	4.5%	4.1%	4.5%	14.2%	13.4%	16.1%	10.5%	22.4%	20.0%	15.2%	1.3%	16.3%	0.9%
Manganese	11.4%	11.8%	16.1%	7.9%	8.5%	7.5%	0.7%	6.4%	3.9%	1.6%	11.5%	32.7%	13.8%	6.5%	0.8%	10.1%	24.2%	0.9%	1.2%	0.7%
Phosphorus	1.6%	12.9%	22.6%	14.4%	19.2%	15.2%	2.5%	10.2%	4.2%	15.1%	10.6%	31.4%	5.2%	30.0%	2.6%	10.6%	9.3%	–	18.4%	–
Silicon	36.3%	132.7%	43.6%	46.6%	9.1%	17.6%	11.4%	45.1%	8.6%	3.4%	92.5%	8.3%	52.9%	16.0%	3.3%	11.2%	41.9%	2.2%	1.6%	2.6%
Sodium	14.9%	4.3%	–	9.8%	4.3%	8.5%	6.3%	17.0%	1.2%	–	–	–	21.2%	–	–	6.7%	0.6%	0.0%	2.6%	2.7%
Strontium	13.6%	1.6%	73.0%	9.4%	30.3%	2.1%	3.1%	6.1%	3.7%	21.2%	25.4%	9.7%	16.9%	35.7%	6.5%	6.3%	54.4%	0.4%	10.8%	2.4%
Vanadium	3.8%	4.4%	12.5%	9.4%	9.6%	1.3%	0.0%	30.4%	3.1%	14.4%	5.4%	19.5%	2.5%	21.7%	8.7%	21.9%	1.2%	–	25.2%	–
Zinc	13.2%	23.6%	3.6%	10.5%	1.9%	14.6%	0.3%	12.0%	7.1%	6.9%	9.2%	28.6%	13.0%	11.0%	7.9%	7.5%	11.7%	–	1.0%	–
Sulfate	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11.4%	–	–	–	–

– = Analysis not required

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway HMS

Rev. No. 0
Date 5/16/11
Sheet No. 4 of 23

1 **Duplicate Analysis - C7683 Interval 5 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232			Aluminum			Antimony			Arsenic		
3				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	C7683; I-005	B25L27	5/18/10	11.9		0.224	0.447		0.050	0.697		0.102	0.725		0.035	0.697		0.102	9130		3.92	4.68	J	0.47	1.88		0.78
5	C7683; I-005 DUP	B25L28	5/18/10	13.8		0.280	0.581		0.060	0.766		0.135	0.872		0.040	0.766		0.135	8010		3.22	0.543	J	0.39	1.88		0.64

6 **Analysis:**

7		TDL		0.5			0.1			0.2			1			1			5			0.6			1		
8	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
9		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)		
10		RPD		14.8%															13.1%								
11		Difference > 2 TDL?		Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable			Not applicable			Yes - assess further			No - acceptable		

12

	Sampling Area	HEIS Number	Sample Date	Barium			Beryllium			Boron			Calcium			Chromium			Cobalt			Copper			Iron		
14				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
15	C7683; I-005	B25L27	5/18/10	91.6		0.39	0.170		0.16	0.875	B	1.57	5180	J	78.4	27.0	J	0.16	5.62		1.57	17.3		0.78	17200		15.7
16	C7683; I-005 DUP	B25L28	5/18/10	77.4		0.32	0.152		0.13	0.783	B	1.29	4470	J	64.3	53.6	J	0.13	5.33		1.29	15.3		0.64	15900		12.9

17 **Analysis:**

18		TDL		0.5			0.2			2			100			0.2			2			1			5		
19	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
20		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)						Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)		
21		RPD		16.8%									14.7%			66.0%						12.3%			7.9%		
22		Difference > 2 TDL?		Not applicable			No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable		

23

	Sampling Area	HEIS Number	Sample Date	Lead			Lithium			Magnesium			Manganese			Molybdenum			Nickel			Phosphorus			Potassium		
25				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
26	C7683; I-005	B25L27	5/18/10	185	J	0.39	10.1		1.96	3740	J	58.8	270		3.92	5.06		1.57	18.2	J	3.13	548		39.2	1210	J	313
27	C7683; I-005 DUP	B25L28	5/18/10	34.2	J	0.32	8.47		1.61	3400	J	48.2	241		3.22	4.33		1.29	30.4	J	2.57	538		32.2	988.0	J	257

28 **Analysis:**

29		TDL		0.5			2.5			75			5			2			4			10			400		
30	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
31		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)		
32		RPD		137.6%						9.5%			11.4%									1.8%					
33		Difference > 2 TDL?		Not applicable			No - acceptable			Not applicable			Not applicable			No - acceptable			Yes - assess further			Not applicable			No - acceptable		

34

	Sampling Area	Sample Number	Sample Date	Silicon			Sodium			Strontium			Vanadium			Zinc		
36				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
37	C7683; I-005	B25L27	5/18/10	404	J	1.57	810		39.2	31.4		0.78	48.0		1.96	38.7		7.84
38	C7683; I-005 DUP	B25L28	5/18/10	280	J	1.29	698		32.2	27.4		0.64	46.2		1.81	33.9		6.43

39 **Analysis:**

40		TDL		2			50			1			2.5			1		
41	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
42		Both >5xTDL?		Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)		
43		RPD		36.3%			14.9%			13.6%			3.8%			13.2%		
44		Difference > 2 TDL?		Not applicable			Not applicable			Not applicable			Not applicable			Not applicable		

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0060
Checked H. M. Sullowey

Rev. No. 0
Date 5/16/11
Sheet No. 5 of 23

1 **Split Analysis - C7683 Interval 6 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232			Aluminum			Antimony			Barium		
2				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
3																											
4	C7683; I-006	B25L29	5/19/10	11.9		0.256	0.450		0.0590	0.591		0.120	0.662		0.050	0.591		0.120	7150		3.93	0.892	J	0.47	68.1		0.39
5	C7683; I-006 SPLIT	B25L38	5/19/10	11.6		0.312	0.388		0.0708	0.613		0.162	0.605		0.104	0.692		0.238	7670		14.3	2.30		0.20	80.2		0.26

6 **Analysis:**

7	TDL			0.5			0.1			0.2			1			1			5			0.6			0.5		
8	Split Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
9		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)		
10		RPD		2.6%															7.0%						16.3%		
11		Difference > 2 TDL?		Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable			Not applicable			Yes - assess further			Not applicable		

12

	Sampling Area	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead			Lithium		
13																											
14				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
15	C7683; I-006	B25L29	5/19/10	3830	J	78.6	17.0	J	0.16	5.33		1.57	13.9		0.79	0.120	B	0.20	15700		15.7	47.6	J	0.39	9.46		1.97
16	C7683; I-006 SPLIT	B25L38	5/19/10	3900		136	16.3		0.31	8.2		0.96	14.4		0.74	0.714		0.154	18400		30.3	32.8		0.18	28.4	B	6.7

17 **Analysis:**

18	TDL			100			0.2			2			1			0.5			5			0.5			2.5		
19	Split Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)		
20		Both >5xTDL?		Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)		
21		RPD		1.8%			4.2%						3.5%						15.8%			36.8%					
22		Difference > 2 TDL?		Not applicable			Not applicable			No - acceptable			Not applicable			No - acceptable			Not applicable			Not applicable			Yes - assess further		

23

	Sampling Area	HEIS Number	Sample Date	Magnesium			Manganese			Molybdenum			Nickel			Phosphorus			Potassium			Silicon			Sodium		
24																											
25				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
26	C7683; I-006	B25L29	5/19/10	4190	J	59.0	271		3.93	3.72		1.57	11.9	J	3.14	513		39.3	1190	J	314	330.0	J	1.57	497		39.3
27	C7683; I-006 SPLIT	B25L38	5/19/10	5400		84.8	305		0.16	4.0	B	0.32	13.7		0.23	584		15.1	1400		344	1630	C	15.8	476		48.1

28 **Analysis:**

29	TDL			75			5			2			4			10			400			2			50		
30	Split Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
31		Both >5xTDL?		Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)		
32		RPD		25.2%			11.8%									12.9%						132.7%			4.3%		
33		Difference > 2 TDL?		Not applicable			Not applicable			No - acceptable			No - acceptable			Not applicable			No - acceptable			Not applicable			Not applicable		

34

	Sampling Area	Sample Number	Sample Date	Strontium			Vanadium			Zinc		
35												
36				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
37	C7683; I-006	B25L29	5/19/10	24.8		0.79	40.2		1.97	34.4		7.86
38	C7683; I-006 SPLIT	B25L38	5/19/10	25.2		0.77	42.0		1.3	43.6		2.0

39 **Analysis:**

40	TDL		1	2.5	1
41	Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)
42		Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
43		RPD	1.6%	4.4%	23.6%
44		Difference > 2 TDL?	Not applicable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford
Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 6 of 23

1 **Duplicate Analysis - C7684 Interval 9 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Actinium-228 pCi/g	Q	MDA	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA	Thorium-228 pCi/g	Q	MDA	Thorium-232 pCi/g	Q	MDA
4	C7684; I-009	B27L31	12/17/10	0.570		0.108	17.8		0.241	0.420		0.048	0.570		0.108	0.634		0.038	0.570		0.108
5	C7684; I-009 DUP	B27L32	12/17/10	0.508		0.154	16.5		0.311	0.429		0.058	0.508		0.154	0.762		0.059	0.508		0.154

6 **Analysis:**

		Actinium-228	Potassium-40	Radium-226	Radium-228	Thorium-228	Thorium-232
7	TDL	0.2	0.5	0.1	0.2	1	1
8	Duplicate Analysis: Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
9	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
10	RPD		7.6%				
11	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

12

	Sampling Area	HEIS Number	Sample Date	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL
15	C7684; I-009	B27L77	12/17/10	7190		5.29	2.24		1.06	60.6		0.53	0.234		0.21	0.572	B	2.12	0.102	B	0.21	4500		106	10.0		0.21	5.57		2.12
16	C7684; I-009 DUP	B27L76	12/17/10	7970		5.04	2.88		1.01	79.0		0.50	0.248		0.20	0.603	B	2.02	0.092	B	0.200	6130		101	11.1		0.20	5.19		2.02

17 **Analysis:**

		Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt
18	TDL	5	1	0.5	0.2	2	0.2	100	0.2	2
19	Duplicate Analysis: Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
20	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
21	RPD	10.3%		26.4%				30.7%	10.4%	
22	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

23

	Sampling Area	HEIS Number	Sample Date	Copper mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Phosphorus mg/kg	Q	PQL
26	C7684; I-009	B27L77	12/17/10	8.66		1.06	15600		21.2	3.62		0.53	9.14		2.65	4330		79.4	276		5.29	0.333	B	2.12	8.51		4.23	381		52.9
27	C7684; I-009 DUP	B27L78	12/17/10	9.69		1.01	16700		20.2	4.45		0.50	8.80		2.52	4680		75.6	331		5.04	0.390	B	2.02	9.66		4.03	478		50.4

28 **Analysis:**

		Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel	Phosphorus
29	TDL	1	5	0.5	2.5	75	5	2	4	10
30	Duplicate Analysis: Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
31	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)	Yes (calc RPD)
32	RPD	11.2%	6.8%	20.6%		7.8%	18.1%			22.6%
33	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable

34

	Sampling Area	Sample Number	Sample Date	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Tin mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
37	C7684; I-009	B27L77	12/17/10	1480		423	661		2.12	170		52.9	22.1		1.06	2.23	B	10.6	37.6		2.65	35.1		10.6
38	C7684; I-009 DUP	B27L78	12/17/10	1450		403	1030		2.02	204		50.4	47.5		1.01	1.97	B	10.1	42.6		2.52	36.4		10.1

39 **Analysis:**

		Potassium	Silicon	Sodium	Strontium	Tin	Vanadium	Zinc
40	TDL	400	2	50	1	10	2.5	1
41	Duplicate Analysis: Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
42	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)		Yes (calc RPD)	Yes (calc RPD)
43	RPD		43.6%		73.0%		12.5%	3.6%
44	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford
Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway HMS

Rev. No. 0
Date 5/16/11
Sheet No. 7 of 23

1 **Duplicate Analysis - C7685 Interval 5 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA	Thorium-228 pCi/g	Q	MDA	Thorium-232 pCi/g	Q	MDA	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL
4	C7685; I-005	B26481	6/29/10	10.5		0.247	0.359		0.046	0.628		0.105	0.602		0.028	0.628		0.105	6970		3.27	1.46		0.65	67.7		0.33
5	C7685; I-005 DUP	B26482	6/29/10	10.8		0.297	0.390		0.057	0.745		0.134	0.712		0.035	0.745		0.134	7700		4.33	1.59		0.87	84.6		0.43

6 **Analysis:**

7		TDL	0.5			0.1			0.2			1			1			5			1			0.5		
8	Duplicate Analysis	Both > PQL?	Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
9		Both >5xTDL?	Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)		
10		RPD	2.8%															10.0%						22.2%		
11		Difference > 2 TDL?	Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable			Not applicable			No - acceptable			Not applicable		

12

	Sampling Area	HEIS Number	Sample Date	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Hexavalent Chromium mg/kg	Q	PQL
15	C7685; I-005	B26481	6/29/10	0.138		0.13	0.916	B	1.31	0.066	B	0.13	4040		65.4	11.0		0.13	5.44		1.31	14.1		0.65	0.16	B	0.20
16	C7685; I-005 DUP	B26482	6/29/10	0.145	B	0.17	0.927	B	1.73	0.077	B	0.17	4290		86.5	13.9		0.17	5.65		1.73	14.9		0.87	0.18	B	0.20

17 **Analysis:**

18		TDL	0.2			2			0.2			100			0.2			2			1			0.5		
19	Duplicate Analysis	Both > PQL?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)		
20		Both >5xTDL?										Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)					
21		RPD										6.0%			23.3%						5.5%					
22		Difference > 2 TDL?	No - acceptable			No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable			Not applicable			No - acceptable		

23

	Sampling Area	HEIS Number	Sample Date	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Phosphorus mg/kg	Q	PQL
26	C7685; I-005	B26481	6/29/10	15300		13.1	3.18		0.33	6.49		1.64	4250		49.1	232		3.27	1.33		1.31	8.14		2.62	488		32.7
27	C7685; I-005 DUP	B26482	6/29/10	16500		17.3	4.20		0.43	7.41		2.16	4450		64.9	251		4.33	3.98		1.73	8.84		3.46	564		43.3

28 **Analysis:**

29		TDL	5			0.5			2.5			75			5			2			4			10		
30	Duplicate Analysis	Both > PQL?	Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
31		Both >5xTDL?	Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)		
32		RPD	7.5%			27.6%						4.6%			7.9%									14.4%		
33		Difference > 2 TDL?	Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable			No - acceptable			No - acceptable			Not applicable		

34

	Sampling Area	Sample Number	Sample Date	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Tin mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
37	C7685; I-005	B26481	6/29/10	1010		262	589		1.31	544		32.7	31.5		0.65	1.75	B	6.54	44.8		1.64	30.6		6.54
38	C7685; I-005 DUP	B26482	6/29/10	1210		346	947		1.73	600		43.3	34.6		0.87	2.12	B	8.65	49.2		2.16	34.0		8.65

39 **Analysis:**

40		TDL	400			2			50			1			10			2.5			1		
41	Duplicate Analysis	Both > PQL?	Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)		
42		Both >5xTDL?	No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)		
43		RPD				46.6%			9.8%			9.4%						9.4%			10.5%		
44		Difference > 2 TDL?	No - acceptable			Not applicable			Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable		

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 18 of 23

1 **Duplicate Analysis - C7686 Interval 16 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Actinium-228			Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232		
3				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	C7686; I-016	B29LJ1	12/14/10	0.479		0.240	14.4		0.635	0.383		0.103	0.479		0.240	0.501		0.080	0.479		0.240
5	C7686; I-016 DUP	B29LJ4	12/14/10	0.707		0.327	14.1		0.975	0.438		0.148	0.707		0.327	0.550		0.090	0.707		0.327
6	**Analysis:**																				
7		TDL		0.2			0.5			0.1			0.2			1			1		
8	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
9		Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
10		RPD					2.1%														
11		Difference > 2 TDL?		No - acceptable			Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable		

12

	Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium			Cobalt		
14				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
15	C7686; I-016	B29LJ3	12/14/10	5090		3.61	1.41		0.72	43.3		0.36	0.128	B	0.14	0.878	B	1.44	0.068	B	0.14	2270		72.2	16.7		0.14	3.65		1.44
16	C7686; I-016 DUP	B29LJ5	12/14/10	5000		3.76	1.29		0.75	37.9		0.38	0.123	B	0.15	1.03	B	1.50	0.072	B	0.15	2130		75.2	15.3		0.15	3.81		1.50
17	**Analysis:**																													
18		TDL		5			1			0.5			0.2			2			0.2			100			0.2			2		
19	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)		
20		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)												Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)		
21		RPD		1.8%						13.3%												6.4%			8.7%					
22		Difference > 2 TDL?		Not applicable			No - acceptable			Not applicable			No - acceptable			No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable		

23

	Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Lithium			Magnesium			Manganese			Molybdenum			Nickel			Phosphorus		
25				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
26	C7686; I-016	B29LJ3	12/14/10	7.41		0.72	9450		14.4	3.25		0.36	7.15		1.80	3060		54.1	181		3.61	1.10	B	1.44	15.9		2.89	342		36.1
27	C7686; I-016 DUP	B29LJ5	12/14/10	7.44		0.75	10100		15.0	2.80		0.38	8.59		1.88	3180		56.4	197		3.76	1.89		1.50	16.5		3.01	282		37.6
28	**Analysis:**																													
29		TDL		1			5			0.5			2.5			75			5			2			4			10		
30	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)		
31		Both >5xTDL?		Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)						No-Stop (acceptable)			Yes (calc RPD)		
32		RPD		0.4%			6.6%			14.9%						3.2%			8.5%									19.2%		
33		Difference > 2 TDL?		Not applicable			Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable			No - acceptable			No - acceptable			Not applicable		

34

	Sampling Area	Sample Number	Sample Date	Potassium			Silicon			Sodium			Strontium			Tin			Vanadium			Zinc		
36				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
37	C7686; I-016	B29LJ3	12/14/10	887		289	323		1.44	546		36.1	23.2		0.72	1.04	B	7.22	19.7		1.80	20.9		7.22
38	C7686; I-016 DUP	B29LJ5	12/14/10	855		301	295		1.50	523		37.6	17.1		0.75	1.11	B	7.52	17.9		1.88	21.3		7.52
39	**Analysis:**																							
40		TDL		400			2			50			1			10			2.5			1		
41	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)		
42		Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)		
43		RPD					9.1%			4.3%			30.3%						9.6%			1.9%		
44		Difference > 2 TDL?		No - acceptable			Not applicable			Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable		

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway HMS

Rev. No. 0
Date 5/16/11
Sheet No. 9 of 23

1 **Duplicate Analysis - C7687 Interval 5 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA	Thorium-228 pCi/g	Q	MDA	Thorium-232 pCi/g	Q	MDA	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL
4	C7687; I-005	B25LC9	5/19/10	15.5		0.358	0.514		0.071	0.902		0.133	0.856		0.042	0.902		0.133	5670		3.91	1.60		0.78	69.0		0.39
5	C7687; I-005 DUP	B25LD0	5/19/10	15.6		0.237	0.471		0.050	0.831		0.107	0.747		0.029	0.831		0.107	5760		4.87	1.50		0.97	64.3		0.49

6 **Analysis:**

7		TDL		0.5			0.1			0.2			1			1			5			1			0.5		
8	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
9		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)		
10		RPD		0.6%															1.6%						7.1%		
11		Difference > 2 TDL?		Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable			Not applicable			No - acceptable			Not applicable		

12

	Sampling Area	HEIS Number	Sample Date	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL
15	C7687; I-005	B25LC9	5/19/10	0.155	B	0.16	0.644	B	1.56	4560		78.2	14.6		0.16	4.15		1.56	24.9		0.78	13800		15.6	4.47		0.39
16	C7687; I-005 DUP	B25LD0	5/19/10	0.142	B	0.20	0.743	B	1.95	4900		97.3	12.6		0.20	4.06		1.95	21.6		0.97	12300		19.5	4.31		0.49

17 **Analysis:**

18		TDL		0.2			2			100			0.2			2			1			5			0.5		
19	Duplicate Analysis	Both > PQL?		No-Stop (acceptable)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
20		Both >5xTDL?								Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)		
21		RPD								7.2%			14.7%						14.2%			11.5%			3.6%		
22		Difference > 2 TDL?		No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable			Not applicable		

23

	Sampling Area	HEIS Number	Sample Date	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Phosphorus mg/kg	Q	PQL	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL
26	C7687; I-005	B25LC9	5/19/10	7.29		1.95	3140		58.6	220		3.91	2.42		1.56	11.0		3.13	431		39.1	1110		313	947		1.56
27	C7687; I-005 DUP	B25LD0	5/19/10	8.42		2.43	3100		73.0	204		4.87	2.05		1.95	9.14		3.89	370		48.7	1120		389	1130		1.95

28 **Analysis:**

29		TDL		2.5			75			5			2			4			10			400			2		
30	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
31		Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)		
32		RPD					1.3%			7.5%									15.2%						17.6%		
33		Difference > 2 TDL?		No - acceptable			Not applicable			Not applicable			No - acceptable			No - acceptable			Not applicable			No - acceptable			Not applicable		

34

	Sampling Area	Sample Number	Sample Date	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Tin mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
37	C7687; I-005	B25LC9	5/19/10	439		39.1	24.1		0.78	1.66	B	7.82	29.7		1.95	24.2		7.82
38	C7687; I-005 DUP	B25LD0	5/19/10	478		48.7	24.6		0.97	1.81	B	9.73	30.1		2.43	28.0		9.73

39 **Analysis:**

40		TDL		50			1			10			2.5			1		
41	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)		
42		Both >5xTDL?		Yes (calc RPD)			Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)		
43		RPD		8.5%			2.1%						1.3%			14.6%		
44		Difference > 2 TDL?		Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable		

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway HMS

Rev. No. 0
Date 5/16/11
Sheet No. 10 of 23

1 **Duplicate Analysis - C7688 Interval 4 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Actinium-228			Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232		
2				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	C7688; I-004	B27LB9	12/29/10	0.526		0.087	10.1		0.202	0.404		0.043	0.526		0.087	0.565		0.032	0.526		0.087
5	C7688; I-004 DUP	B27LC0	12/29/10	0.474		0.187	10.5		0.369	0.382		0.095	0.474		0.187	0.548		0.054	0.474		0.187

6 **Analysis:**

7	TDL			0.2			0.5			0.1			0.2			1			1								
8	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)								
9		Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)								
10		RPD					3.9%																				
11		Difference > 2 TDL?		No - acceptable			Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable								

	Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Calcium			Chromium			Cobalt			Copper		
14				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
15	C7688; I-004	B28F22	12/29/10	5880		10.1	2.53		2.03	58.9		1.01	0.300	B	0.41	8440		203	4.39		0.41	10.1		4.05	17.3		2.03
16	C7688; I-004 DUP	B28F23	12/29/10	5600		11.9	2.25	B	2.39	58.3		1.19	0.303	B	0.48	8200		239	4.10		0.48	10.2		4.77	18.4		2.39

17 **Analysis:**

18	TDL			5			1			0.5			0.2			100			0.2			2			1		
19	Duplicate Analysis	Both > PQL?		Yes (continue)			No-Stop (acceptable)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
20		Both >5xTDL?		Yes (calc RPD)						Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)		
21		RPD		4.9%						1.0%						2.9%			6.8%			1.0%			6.2%		
22		Difference > 2 TDL?		Not applicable			No - acceptable			Not applicable			No - acceptable			Not applicable			Not applicable			Not applicable			Not applicable		

	Sampling Area	HEIS Number	Sample Date	Iron			Lead			Lithium			Magnesium			Manganese			Molybdenum			Nickel			Phosphorus		
25				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
26	C7688; I-004	B28F22	12/29/10	36700		40.5	2.46		1.01	4.74	B	5.07	5240		152	414		10.1	0.680	B	4.05	7.29	B	8.10	1620		101
27	C7688; I-004 DUP	B28F23	12/29/10	37700		47.7	2.55		1.19	4.47	B	5.97	5380		179	417		11.9	0.637	B	4.77	7.08	B	9.55	1580		119

28 **Analysis:**

29	TDL			5			0.5			2.5			75			5			2			4			10		
30	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (continue)		
31		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)						Yes (calc RPD)			Yes (calc RPD)									Yes (calc RPD)		
32		RPD		2.7%									2.6%			0.7%									2.5%		
33		Difference > 2 TDL?		Not applicable			No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable			No - acceptable			Not applicable		

	Sampling Area	Sample Number	Sample Date	Potassium			Silicon			Sodium			Strontium			Tin			Vanadium			Zinc		
36				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
37	C7688; I-004	B28F22	12/29/10	654	B	810	596		4.05	594		101	26.5		2.03	4.85	B	20.3	102		5.07	62.8		20.3
38	C7688; I-004 DUP	B28F23	12/29/10	626	B	955	668		4.77	558		119	25.7		2.39	5.21	B	23.9	102		5.97	63.0		23.9

39 **Analysis:**

40	TDL			400			2			50			1			10			2.5			1					
41	Duplicate Analysis	Both > PQL?		No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)					
42		Both >5xTDL?					Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)					
43		RPD					11.4%			6.3%			3.1%						0.0%			0.3%					
44		Difference > 2 TDL?		No - acceptable			Not applicable			Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable					

CALCULATION SHEET

Washington Closure Hanford
Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway HMS

Rev. No. 0
Date 5/16/11
Sheet No. 11 of 23

Duplicate Analysis - C7688 Interval 8 Soil Samples

Sampling Area	Sample Number	Sample Date	Actinium-228 pCi/g	Q	MDA	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA	Thorium-228 pCi/g	Q	MDA	Thorium-232 pCi/g	Q	MDA
C7688; I-008	B27LC5	1/3/11	0.536		0.256	9.26		0.552	0.464		0.082	0.536		0.256	0.465		0.096	0.536		0.256
C7688; I-008 DUP	B27LC4	1/3/11	0.599		0.346	11.3		0.598	0.334		0.182	0.599		0.346	0.448		0.094	0.599		0.346

Analysis:

	TDL	0.2	0.5	0.1	0.2	1	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD		19.8%				
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

Sampling Area	HEIS Number	Sample Date	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL
C7688; I-008	B28F28	1/3/11	6450		13.8	1.60	B	2.77	65.2		1.38	0.191	B	0.55	5480		277	8.47		0.55	9.93		5.54	13.2		2.77
C7688; I-008 DUP	B28F27	1/3/11	6840		15.7	2.14	B	3.14	76.6		1.57	0.208	B	0.63	6300		314	11.3		0.63	10.7		6.29	16.8		3.14

Analysis:

	TDL	5	1	0.5	0.2	100	0.2	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)		Yes (calc RPD)		Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	5.9%		16.1%		13.9%	28.6%		24.0%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Sampling Area	HEIS Number	Sample Date	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Phosphorus mg/kg	Q	PQL
C7688; I-008	B28F28	1/3/11	24500		55.4	3.24		1.38	6.82	B	6.92	4770		208	350		13.8	1.27	B	5.54	8.76	B	11.1	1120		138
C7688; I-008 DUP	B28F27	1/3/11	28200		62.9	3.52		1.57	3.24	B	7.86	4560		236	373		15.7	1.51	B	6.29	10.5	B	12.6	1240		157

Analysis:

	TDL	5	0.5	2.5	75	5	2	4	10
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)		Yes (calc RPD)	Yes (calc RPD)			Yes (calc RPD)
	RPD	14.0%	8.3%		4.5%	6.4%			10.2%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable

Sampling Area	Sample Number	Sample Date	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
C7688; I-008	B28F28	1/3/11	930	B	1110	526		5.54	517		138	23.7		2.77	59.5		6.92	47.1		27.7
C7688; I-008 DUP	B28F27	1/3/11	938	B	1260	832		6.29	613		157	25.2		3.14	80.8		7.86	53.1		31.4

Analysis:

	TDL	400	2	50	1	2.5	1
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?		Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD		45.1%	17.0%	6.1%	30.4%	12.0%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 12 of 23

1 **Duplicate Analysis - C7689 Interval 4 Soil Samples**

2 Sampling Area	Sample Number	Sample Date	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA
4 C7689; I-004	B26WB8	7/28/10	7.70		0.592	0.390		0.101	0.416		0.173
5 C7689; I-004 DUP	B26WB9	7/28/10	7.88		0.649	0.317		0.147	0.468		0.261

6 **Analysis:**

7		Potassium-40	Radium-226	Radium-228
	TDL	0.5	0.1	0.2
8 Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)
9	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
10	RPD	2.3%		
11	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable

12

13 Sampling Area	HEIS Number	Sample Date	Aluminum mg/kg	Q	PQL	Antimony mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL
15 C7689; I-004	B26WF0	7/28/10	5030		4.02	0.803		0.48	2.54		0.80	56.1		0.40	0.161	B	0.16	0.056	B	0.16	5780		80.4	12.8		0.16	10.2		1.61
16 C7689; I-004 DUP	B26WF1	7/28/10	4780		4.17	0.713		0.50	2.10		0.83	53.1		0.42	0.152	B	0.17	0.044	B	0.17	5230		83.4	7.11		0.17	9.48		1.67

17 **Analysis:**

18		Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt
	TDL	5	0.6	1	0.5	0.2	0.2	100	0.2	2
19 Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
20	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)			Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
21	RPD	5.1%			5.5%			10.0%	57.2%	
22	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

23

24 Sampling Area	HEIS Number	Sample Date	Copper mg/kg	Q	PQL	Hexavalent Chromium mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL
26 C7689; I-004	B26WF0	7/28/10	16.5		0.80	0.14	B	0.21	26100		16.1	2.54		0.40	2.27		2.01	3950		60.3	317		4.02	7.04		1.61	8.48		3.22
27 C7689; I-004 DUP	B26WF1	7/28/10	16.3		0.83	0.38		0.21	24500		16.7	2.20		0.42	2.21		2.08	3790		62.5	305		4.17	1.98		1.67	7.65		3.33

28 **Analysis:**

29		Copper	Hexavalent Chromium	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum	Nickel
	TDL	1	0.5	5	0.5	2.5	75	5	2	4
30 Duplicate Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
31	Both >5xTDL?	Yes (calc RPD)		Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
32	RPD	1.2%		6.3%			4.1%	3.9%		
33	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	Yes - assess further	No - acceptable

34

35 Sampling Area	Sample Number	Sample Date	Phosphorus mg/kg	Q	PQL	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
37 C7689; I-004	B26WF0	7/28/10	1160		40.2	725		322	179		1.61	408		40.2	22.0		0.80	72.1		2.01	49.3		8.04
38 C7689; I-004 DUP	B26WF1	7/28/10	1210		41.7	652		333	195		1.67	403		41.7	21.2		0.83	69.9		2.08	45.9		8.34

39 **Analysis:**

40		Phosphorus	Potassium	Silicon	Sodium	Strontium	Vanadium	Zinc
	TDL	10	400	2	50	1	2	3
41 Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
42	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
43	RPD	4.2%		8.6%	1.2%	3.7%	3.1%	7.1%
44	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford
Originator P. L. Benjamin
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sullowey

Rev. No. 0
Date 5/16/11
Sheet No. 13 of 23

Duplicate Analysis - C7690 Interval 4 Soil Samples

Sampling Area	Sample Number	Sample Date	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA
C7690; I-004	B26V81	7/27/10	13.3		0.484	0.297		0.101	0.474	0	0.313
C7690; I-004 DUP	B26V82	7/27/10	15.2		0.748	0.412		0.119	0.522		0.318

Analysis:

	TDL	0.5	0.1	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	13.3%		
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable

Sampling Area	HEIS Number	Sample Date	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL
C7690; I-004	B26V99	7/27/10	4270		4.82	1.23		0.96	50.1		0.48	0.118	B	0.19	0.555	B	1.93	0.069	B	0.19	2210		96.4	8.37		0.19	2.99		1.93
C7690; I-004 DUP	B26VB0	7/27/10	4170		4.83	1.30		0.97	39.3		0.48	0.122	B	0.19	0.613	B	1.93	0.076	B	0.19	2140		96.7	7.48		0.19	2.91		1.93

Analysis:

	TDL	5	1	0.5	0.2	2	0.2	100	0.2	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)				Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	2.4%		24.2%				3.2%	11.2%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Sampling Area	HEIS Number	Sample Date	Copper mg/kg	Q	PQL	Hexavalent Chromium mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL
C7690; I-004	B26V99	7/27/10	6.67		0.96	0.15	B	0.20	7910		19.3	2.64		0.48	6.92		2.41	2510		72.3	127		4.82	0.262	B	1.93	7.85		3.86
C7690; I-004 DUP	B26VB0	7/27/10	6.51		0.97	0.17	B	0.20	8600		19.3	3.04		0.48	7.06		2.42	2400		72.5	129		4.83	0.680	B	1.93	7.39		3.87

Analysis:

	TDL	1	0.5	5	0.5	2.5	75	5	2	4
Duplicate Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)		Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)
	RPD	2.4%		8.4%	14.1%		4.5%	1.6%		
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

Sampling Area	Sample Number	Sample Date	Phosphorus mg/kg	Q	PQL	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
C7690; I-004	B26V99	7/27/10	263		48.2	751		386	1150		1.93	176		48.2	17.7		0.96	16.1		2.41	18.2		9.64
C7690; I-004 DUP	B26VB0	7/27/10	306		48.3	778		387	1190		1.93	179		48.3	21.9		0.97	18.6		2.42	19.5		9.67

Analysis:

	TDL	10	400	2	50	1	2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	15.1%		3.4%		21.2%	14.4%	6.9%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford
Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway HMS

Rev. No. 0
Date 5/16/11
Sheet No. 14 of 23

1 **Duplicate Analysis - C7691 Interval 9 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Actinium-228			Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232			Aluminum			Antimony			Arsenic		
3				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	C7691; I-009	B25N96	6/24/10	0.512		0.238	12.5		0.727	0.381		0.118	0.512		0.238	0.760		0.093	0.512		0.238	6160		4.88	0.539	B	0.59	1.92		0.98
5	C7691; I-009 DUP	B25N92	6/24/10	0.533		0.357	11.4		0.871	0.383		0.147	0.533		0.357	0.532		0.085	0.533		0.357	5010		3.32	0.315	B	0.40	3.48		0.68
6	**Analysis:**																													
7	TDL			0.2			0.5			0.1			0.2			1			1			5			0.6			1		
8	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)		
9		Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)						No-Stop (acceptable)		
10		RPD					9.2%															20.6%								
11		Difference > 2 TDL?		No - acceptable			Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable			Not applicable			No - acceptable			No - acceptable		

	Sampling Area	HEIS Number	Sample Date	Barium			Beryllium			Boron			Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
14				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
15	C7691; I-009	B25N96	6/24/10	54.6		0.49	0.168	B	0.20	1.12	B	1.95	0.075	B	0.20	7960		97.5	12.1		0.20	4.21		1.95	16.6		0.98	0.11	B	0.23
16	C7691; I-009 DUP	B25N92	6/24/10	44.0		0.33	0.137		0.13	0.779	B	1.33	0.057	B	0.13	6270		66.3	10.6		0.13	3.73		1.33	15.0		0.66	0.16	B	0.21
17	**Analysis:**																													
18	TDL			0.5			0.2			2			0.2			100			0.2			2			1			0.5		
19	Duplicate Analysis	Both > PQL?		Yes (continue)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)		
20		Both >5xTDL?		Yes (calc RPD)												Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)					
21		RPD		21.5%												23.8%			13.2%						10.1%					
22		Difference > 2 TDL?		Not applicable			No - acceptable			No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable			Not applicable			No - acceptable		

	Sampling Area	HEIS Number	Sample Date	Iron			Lead			Lithium			Magnesium			Manganese			Molybdenum			Nickel			Phosphorus			Potassium		
25				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
26	C7691; I-009	B25N96	6/24/10	12500		19.5	26.9		0.49	6.57		2.44	3910		73.1	212		4.88	1.40	B	1.95	10.2		3.90	399		48.8	1020		390
27	C7691; I-009 DUP	B25N92	6/24/10	11500		13.3	19.3		0.33	6.41		1.66	3390		49.8	189		3.32	1.17	B	1.33	8.39		2.65	358		33.2	847		265
28	**Analysis:**																													
29	TDL			5			0.5			2.5			75			5			2			4			10			400		
30	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)		
31		Both >5xTDL?		Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)						No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)		
32		RPD		8.3%			32.9%						14.2%			11.5%									10.8%					
33		Difference > 2 TDL?		Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable			No - acceptable			No - acceptable			Not applicable			No - acceptable		

	Sampling Area	Sample Number	Sample Date	Silicon			Sodium			Strontium			Tin			Vanadium			Zinc		
36				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
37	C7691; I-009	B25N96	6/24/10	917		1.95	201		48.8	35.5		0.98	1.71	B	9.75	30.4		2.44	26.2		9.75
38	C7691; I-009 DUP	B25N92	6/24/10	337		1.33	174		33.2	27.5		0.66	1.42	B	6.63	28.6		1.66	23.9		6.63
39	**Analysis:**																				
40	TDL			2			50			1			10			2.5			1		
41	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)		
42		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)		
43		RPD		92.5%						25.4%						5.4%			9.2%		
44		Difference > 2 TDL?		Not applicable			No - acceptable			Not applicable			No - acceptable			Not applicable			Not applicable		

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 15 of 23

1 **Duplicate Analysis - C7692 Interval 9 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA
4	C7692; I-009	B276Y1	8/30/10	11.5		0.481	0.365		0.091	0.579		0.145
5	C7692; I-009 DUP	B276Y2	8/30/10	10.6		0.854	0.354		0.127	0.762		0.236

6 **Analysis:**

7		TDL	0.5	0.1	0.2
8	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)
9		Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
10		RPD	8.1%		
11		Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable

12

	Sampling Area	HEIS Number	Sample Date	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL
15	C7692; I-009	B276W4	8/30/10	3850		4.78	1.56		0.96	30.6		0.48	0.124	B	0.19	0.675	B	1.91	0.073	B	0.19	5970		95.6	9.85		0.19
16	C7692; I-009 DUP	B276W5	8/30/10	3640		4.10	1.19		0.82	34.2		0.41	0.120	B	0.16	0.469	B	1.64	0.054	B	0.16	5150		82.0	9.22		0.16

17 **Analysis:**

18		TDL	5	1	0.5	0.2	2	0.2	100	0.2
19	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
20		Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)				Yes (calc RPD)	Yes (calc RPD)
21		RPD	5.6%		11.1%				14.7%	6.6%
22		Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

23

	Sampling Area	HEIS Number	Sample Date	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL
26	C7692; I-009	B276W4	8/30/10	2.67		1.91	10.3		0.96	9090		19.1	4.52		0.48	5.59		2.39	2470		71.7	199		4.78	0.846	B	1.91
27	C7692; I-009 DUP	B276W5	8/30/10	2.35		1.64	10.5		0.82	8050		16.4	4.69		0.41	5.06		2.05	2160		61.5	143		4.10	0.775	B	1.64

28 **Analysis:**

29		TDL	2	1	5	0.5	2.5	75	5	2
30	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
31		Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	
32		RPD		1.9%	12.1%	3.7%		13.4%	32.7%	
33		Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable

34

	Sampling Area	Sample Number	Sample Date	Nickel mg/kg	Q	PQL	Phosphorus mg/kg	Q	PQL	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
37	C7692; I-009	B276W4	8/30/10	6.23		3.82	317		47.8	788		382	476		1.91	107		47.8	19.5		0.96	16.6		2.39	26.0		9.56
38	C7692; I-009 DUP	B276W5	8/30/10	6.65		3.28	231		41.0	742		328	438		1.64	124		41.0	17.7		0.82	15.3		2.05	19.5		6.20

39 **Analysis:**

40		TDL	4	10	400	2	50	1	2.5	1
41	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
42		Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
43		RPD		31.4%		8.3%		9.7%	19.5%	28.6%
44		Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford
Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/14
Sheet No. 16 of 23

Duplicate Analysis - C7693 Interval 5 Soil Samples

Sampling Area	Sample Number	Sample Date	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA	Thorium-228 pCi/g	Q	MDA	Thorium-232 pCi/g	Q	MDA	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL
C7693; I-005	B25YK8	9/15/10	11.4		0.801	0.432		0.145	0.516		0.344	0.590		0.120	0.516		0.344	5800		3.56	1.51		0.71	61.9		0.36
C7693; I-005 DUP	B25YK9	9/15/10	11.4		0.480	0.534		0.112	0.730		0.237	0.548		0.078	0.730		0.237	7100		4.83	1.75		0.97	68.8		0.48

Analysis:

	TDL		0.5			0.1			0.2			1			1			5			1			0.5		
Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
	Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)		
	RPD		0.0%															20.2%						10.6%		
	Difference > 2 TDL?		Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable			Not applicable			No - acceptable			Not applicable		

Sampling Area	HEIS Number	Sample Date	Beryllium mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL
C7693; I-005	B25YK8	9/15/10	0.159		0.14	0.078	B	0.14	6240		71.1	10.9		0.14	4.18		1.42	11.7		0.71	12700		14.2	3.77		0.36
C7693; I-005 DUP	B25YK9	9/15/10	0.185	B	0.19	0.100	B	0.19	7180		96.7	11.9		0.19	4.93		1.93	13.6		0.97	15000		19.3	4.41		0.48

Analysis:

	TDL		0.2			0.2			100			0.2			2			1			5			0.5		
Duplicate Analysis	Both > PQL?		No-Stop (acceptable)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
	Both >5xTDL?								Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)		
	RPD								14.0%			8.8%						15.0%			16.6%			15.6%		
	Difference > 2 TDL?		No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable			Not applicable		

Sampling Area	HEIS Number	Sample Date	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Phosphorus mg/kg	Q	PQL	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL
C7693; I-005	B25YK8	9/15/10	7.17		1.78	3490		53.4	223		3.56	1.35	B	1.42	7.45		2.85	427		35.6	1080		285	412		1.42
C7693; I-005 DUP	B25YK9	9/15/10	7.89		2.42	4100		72.5	256		4.83	1.51	B	1.93	9.11		3.87	450		48.3	1180		387	708		1.93

Analysis:

	TDL		2.5			75			5			2			4			10			400			2		
Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
	Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)						No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)		
	RPD					16.1%			13.8%									5.2%						52.9%		
	Difference > 2 TDL?		No - acceptable			Not applicable			Not applicable			No - acceptable			No - acceptable			Not applicable			No - acceptable			Not applicable		

Sampling Area	Sample Number	Sample Date	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
C7693; I-005	B25YK8	9/15/10	410		35.6	30.3		0.71	34.2		1.78	28.1		7.11
C7693; I-005 DUP	B25YK9	9/15/10	507		48.3	35.9		0.97	39.9		2.42	32.0		9.67

Analysis:

	TDL	50	1	2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	21.2%	16.9%	15.4%	13.0%
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 17 of 23

1 **Duplicate Analysis - C7694 Interval 8 Soil Samples**

2	Sampling Area	Sample Number	Sample Date	Actinium-228			Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232		
3				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	C7694; I-008	B260B5	1/10/11	0.793		0.130	16.6		0.379	0.495		0.058	0.793		0.130	0.721		0.036	0.793		0.130
5	C7694; I-008 DUP	B26T02	1/10/11	0.698		0.245	11.6		0.608	0.207		0.148	0.698		0.245	0.604		0.106	0.698		0.245
6	**Analysis:**																				
7		TDL		0.2			0.5			0.1			0.2			1			1		
8	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
9		Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
10		RPD					35.5%														
11		Difference > 2 TDL?		No - acceptable			Not applicable			Yes - assess further			No - acceptable			No - acceptable			No - acceptable		

12

13	Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt		
14				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
15	C7694; I-008	B260B5	1/10/11	4980		4.04	1.16		0.81	45.7		0.40	0.127	B	0.16	0.061	B	0.16	5060		80.8	12.7		0.16	3.80		1.62
16	C7694; I-008 DUP	B26T03	1/10/11	5460		4.68	1.34		0.94	60.1		0.47	0.225		0.19	0.069	B	0.19	6180		93.7	10.3		0.19	3.88		1.67
17	**Analysis:**																										
18		TDL		5			1			0.5			0.2			0.2			100			0.2			2		
19	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)		
20		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)									Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)		
21		RPD		9.2%						27.2%									19.9%			20.9%					
22		Difference > 2 TDL?		Not applicable			No - acceptable			Not applicable			No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable		

23

24	Sampling Area	HEIS Number	Sample Date	Copper			Hexavalent chromium			Iron			Lead			Lithium			Magnesium			Manganese			Molybdenum		
25				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
26	C7694; I-008	B260B5	1/10/11	10.2		0.81	0.57		0.55	10400		16.2	2.23		0.40	6.21		2.02	3600		60.6	207		4.04	0.855	B	1.62
27	C7694; I-008 DUP	B26T03	1/10/11	13.6		0.94	0.84		0.59	11900		18.7	3.41		0.47	6.92		2.34	3240		70.3	194		4.68	0.426	B	1.87
28	**Analysis:**																										
29		TDL		1			0.5			5			0.5			2.5			75			5			2		
30	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)		
31		Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)					
32		RPD		30.0%						13.5%									10.5%			6.5%					
33		Difference > 2 TDL?		Not applicable			No - acceptable			Not applicable			Yes - assess further			No - acceptable			Not applicable			Not applicable			No - acceptable		

34

35	Sampling Area	Sample Number	Sample Date	Nickel			Phosphorus			Potassium			Silicon			Sodium			Strontium			Tin			Vanadium			Zinc		
36				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
37	C7694; I-008	B260B5	1/10/11	9.52		3.23	334		40.4	981		323	391		1.62	180		40.4	24.6		0.81	1.42	B	8.08	25.1		2.02	25.7		8.08
38	C7694; I-008 DUP	B26T03	1/10/11	9.39		3.75	452		46.8	836		375	459		1.87	220		46.8	35.3		0.94	1.99	B	9.37	31.2		2.34	28.7		9.37
39	**Analysis:**																													
40		TDL		4			10			400			2			50			1			10			2.5			1		
41	Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)		
42		Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)		
43		RPD					30.0%						16.0%						35.7%						21.7%			11.0%		
44		Difference > 2 TDL?		No - acceptable			Not applicable			No - acceptable			Not applicable			No - acceptable			Not applicable			No - acceptable			Not applicable			Not applicable		

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 18 of 23

1 **Duplicate Analysis - C7695 Interval 15 Soil Samples**

	Sampling Area	Sample Number	Sample Date	Actinium-228			Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	C7695; I-015	B27FW6	11/10/10	0.605		0.119	14.8		0.245	0.408		0.047	0.605		0.119	0.530		0.033	0.605		0.119
5	C7695; I-015 DUP	B27FV5	11/10/10	0.637		0.085	16.0		0.221	0.428		0.044	0.636		0.031	0.636		0.031	0.637		0.085

6 **Analysis:**

7	TDL	0.2	0.5	0.1	0.2	1	1
8	Duplicate Analysis: Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
9	Duplicate Analysis: Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
10	Duplicate Analysis: RPD		7.8%				
11	Duplicate Analysis: Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

12

	Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium		
14				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
15	C7695; I-015	B27H37	11/10/10	6190		4.04	2.08		0.81	54.5		0.40	0.216		0.16	0.600	B	1.62	0.062	B	0.16	3910	J	80.8	16.0		0.16
16	C7695; I-015 DUP	B27H26	11/10/10	5820		3.76	2.74		0.75	52.2		0.38	0.222		0.15	0.601	B	1.51	0.068	B	0.15	3840	J	75.3	15.7		0.15

17 **Analysis:**

18	TDL	5	1	0.5	0.2	2	0.2	100	0.2
19	Duplicate Analysis: Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
20	Duplicate Analysis: Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)	Yes (calc RPD)
21	Duplicate Analysis: RPD	6.2%		4.3%				1.8%	1.9%
22	Duplicate Analysis: Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

23

	Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead			Lithium			Magnesium			Manganese			Molybdenum		
25				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
26	C7695; I-015	B27H37	11/10/10	4.67		1.62	9.86		0.81	15600		16.2	2.79		0.40	8.65		2.02	4560		60.6	245		4.04	1.26	B	1.62
27	C7695; I-015 DUP	B27H26	11/10/10	4.97		1.51	10.6		0.75	14300		15.1	3.00		0.38	7.69		1.88	3640		56.5	247		3.76	0.855	B	1.51

28 **Analysis:**

29	TDL	2	1	5	0.5	2.5	75	5	2
30	Duplicate Analysis: Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
31	Duplicate Analysis: Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	
32	Duplicate Analysis: RPD		7.2%	8.7%	7.3%		22.4%	0.8%	
33	Duplicate Analysis: Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable

34

	Sampling Area	Sample Number	Sample Date	Nickel			Phosphorus			Potassium			Silicon			Sodium			Strontium			Vanadium			Zinc		
36				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
37	C7695; I-015	B27H37	11/10/10	12.0	J	3.23	422		40.4	1000		323	398	J	1.62	224		40.4	23.7		0.81	37.3		2.02	30.1		8.08
38	C7695; I-015 DUP	B27H26	11/10/10	9.4	J	3.01	411		37.6	995		301	385	J	1.51	194		37.6	22.2		0.75	34.2		1.88	27.8		7.53

39 **Analysis:**

40	TDL	4	10	400	2	50	1	2.5	1
41	Duplicate Analysis: Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
42	Duplicate Analysis: Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
43	Duplicate Analysis: RPD		2.6%		3.3%		6.5%	8.7%	7.9%
44	Duplicate Analysis: Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 19 of 23

1 Duplicate Analysis - C7831 Interval 7 Soil Samples

Sampling Area	Sample Number	Sample Date	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA	Total beta radiostrontium pCi/g	Q	MDA
C7831; I-007	B272P5	8/24/10	15.2		0.48	0.512		0.085	0.693		0.214	1.23		0.316
C7831; I-007 DUP	B273H1	8/24/10	15.2		0.263	0.471		0.080	0.710		0.134	1.82		0.606

Analysis:

		Potassium-40	Radium-226	Radium-228	Total beta radiostrontium
Duplicate Analysis	TDL	0.5	0.1	0.2	1
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	0.0%			
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable

Sampling Area	HEIS Number	Sample Date	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL
C7831; I-007	B272C8	8/24/10	8070		4.19	2.36		0.84	160		0.42	0.163	B	0.170	0.953	B	1.68	0.087	B	0.17	6920		83.8	19.6	J	0.17
C7831; I-007 DUP	B272C4	8/24/10	7120		3.41	1.57		0.68	79.2		0.34	0.169		0.140	0.949	B	1.36	0.085	B	0.14	6550		68.2	25.6	J	0.14

Analysis:

		Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium
Duplicate Analysis	TDL	5	1	0.5	0.2	2	0.2	100	0.2
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)				Yes (calc RPD)	Yes (calc RPD)
	RPD	12.5%		67.6%				5.5%	26.5%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

Sampling Area	HEIS Number	Sample Date	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL
C7831; I-007	B272C8	8/24/10	4.54		1.68	23.4	J	0.84	15500		16.8	2.62		0.42	10.8		2.09	5220		62.8	282		4.19	1.67	B	1.68
C7831; I-007 DUP	B272C4	8/24/10	4.43		1.36	19.2	J	0.68	14400		13.6	2.38		0.34	9.43		1.71	4270		51.2	255		3.41	3.38		1.36

Analysis:

		Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum
Duplicate Analysis	TDL	2	1	5	0.5	2.5	75	5	2
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	
	RPD		19.7%	7.4%			20.0%	10.1%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Sampling Area	Sample Number	Sample Date	Nickel mg/kg	Q	PQL	Phosphorus mg/kg	Q	PQL	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Tin mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL
C7831; I-007	B272C8	8/24/10	10.6		3.35	477		41.9	2080		335	935		1.68	488		41.9	34.4		0.84	0.937	B	8.38	41.6		2.09
C7831; I-007 DUP	B272C4	8/24/10	10.5		2.73	429		34.1	1400		273	836		1.36	522		34.1	32.3		0.68	1.02	B	6.82	33.4	0	1.71

Analysis:

		Nickel	Phosphorus	Potassium	Silicon	Sodium	Strontium	Tin	Vanadium
Duplicate Analysis	TDL	4	10	400	2	50	1	10	2.5
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)		Yes (calc RPD)
	RPD		10.6%		11.2%	6.7%	6.3%		21.9%
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable	Not applicable

Sampling Area	Sample Number	Sample Date	Zinc mg/kg	Q	PQL	Chloride mg/kg	Q	PQL	Fluoride mg/kg	Q	PQL	Nitrate mg/kg	Q	PQL	Nitrogen in Nitrite and Nitrate mg/kg	Q	PQL	Sulfate mg/kg	Q	PQL
C7831; I-007	B272C8	8/24/10	33.1		8.38	5.3		4.4	1.0	B	4.4	2.4	BJ	4.4	0.63		0.44	24.1		4.4
C7831; I-007 DUP	B272C4	8/24/10	30.7		6.82	5.4		5.1	1.0	B	5.1	2.3	BJ	5.1	0.65		0.51	27.0		5.1

Analysis:

		Zinc	Chloride	Fluoride	Nitrate	Nitrogen in Nitrite and Nitrate	Sulfate
Duplicate Analysis	TDL	1	2	5	2.5	0.75	1
	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)			No-Stop (acceptable)	Yes (calc RPD)
	RPD	7.5%					11.4%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 20 of 23

1 **Split Analysis - C7831 Interval 8 Soil Samples**

2 Sampling Area	Sample Number	Sample Date	Potassium-40			Radium-226			Radium-228			Total beta radiostrontium		
3			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4 C7831; I-008	B272F6	8/24/10	16.9		0.318	0.558		0.0570	0.945		0.129	1.54		0.377
5 C7831; I-008 SPLT	B27272	8/24/10	17.1		0.304	0.645		0.0698	0.875		0.133	0.757		0.122

6 **Analysis:**

7	TDL	0.5	0.1	0.2	1
8 Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
9	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
10	RPD	1.2%	14.5%		
11	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

12

13 Sampling Area	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt		
14			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
15 C7831; I-008	B272C9	8/24/10	5990		3.56	0.318	BJ	0.43	1.70		0.72	49.6		0.36	0.176		0.14	0.091	B	0.14	6230		71.7	12.2	J	0.14	3.74		1.43
16 C7831; I-008 SPLT	B272D2	8/24/10	6390		14.2	0.70	B	0.20	20.2		3.2	65.9		0.25	0.31	B	0.17	3.6	B	0.51	6690		135	12.6		0.31	7.8		0.95

17 **Analysis:**

18	TDL	5	0.6	1	0.5	0.2	0.2	100	0.2	2
19 Split Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
20	Both >5xTDL?	Yes (calc RPD)		No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)		Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
21	RPD	6.5%			28.2%			7.1%	3.2%	
22	Difference > 2 TDL?	Not applicable	No - acceptable	Yes - assess further	Not applicable	No - acceptable	Yes - assess further	Not applicable	Not applicable	Yes - assess further

23

24 Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Lithium			Magnesium			Manganese			Molybdenum			Nickel			Phosphorus		
25			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
26 C7831; I-008	B272C9	8/24/10	10.9	J	0.72	13400		14.3	2.72		0.36	8.16		1.79	3460		53.8	218		3.58	2.12		1.43	6.09		2.87	420		35.8
27 C7831; I-008 SPLT	B272D2	8/24/10	10.8		0.74	14400		30.2	2.6		0.17	10.9	B	6.7	4030		84.4	278	C	0.16	2.1	B	1.0	7.9		0.23	461	C	15.0

28 **Analysis:**

29	TDL	1	5	0.5	2.5	75	5	2	4	10
30 Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
31	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
32	RPD	0.9%	7.2%	4.5%		15.2%	24.2%			9.3%
33	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable

34

35 Sampling Area	Sample Number	Sample Date	Potassium			Silicon			Sodium			Strontium			Tin			Vanadium			Zinc			Chloride			Sulfate		
36			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
37 C7831; I-008	B272C9	8/24/10	968		287	721		1.43	361		35.8	25.8		0.72	0.917	B	7.17	33.0		1.79	28.9		7.17	4.6	B	5.1	10.6		5.1
38 C7831; I-008 SPLT	B272D2	8/24/10	1550		342	471		10.2	359		47.8	45.1		2.5	1.4	B	0.83	33.4		1.3	32.5		2.0	3.4		0.20	13.0		0.51

39 **Analysis:**

40	TDL	400	2	50	1	10	2.5	1	2	5
41 Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
42	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)		Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)
43	RPD		41.9%	0.6%	54.4%		1.2%	11.7%		
44	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford PLB

Originator P. L. Benjamin
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway HMS

Rev. No. 0
Date 5/16/11
Sheet No. 21 of 23

1 **Duplicate Analysis - C7831 Interval 16 Groundwater Samples**

2	Sampling	Sample	Sample	Aluminum			Barium			Boron			Calcium			Chromium			Cobalt			Lithium			Magnesium		
3	Area	Number	Date	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
4	C7831; I-016	B272J0	8/26/10	36.4	B	50	39.3		2	51.5		10	55300		100	3.27		2	1.24	B	2	6.74	B	20	10100		100
5	C7831; I-016 DUP	B272J1	8/26/10	28.2	B	50	39.1		2	50.8		10	54900		100	3.28		2	1.45	B	2	7.01	B	20	9970		100

6 **Analysis:**

7		TDL	50	5	20	1000	2	20	25	750
8	Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)
9		Both >5xTDL?		Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)
10		RPD		0.5%		0.7%				1.3%
11		Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable

12

13	Sampling	HEIS	Sample	Manganese			Molybdenum			Nickel			Potassium			Silicon			Sodium			Strontium			Vanadium		
14	Area	Number	Date	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
15	C7831; I-016	B272J0	8/26/10	216		2	38.5		2	4.18	B	5	4160		500	4570		50	11900		100	275		5	6.91		5
16	C7831; I-016 DUP	B272J1	8/26/10	214		2	40.5		2	4.24	B	5	4180		500	4670		50	11900		100	276		5	7.06		5

17 **Analysis:**

18		TDL	5	20	40	4000	20	500	10	25
19	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
20		Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)		No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
21		RPD	0.9%				2.2%	0.0%	0.4%	
22		Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable

23

24	Sampling	HEIS	Sample	Zinc		
25	Area	Number	Date	ug/L	Q	PQL
26	C7831; I-016	B272J0	8/26/10	30.6		20
27	C7831; I-016 DUP	B272J1	8/26/10	28.2		20

28 **Analysis:**

29		TDL	10
30	Duplicate Analysis	Both > PQL?	Yes (continue)
31		Both >5xTDL?	No-Stop (acceptable)
32		RPD	
33		Difference > 2 TDL?	No - acceptable

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 5/16/11
Sheet No. 22 of 23

Duplicate Analysis - C7832 Interval 4 Soil Samples

Sampling Area	Sample Number	Sample Date	Potassium-40 pCi/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA	Total beta radiostroptium pCi/g	Q	MDA
C7832; I-004	B27304	9/7/10	10.6		0.442	0.373	J	0.156	0.653		0.282	0.635		0.258
C7832; I-004 DUP	B27305	9/7/10	9.7		0.286	0.345	J	0.095	0.620		0.249	0.659		0.196

Analysis:

	TDL	0.5	0.1	0.2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	8.9%			
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable

Sampling Area	HEIS Number	Sample Date	Aluminum mg/kg	Q	PQL	Antimony mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL
C7832; I-004	B272X2	9/7/10	5940		3.38	0.206	B	0.41	1.40		0.68	53.1		0.34	0.169		0.14	0.816	B	1.35	0.075	B	0.14	6360		67.6	14.8		0.14
C7832; I-004 DUP	B272X3	9/7/10	6600		3.25	0.273	B	0.39	1.54		0.65	71.0		0.33	0.164		0.13	0.731	B	1.30	0.077	B	0.13	6460		65.0	36.7		0.13

Analysis:

	TDL	5	0.6	1	0.5	0.2	2	0.2	100	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)		No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)	Yes (calc RPD)
	RPD	10.5%			28.8%				1.6%	62.8%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

Sampling Area	HEIS Number	Sample Date	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Lithium mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL
C7832; I-004	B272X2	9/7/10	3.67		1.35	10.1		0.68	12300		13.5	2.97		0.34	6.55		1.69	3210		50.7	254		3.38	0.958	B	1.35	9.29		2.7
C7832; I-004 DUP	B272X3	9/7/10	4.06		1.30	10.3		0.65	14100		13.0	2.44		0.33	7.38		1.63	3780		48.8	251		3.25	0.696	B	1.3	18.4		2.6

Analysis:

	TDL	2	1	5	0.5	2.5	75	5	2	4
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)
	RPD		2.0%	13.6%			16.3%	1.2%		
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Yes - assess further

Sampling Area	Sample Number	Sample Date	Phosphorus mg/kg	Q	PQL	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Strontium mg/kg	Q	PQL	Tin mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL	Chloride mg/kg	Q	PQL
C7832; I-004	B272X2	9/7/10	361		33.8	880		270	781		1.35	493		33.8	28.1		0.68	1.35	B	6.76	26.4		1.69	29.1		6.76	2.4	B	4.9
C7832; I-004 DUP	B272X3	9/7/10	434		32.5	1010		260	795		1.30	506		32.5	31.3		0.65	1.62	B	6.50	34.0		1.63	29.4		6.5	2.7	B	4.7

Analysis:

	TDL	10	400	2	50	1	10	2.5	1	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)		Yes (calc RPD)	Yes (calc RPD)	
	RPD	18.4%		1.8%	2.6%	10.8%		25.2%	1.0%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable

Sampling Area	Sample Number	Sample Date	Nitrate mg/kg	Q	PQL	Nitrogen in Nitrite and Nitrate mg/kg	Q	PQL	Sulfate mg/kg	Q	PQL
C7832; I-004	B272X2	9/7/10	5.0		4.9	1.26		0.49	13.7		4.9
C7832; I-004 DUP	B272X3	9/7/10	4.7		4.7	1.26		0.47	13.6		4.7

Analysis:

	TDL	2.5	0.75	5
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?		No-Stop (acceptable)	No-Stop (acceptable)
	RPD			
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford

Originator P. L. Benjamin PLB
Project 100-K Remedial Investigation
Subject 100-K Remedial Investigation Relative Percent Difference (RPD) Calculations

Date 05/12/11
Job No. 14655

Calc. No. 0100K-CA-V0080
Checked H. M. Sulloway

Rev. No. 0
Date 3/16/11
Sheet No. 23 of 23

1 **Duplicate Analysis - C7832 Interval 21 Groundwater Samples**

	Sampling Area	Sample Number	Sample Date	Aluminum			Barium			Boron			Calcium			Chromium			Magnesium			Manganese			Molybdenum		
3				ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
4	C7832; I-021	B27336	9/15/10	16.5	B	50	30.5		2	8.13	B	10	62200		100	4.65		2	10600		100	43.1		2	23.4		2
5	C7832; I-021 DUP	B27336	9/15/10	22.8	B	50	31.5		2	8.22	B	10	63400		100	6.14		2	10700		100	43.4		2	22.6		2

6 **Analysis:**

7	TDL			50			5			20			1000			2			750			5			20		
8	Duplicate Analysis	Both > PQL?		No-Stop (acceptable)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
9		Both >5xTDL?					Yes (calc RPD)						Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)		
10		RPD					3.2%						1.9%						0.9%			0.7%					
11		Difference > 2 TDL?		No - acceptable			Not applicable			No - acceptable			Not applicable			No - acceptable			Not applicable			Not applicable			No - acceptable		

12

	Sampling Area	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Sodium			Strontium			Vanadium		
14				ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
15	C7832; I-021	B27336	9/15/10	1.02	B	5	6310		500	3.20	B	10	9940.0		50	9250		100	326		5	2.59	B	5
16	C7832; I-021 DUP	B27338	9/15/10	1.11	B	5	6440		500	4.27	B	10	10200		50	9500		100	334		5	2.94	B	5

17 **Analysis:**

18	TDL			40			4000			10			20			500			10			25					
19	Duplicate Analysis	Both > PQL?		No-Stop (acceptable)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)				
20		Both >5xTDL?					No-Stop (acceptable)						Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)								
21		RPD											2.6%			2.7%			2.4%								
22		Difference > 2 TDL?		No - acceptable			No - acceptable			No - acceptable			Not applicable			Not applicable			Not applicable			No - acceptable					

DISTRIBUTION

Washington Closure Hanford

R. W. Ovink	H4-21
J. A. Lerch	H4-22
H. M. Sulloway	H4-23
R. L. Weiss	H4-21
R. P. Wells	H4-22
Document Control	H4-11
DOE-RL Public Reading Room	H2-53
Hanford Technical Library	P8-55