Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

OCT 24 2017

Ms. Susan Fulmer, P. G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

Mr. Robert H. Pope
Savannah River Site Remedial Project Manager
Superfund Division
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. Fulmer and Mr. Pope:

SUBJECT: Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U) (ERD-EN-2017-0027, Revision 1, October 2017) (Redline and Clean Copy) and Savannah River Site's Reponses to Regulatory Comments on the Revision 0 Document, CERCLIS Number: 63

The U. S. Department of Energy (DOE) is submitting the enclosed *Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U)* (ERD-EN-2017-0027, Revision 1, October 2017) for your review and approval. Both the redline copy and clean copy of the document is enclosed for completeness. The South Carolina Department of Health and Environmental Control (SCDHEC) and U. S. Environmental Protection Agency (EPA) provided comments on the Revision 0 document in letters dated June 22, 2017 and July 24, 2017, respectively. The responses to the EPA's and SCDHEC's comments on the Revision 0 document are enclosed. Please review the enclosures and provide your responses within thirty (30) days of receipt. The effort and time that the EPA and the SCDHEC have provided on this operable unit are greatly appreciated.

Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Federal Project Director, Ms. Karen Adams, at (803) 952-7871.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-18-100

OCT 24 2017

Enclosures:
1. Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U) (ERD-EN-2017-0027, Revision 1, October 2017) (Redline and Clean Copy) CERCLIS Number: 63
2. SRS Responses to the U.S. Environmental Protection Agency Comments on: Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U) (ERD-EN-2017-0027, Revision 0, April 2017) CERCLIS Number: 63
3. SRS Responses to the South Carolina Department of Health and Environmental Control Comments on: Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U) (ERD-EN-2017-0027, Revision 0, April 2017) CERCLIS Number: 63

cc w/o encl:
D. Scaturo, SCDHEC-Columbia
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cc w/encl:
D. Lloyd, EPA-Atlanta
M. McRae, TechLaw, Inc.

SRS Responses to
United States Environmental Protection Agency Comments on:
Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U), CERCLIS Number: 63 (ERD-EN-2017-0027, Revision 0, April 2017)
(comments received 7/25/17)

GENERAL COMMENTS:

1. According to Section 4.0 of the Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U), ERD-EN-2017-0027, Revision 0 dated April 2017 (the Report), the maximum-detected concentrations of hexavalent chromium, potassium-40, radium-226, radium-228, and uranium-238 exceed their respective human health Threshold Levels (TLs). Based on these exceedances, additional statistical hypothesis testing [t-Test or Wilcoxon Signed Rank Test, the latter to support analysis of datasets with non-detects] was conducted using the mean Chemical of Concern (COC) concentrations to verify attainment of cleanup levels within the area of contamination after removal activities. The results of the statistical tests showed that the mean COC concentrations fell below their respective human health TLs, indicating that cleanup levels were met and, supporting an unrestricted land use.
However, except for hexavalent chromium, the Report fails to present a quantification of residual site risk and hazard. As such, the cumulative levels of risk and hazard that remain *in situ* are unclear, and the unrestricted land use designation is unsupported. To address this issue, please revise the report to provide an assessment of total residual risk and hazard, to support the conclusion that an unrestricted land use designation is appropriate at the 489-D Coal Pile Runoff Basin. It is noted that this assessment should be conducted for all constituents with a maximum detected concentration in excess of health-based TL (i.e., regardless of whether the secondary mean-based assessment concentration meets the cleanup criteria).

   Response: Clarification. Based on previous Core Team agreements as described below, an additional assessment of the total residual risk and hazard is not needed in order to make a risk management decision for this unit.

   Section 3.0 summarizes the analytical approach and acceptance criteria for the confirmation sampling evaluation as described in the *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site* (Revision 1.1, SRNS-RP-2013-00332). The confirmation plan follows the USEPA ProUCL software guidance to use single-sample hypothesis testing when the environmental parameters such as the clean standard, threshold level, or compliance limits are known, and the objective is to compare site concentrations with these known threshold values. Specifically, a t-Test or a Wilcoxon Signed Rank Test are used to verify the attainment of cleanup levels within the AOC after a remediation activity and a quantification of residual site risk and hazard (i.e., a risk calculation) is not discussed. The Confirmation SAP was reviewed and approved by USEPA and SCDHEC in 2014; as such, the methodology described therein is deemed appropriate for use in final risk management decision making.

   The statistical hypothesis testing methodology used to evaluate the confirmation sampling data at the 489-D Coal Pile Runoff Basin is the same approach that was used to evaluate the confirmation sampling data for the 488-2D Ash Basin. The *Human Health and Ecological*

Evaluation for Confirmation Sampling at the 488-2D Ash Basin **was approved by SCDHEC on November 30, 2016 and EPA on January 26, 2017.**

An additional assessment of site risks would not change the conclusions presented in the report. The PRG concentrations at the 1E-06 risk level for several naturally occurring radionuclides, (including potassium-40, radium-226, radium-228, and uranium-238), are less than what can be found in background (un-impacted) soil. Therefore the risk posed by background must also be acknowledged. A comparison of the maximum detected concentration of potassium-40, radium-226, radium-228, and uranium-238 to the SRS background concentration is provided in the table below.

	Potassium-40 (pCi/g)	Radium-226 (pCi/g)	Radium-228 (pCi/g)	Uranium-238 (pCi/g)
489-D CPRB	6.72 (max)	1.71 (max)	2.49 (max)	1.4 (max)
SRS Background	8.53 (max)	1.74 (max)	6.75 (max)	1.9 (max)

The concentrations of the naturally occurring radionuclides detected at the 489-D CPRB are within (i.e., less than) the concentrations that can be found in background soils at SRS. It can be concluded that the residual risk posed by 489-D CPRB is essentially the same as the SRS background soils. In addition, these constituents would not be considered final COCs in a formal risk assessment as problems warranting action since their concentrations are less than what could be found naturally in background soils. No change to the document is proposed.

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

2. The Report indicates that the former 489-D Coal Pile Runoff Basin will be used as a storm water detention structure. However, the text does not address (a) the potential for the regional groundwater table to rise above the bottom of the detention basin and (b) the quality of that groundwater (i.e., whether or not it contains Site-related contamination). Revise the Report to address the potential for groundwater in the basin area and whether groundwater contains Site-related contamination.

Response: Agree. The following text will be added to Section 6.0 CONCLUSION:

"The 489-D CPRB will be used as a storm water retention structure to support the overall early action removal strategy for D-Area. In this end state condition, surface water within the basin will be present as a result of receiving storm water runoff that is channeled from other portions of D-Area as well as rainfall in the basin proper. The fluctuating water table may also periodically rise into the section of the basin with the lowest elevation. The low pH/metals groundwater plume, which is part of the D-Area Groundwater Operable Unit, will decrease in size and water quality will improve over time as a result of the source removal of the coal fines

and contaminated sediment from the 489-D CPRB (and subsequent liming and backfilling) achieved through this completed removal action; and through the investigation, assessment, and (if needed) remediation of groundwater in the vicinity of the 489-D Basin, which are scheduled to begin in Fiscal Year 2020. Changes in the plume will be evaluated through groundwater monitoring and documented in future D-Area Groundwater Operable Unit reporting efforts."

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

SPECIFIC COMMENTS:

1. **Section 2.2 Ecological, 2nd Paragraph, Page 4 of 26**
   The ecological Threshold Levels (ECO TLs) for both aquatic/semi-aquatic and terrestrial receptors represent the Lowest-Observed Adverse Effects Level (LOAEL)-based ecological thresholds. An alternative would have been to use a Maximum-Acceptable Toxicant Concentration (MATC), calculated as the geometric mean of a No-Observed Adverse Effects Level (NOAEL) and a LOAEL, which represents a more defensible cleanup goal because it falls between the no-effect and low-effect TLs. It is unclear from the available information if the current approach was agreed to by all parties. Revise this section to justify why an effect-based ECO TL was used instead of a MATC ECO TL and explain how this decision was reached.

   Response: Clarification. SRS is not aware of any published MATC values that are approved by EPA that can be used as cleanup goals as suggested in the comment. The ECO TLs used in this document are consistent with the additional ecological evaluation presented in Appendix G of the approved *Human Health and Ecological Evaluation for Confirmation Sampling at the 488-2D Ash Basin*. The primary source of the TLs used in this document is the *EPA Region 4 Ecological Risk Assessment Supplemental Guidance Interim Draft* (2015). For soil media, the ECO TLs from this source are NOAEL-based (not LOAEL-based as indicated in the comment). For sediment media, the refinement screening value (RSV) was used. The Los Alamos National Laboratory EcoRisk database (2015) was identified as an additional resource. These two sources of toxicity information were deemed appropriate by USEPA and SCDHEC in scoping meetings for the Lower Three Runs Integrator Operator Unit baseline risk assessment document submittal (June 2017).

   In former risk assessments, SRS has identified either a NOAEL or LOAEL-based TL as the appropriate cleanup level, depending on the receptor. Use of an alternative approach (i.e., MATC calculation), is beyond the scope of this document. Instead, acceptability of MATCs in SRS risk assessments should be evaluated and agreed to in a SRS Risk Assessment Design Team setting before inclusion in a regulatory document. No change to this document is proposed.

   Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

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United States Environmental Protection Agency Comments on:
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(comments received 7/25/17)

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2. **Section 2.2 Ecological, 3rd Paragraph, Page 4 of 26**
The receptor groups included in the terrestrial evaluation consist of invertebrates, birds, and mammals. The text does not refer to terrestrial plants nor does it state why this receptor group was excluded. Revise the text by explaining the rationale for eliminating terrestrial plants from the evaluation.

Response: Clarification. The ECO TLs used in this document are consistent with the additional ecological evaluation presented in Appendix G of the approved *Human Health and Ecological Evaluation for Confirmation Sampling at the 488-2D Ash Basin.* The 489-D CPRB will be managed as a storm water retention structure and the aquatic environment of this small basin does not represent a significant area of terrestrial plant habitat for population-level effects to occur.

The following sentence will be added to the third paragraph in Section 2.2:

"For the evaluation of terrestrial receptors (i.e., assessed as soil media), the lesser (most conservative) of the soil invertebrate, mammalian and avian screening values identified in Table 3, Region 4 Soil Screening Values for Hazardous Waste Sites (USEPA 2015a) was used. Terrestrial plant screening values were not considered in this evaluation since the 489-D CPRB will be managed as a storm water retention structure and the aquatic environment of this small basin does not represent a significant area of terrestrial plant habitat for population-level effects to occur. For the radiological constituents, …"

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

3. **Section 3.0 Acceptance Criteria, 2nd Paragraph, Page 6 of 26**
Section 3.0 describes using ProUCL to calculate representative site concentrations for comparison against the selected TLs. The mean contaminant levels were used for this purpose. This approach does not appear protective enough for use in final risk management decision making. Revise this section to provide a reference supporting this approach or justify why a more conservative 95% Upper Confidence Limit (UCL) of the mean was not calculated to represent a Reasonable Maximum Exposure (RME) for use in comparing to the TLs.

Response: Clarification. See response to General Comment #1. The *Confirmation Sampling and Analysis Plan for Coal and/or Ash Removal at the Savannah River Site* (Revision 1.1, SRNS-RP-2013-00332) was reviewed and approved by EPA and SCDHEC in 2014; as such the methodology for data evaluation described therein is deemed appropriate for use in final risk management decision making. No change to the document is proposed.

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

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4. **Section 5.2 Hexavalent Chromium, 5th Paragraph, Page 10 of 26**
Section 5.2 states the 95% UCL for hexavalent chromium analyzed by Method 7196A (colorimetric) is 0.47 mg/kg and the 95% UCL by Method 7199 (IC-ICP-MS) is 0.44 mg/kg. However, based on review of Appendix E – Additional Hexavalent Chromium Data, the 95% UCLs for hexavalent chromium by Method 7196A and Method 7199 are not listed. Please include the 95% UCLs for hexavalent chromium such that they can be verified. Additionally, as mentioned in General Comment 1, risk estimates were calculated only for hexavalent chromium. Revise the Report to conduct an assessment for all constituents with a maximum detected concentration in excess of health-based TLs (i.e., regardless of whether the mean-based concentration assessment meets the cleanup criteria).

Response: Clarification. See response to General Comment #1 regarding request for additional risk information. ProUCL inputs are provided in each appendix, as appropriate, to allow for an independent verification. The 95%UCL for Method 7196A and 7199 are attached to these comment responses. No change to the document is proposed.

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

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(comments received 7/25/17)

UCL Statistics for Data Sets with Non-Detects; Cr6 95%UCL Calculation for Method 7196 (All Data)

User Selected Options			
Date/Time of Computation	ProUCL 5.17/28/2017 11:48:00 AM		
From File	WorkSheet.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operatio	2000		
Cr6 7196 Color			
General Statistics			
Total Number of Observations	23	Number of Distinct Observations	23
Number of Detects	15	Number of Non-Detects	8
Number of Distinct Detects	15	Number of Distinct Non-Detects	8
Minimum Detect	0.212	Minimum Non-Detect	0.101
Maximum Detect	1.53	Maximum Non-Detect	0.186
Variance Detects	0.108	Percent Non-Detects	34.78%
Mean Detects	0.491	SD Detects	0.329
Median Detects	0.394	CV Detects	0.67
Skewness Detects	2.49	Kurtosis Detects	7.411
Mean of Logged Detects	-0.856	SD of Logged Detects	0.517
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.727	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.198	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.22	Detected Data appear Normal at 5% Significance Level	
Detected Data appear Approximate Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.355	KM Standard Error of Mean	0.0683
KM SD	0.317	95% KM (BCA) UCL	0.478
95% KM (t) UCL	0.472	95% KM (Percentile Bootstrap) UCL	0.479
95% KM (z) UCL	0.468	95% KM Bootstrap t UCL	0.523
90% KM Chebyshev UCL	0.56	95% KM Chebyshev UCL	0.653
97.5% KM Chebyshev UCL	0.782	99% KM Chebyshev UCL	1.035
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.551	Anderson-Darling GOF Test	
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.149	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.223	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	3.635	k star (bias corrected MLE)	2.952
Theta hat (MLE)	0.135	Theta star (bias corrected MLE)	0.166
nu hat (MLE)	109	nu star (bias corrected)	88.57
Mean (detects)	0.491		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	0.323
Maximum	1.53	Median	0.306
SD	0.352	CV	1.087
k hat (MLE)	0.599	k star (bias corrected MLE)	0.55
Theta hat (MLE)	0.54	Theta star (bias corrected MLE)	0.588
nu hat (MLE)	27.56	nu star (bias corrected)	25.3
Adjusted Level of Significance (β)	0.0389		
Approximate Chi Square Value (25.30, α)	14.84	Adjusted Chi Square Value (25.30, β)	14.26
95% Gamma Approximate UCL (use when n>=50)	0.551	95% Gamma Adjusted UCL (use when n<50)	0.574

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Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.355	SD (KM)	0.317
Variance (KM)	0.1	SE of Mean (KM)	0.0683
k hat (KM)	1.258	k star (KM)	1.123
nu hat (KM)	57.88	nu star (KM)	51.66
theta hat (KM)	0.282	theta star (KM)	0.316
80% gamma percentile (KM)	0.566	90% gamma percentile (KM)	0.795
95% gamma percentile (KM)	1.021	99% gamma percentile (KM)	1.543
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (51.66, α)	36.15	Adjusted Chi Square Value (51.66, β)	35.21
95% Gamma Approximate KM-UCL (use when n>=5	0.507	95% Gamma Adjusted KM-UCL (use when n<50)	0.521
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.938	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.117	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.362	Mean in Log Scale	-1.291
SD in Original Scale	0.318	SD in Log Scale	0.736
95% t UCL (assumes normality of ROS data)	0.476	95% Percentile Bootstrap UCL	0.474
95% BCA Bootstrap UCL	0.515	95% Bootstrap t UCL	0.546
95% H-UCL (Log ROS)	0.51		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-1.356	KM Geo Mean	0.258
KM SD (logged)	0.794	95% Critical H Value (KM-Log)	2.272
KM Standard Error of Mean (logged)	0.171	95% H-UCL (KM -Log)	0.519
KM SD (logged)	0.794	95% Critical H Value (KM-Log)	2.272
KM Standard Error of Mean (logged)	0.171		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.345	Mean in Log Scale	-1.481
SD in Original Scale	0.332	SD in Log Scale	0.975
95% t UCL (Assumes normality)	0.464	95% H-Stat UCL	0.615
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Approximate Normal Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM (t) UCL	0.472		
When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test			
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

SRS Responses to
United States Environmental Protection Agency Comments on:
Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin (U), CERCLIS Number: 63 (ERD-EN-2017-0027, Revision 0, April 2017)
(comments received 7/25/17)

UCL Statistics for Uncensored Full Data Sets; Cr6 95%UCL Calculation for Method 7199 (All Data)

User Selected Options				
Date/Time of Computation	ProUCL 5.17/28/2017 11:36:07 AM			
From File	WorkSheet.xls			
Full Precision	OFF			
Confidence Coefficient	95%			
Number of Bootstrap Operatio	2000			
Cr6 7199				
General Statistics				
Total Number of Observations		23	Number of Distinct Observations	23
			Number of Missing Observations	0
Minimum		0.11	Mean	0.336
Maximum		1.52	Median	0.258
SD		0.293	Std. Error of Mean	0.0611
Coefficient of Variation		0.871	Skewness	3.227
Normal GOF Test				
Shapiro Wilk Test Statistic		0.647	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value		0.914	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic		0.22	Lilliefors GOF Test	
5% Lilliefors Critical Value		0.18	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level				
Assuming Normal Distribution				
95% Normal UCL			95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL		0.441	95% Adjusted-CLT UCL (Chen-1995)	0.481
			95% Modified-t UCL (Johnson-1978)	0.448
Gamma GOF Test				
A-D Test Statistic		0.637	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value		0.753	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic		0.114	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value		0.183	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level				

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Gamma Statistics			
k hat (MLE)	2.466	k star (bias corrected MLE)	2.173
Theta hat (MLE)	0.136	Theta star (bias corrected MLE)	0.155
nu hat (MLE)	113.4	nu star (bias corrected)	99.97
MLE Mean (bias corrected)	0.336	MLE Sd (bias corrected)	0.228
		Approximate Chi Square Value (0.05)	77.9
Adjusted Level of Significance	0.0389	Adjusted Chi Square Value	76.49
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50)	0.432	95% Adjusted Gamma UCL (use when n<50)	0.44
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.952	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0902	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.18	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-2.207	Mean of logged Data	-1.305
Maximum of Logged Data	0.419	SD of logged Data	0.622
Assuming Lognormal Distribution			
95% H-UCL	0.434	90% Chebyshev (MVUE) UCL	0.46
95% Chebyshev (MVUE) UCL	0.521	97.5% Chebyshev (MVUE) UCL	0.605
99% Chebyshev (MVUE) UCL	0.771		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	0.437	95% Jackknife UCL	0.441
95% Standard Bootstrap UCL	0.434	95% Bootstrap-t UCL	0.541
95% Hall's Bootstrap UCL	0.875	95% Percentile Bootstrap UCL	0.449
95% BCA Bootstrap UCL	0.488		
90% Chebyshev(Mean, Sd) UCL	0.52	95% Chebyshev(Mean, Sd) UCL	0.603
97.5% Chebyshev(Mean, Sd) UCL	0.718	99% Chebyshev(Mean, Sd) UCL	0.944
Suggested UCL to Use			
95% Adjusted Gamma UCL	0.44		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

SRS Responses to
South Carolina Department of Health and Environmental Control Comments on:
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(comments received 6/22/17)

Specific Comments

1. Section 1.0, Introduction, page 1 of 26. This section states that "confirmation sampling was conducted in accordance with the *Confirmation Sampling and Analysis Plan (SAP) for Coal and/or Ash Removal at the Savannah River Site (U)* (SRNS 2014)." The SAP, Section 5.2, Field Analytical Sampling Quality Assurance/Quality Control, page 13 of 24, Part 1, discusses obtaining field duplicate samples. Field duplicate samples are not mentioned in the *Human Health and Ecological Evaluation for Confirmation Sampling at the 489-D Coal Pile Runoff Basin* (April 2017) nor the results of the field duplicate samples. Please include field duplicate sample numbers and results in the text and Appendix A.

Response: Agree. A new paragraph will be added to the end of Section 2.0, Analytical Approach that acknowledges the collection and analysis of additional QA/QC samples, including field duplicates, as follows:

"Quality Assurance/Quality Control (QA/QC) samples were also collected and analyzed in accordance with the Confirmation SAP (SRNS 2014) and the FSP (SRNS 2015). These samples (e.g., field duplicates, split samples, laboratory duplicates, etc.) are used to assess the precision, variability and comparability of the data. The *Data Usability Report for Confirmation Sampling at the 489-D Coal Pile Runoff Basin* will present the data verification, validation and usability assessment results for confirmation sampling for the project. Appendix A provides the field duplicate (FD) results for all three samples taken at DCRB-62, -65, and -67."

In addition, Appendix A will be revised to include the table that is attached to these comment responses.

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

2. Section 5.2, Hexavalent Chromium, page 10 of 26. The second paragraph discusses the similarity of sample results between the two analytical methods, USEPA 7196A and 7199. The second sentence discusses two maximum concentrations of 1.53 mg/kg and 1.52 mg/kg from two different locations and from different test methods. This gives evidence that these two concentrations could be outliers. Please see comparison below. By performing a Dixon's Outlier Test using the USEPA ProUCL 5.1 software for both data sets, these concentrations are considered outliers and can be removed from the data sets for each method. By removing the outliers, the mean concentrations and the calculated risk will be reduced.

Location	Method 7196A	Method 7199
DCRB-71	0.342 mg/kg	1.52 mg/kg

DCRB-76	1.53 mg/kg	0.492 mg/kg

Response: Agree. Text will be added to Section 5.2, Hexavalent Chromium that includes the results of the outlier test as additional evidence to support the conclusions of the report as follows:

"The maximum detected concentrations of 1.52 mg/kg (DCRB-71) and 1.53 mg/kg (DCRB-76) from two different locations and from different test methods give evidence that these two results may be outliers. The Dixon's Outlier Test can be used to identify data outliers when the sample size is ≤ 25. The USEPA ProUCL software was used to perform this statistical test for outliers in both datasets; the ProUCL result is that these maximum concentrations are considered outliers and can be removed from the dataset for each method. Accordingly, the maximum, the mean and the risk calculation for each dataset are reduced as indicated below. This information provides further evidence to support the conclusion that the concentrations of hexavalent chromium do not pose an unacceptable risk.

Method 7196A: maximum = 0.746 mg/kg, mean = 0.291 mg/kg, 95%UCL = 0.377 mg/kg, risk = 1.3E-06

Method 7199: maximum = 0.625 mg/kg, mean = 0.283 mg/kg, 95%UCL = 0.335 mg/kg, risk = 1.2E-06"

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

3. Appendix A, 489-D CPRB Final Confirmation Sample Data, page A-7 of A-20. There is some confusion concerning non-detect results (specifically samples DCRB-69, 71, 77, 56, and 57) being higher than a threshold level and other detected concentrations. Table 10, page 25 of 26, lists the detection limits for these samples in parentheses and are considerably lower than the results listed in Appendix A, EPA Method 7196A column. Please clarify.

Response: Clarification. Analytical results that are less than the method detection limit (MDL) are U qualified, indicating a nondetect; results that are greater than the MDL but less that the practical quantitation limit (PQL) are J qualified, indicating an estimated result, and; results that are greater than the PQL are not qualified, indicating a high degree of confidence in the reported result. USEPA guidance for reporting data indicates that for nondetects (U qualified, less than the MDL), the preferred reported result is the sample PQL (not the MDL). The results provided in Appendix A show the sample PQL for nondetects (U qualified, less than MDL) per the guidance as reported by the laboratory. Table 10 shows the sample MDL (not PQL) for the same samples, and the footnote

indicates that the detection limit is shown in parenthesis in the table. For clarification, a footnote will be added to the table in Appendix A as follows:

"Reported result for U qualified data (nondetect) is the practical quantitation limit."

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

4. Appendix D, ProUCL Output for Ecological Statistical Hypothesis Testing, page D-3 of D-8. Please insert into the label that this hypothesis test for barium is for aquatic receptors and page D-4 is for terrestrial receptors.

Response: Agree. The titles in Appendix D will be revised as suggested in the comment:

Page D-3: "One Sample t-Test for Uncensored Full Data Sets without NDs – Ba (Aquatic Receptors)"

Page D-4: "One Sample t-Test for Uncensored Full Data Sets without NDs – Ba (Terrestrial Receptors)"

Responsible Party: Doug Martinson, (803) 952-6043, douglas.martinson@srs.gov

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Attachment A: Field Duplicate Sample Results

Station ID	Analyte	Result	Result Units	Review Qualifier	Field QC Code
DCRB-62	ALUMINUM	8150	mg/kg		FD
DCRB-62	ANTIMONY	1.16	mg/kg	U	FD
DCRB-62	ARSENIC	1.27	mg/kg		FD
DCRB-62	BARIUM	312	mg/kg		FD
DCRB-62	BERYLLIUM	0.816	mg/kg		FD
DCRB-62	BORON	1.08	mg/kg	J	FD
DCRB-62	CADMIUM	0.217	mg/kg	U	FD
DCRB-62	CHROMIUM	9.89	mg/kg		FD
DCRB-62	CHROMIUM, HEXAVALENT	0.443	mg/kg	U	FD
DCRB-62	COBALT	0.341	mg/kg		FD
DCRB-62	COPPER	2.09	mg/kg		FD
DCRB-62	IRON	5640	mg/kg		FD
DCRB-62	LEAD	5.27	mg/kg		FD
DCRB-62	MAGNESIUM	203	mg/kg		FD
DCRB-62	MANGANESE	4.16	mg/kg		FD
DCRB-62	MERCURY	0.397	mg/kg	J	FD
DCRB-62	MOLYBDENUM	0.217	mg/kg	U	FD
DCRB-62	NICKEL	1.32	mg/kg		FD
DCRB-62	SELENIUM	0.606	mg/kg	J	FD
DCRB-62	SILVER	0.186	mg/kg	J	FD
DCRB-62	STRONTIUM	53.5	mg/kg		FD
DCRB-62	THALLIUM	0.434	mg/kg	U	FD
DCRB-62	VANADIUM	13.7	mg/kg		FD
DCRB-62	ZINC	4.59	mg/kg		FD
DCRB-62	2-METHYLNAPHTHALENE	0.0387	mg/kg	U	FD
DCRB-62	ACTINIUM-228	0.931	pCi/g		FD
DCRB-62	LEAD-212	1.05	pCi/g		FD
DCRB-62	LEAD-214	0.637	pCi/g		FD
DCRB-62	POTASSIUM-40	1.33	pCi/g	J	FD
DCRB-62	URANIUM-233/234	0.746	pCi/g		FD
DCRB-62	URANIUM-235	0.0481	pCi/g	U	FD
DCRB-62	URANIUM-238	0.855	pCi/g		FD
DCRB-65	ALUMINUM	10100	mg/kg		FD
DCRB-65	ANTIMONY	1.13	mg/kg	U	FD
DCRB-65	ARSENIC	1.86	mg/kg		FD
DCRB-65	BARIUM	131	mg/kg		FD
DCRB-65	BERYLLIUM	0.454	mg/kg		FD
DCRB-65	BORON	1.06	mg/kg	J	FD

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DCRB-65	CADMIUM	0.228	mg/kg	U	FD
DCRB-65	CHROMIUM	14.3	mg/kg	J	FD
DCRB-65	CHROMIUM, HEXAVALENT	0.437	mg/kg	U	FD
DCRB-65	COBALT	0.435	mg/kg		FD
DCRB-65	COPPER	2.78	mg/kg		FD
DCRB-65	IRON	9060	mg/kg		FD
DCRB-65	LEAD	5.67	mg/kg		FD
DCRB-65	MAGNESIUM	247	mg/kg	J	FD
DCRB-65	MANGANESE	5.38	mg/kg		FD
DCRB-65	MERCURY	0.0214	mg/kg		FD
DCRB-65	MOLYBDENUM	0.165	mg/kg	U	FD
DCRB-65	NICKEL	2.77	mg/kg	J	FD
DCRB-65	SELENIUM	1.14	mg/kg	U	FD
DCRB-65	SILVER	0.386	mg/kg	J	FD
DCRB-65	STRONTIUM	41.6	mg/kg		FD
DCRB-65	THALLIUM	0.456	mg/kg	U	FD
DCRB-65	VANADIUM	17.8	mg/kg	J	FD
DCRB-65	ZINC	6.8	mg/kg	J	FD
DCRB-65	2-METHYLNAPHTHALENE	0.0392	mg/kg	U	FD
DCRB-65	ACTINIUM-228	0.8	pCi/g		FD
DCRB-65	LEAD-212	0.859	pCi/g		FD
DCRB-65	LEAD-214	0.546	pCi/g		FD
DCRB-65	POTASSIUM-40	1.31	pCi/g	J	FD
DCRB-65	URANIUM-233/234	0.596	pCi/g		FD
DCRB-65	URANIUM-235	0.115	pCi/g	J	FD
DCRB-65	URANIUM-238	0.462	pCi/g		FD
DCRB-67	ALUMINUM	18700	mg/kg		FD
DCRB-67	ANTIMONY	6.16	mg/kg	U	FD
DCRB-67	ARSENIC	2.88	mg/kg	J	FD
DCRB-67	BARIUM	447	mg/kg		FD
DCRB-67	BERYLLIUM	1.24	mg/kg	J	FD
DCRB-67	BORON	8.15	mg/kg		FD
DCRB-67	CADMIUM	0.232	mg/kg	U	FD
DCRB-67	CHROMIUM	27.6	mg/kg		FD
DCRB-67	CHROMIUM, HEXAVALENT	0.762	mg/kg		FD
DCRB-67	COBALT	0.519	mg/kg		FD
DCRB-67	COPPER	1.68	mg/kg	J	FD
DCRB-67	IRON	7550	mg/kg		FD
DCRB-67	LEAD	14.8	mg/kg	J	FD
DCRB-67	MAGNESIUM	1670	mg/kg		FD
DCRB-67	MANGANESE	6.07	mg/kg		FD
DCRB-67	MERCURY	0.019	mg/kg		FD
DCRB-67	MOLYBDENUM	0.232	mg/kg	U	FD

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DCRB-67	NICKEL	2.08	mg/kg		FD
DCRB-67	SELENIUM	3.85	mg/kg	J	FD
DCRB-67	SILVER	0.616	mg/kg	U	FD
DCRB-67	STRONTIUM	187	mg/kg		FD
DCRB-67	THALLIUM	0.463	mg/kg	U	FD
DCRB-67	VANADIUM	19.2	mg/kg	J	FD
DCRB-67	ZINC	9.96	mg/kg		FD
DCRB-67	ACTINIUM-228	0.92	pCi/g		FD
DCRB-67	LEAD-212	1.12	pCi/g		FD
DCRB-67	LEAD-214	0.731	pCi/g		FD
DCRB-67	POTASSIUM-40	3.5	pCi/g		FD
DCRB-67	URANIUM-233/234	0.701	pCi/g		FD
DCRB-67	URANIUM-235	0.0628	pCi/g	J	FD
DCRB-67	URANIUM-238	0.673	pCi/g	J	FD

FD = field duplicate
Reported result for U qualified data (nondetect) is the practical quantitation limit.