



November 6, 2008

Dr. Thomas McLaughlin
Materials Decommissioning Branch
Division of Waste Management and Environmental Protection
Office of Nuclear Materials Safety and Safeguard
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

Dear Dr. McLaughlin:

As described in *Field Sampling Plan (FSP) Addendum 7 – Depleted Uranium Impact Area Site Characterization: Soil Sampling and Analysis, Corrosion Study, Partition Coefficient Study, Modeling Overview, and Slug Testing*, the Army will conduct 24 partition coefficient (K_d) tests using soil collected from the Jefferson Proving Ground (JPG). Initially, the Army proposed using American Society for Testing and Materials (ASTM) D4319-93, *Standard Test Method for Distribution Ratios by the Short-Term Batch Method*, for the K_d tests. Subsequent to submitting FSP Addendum 7 to the U.S. Nuclear Regulatory Commission (NRC), it was determined that ASTM D4319-93 was withdrawn without explanation or replacement. As described in the Revised Final version of FSP Addendum 7 that was submitted to NRC on 16 October 2008, the Army proposed using the testing laboratory's Standard Operating Procedure (SOP). This letter transmits the SOP and describes the site-specific and uranium-specific analysis parameters that will be used by TestAmerica, Inc. (Earth City, MO) for NRC's review and approval.

The Army proposes using TestAmerica's SOP, which is based on ASTM D4319-93, for several reasons. The primary reason is the lack of a widely accepted replacement method (e.g., NRC, U.S. Environmental Protection Agency) for ASTM D4319-93. However, it should be noted that the ASTM method was used successfully for at least 15 years (the "-93" in the ASTM D4319-93 designation indicates "...the year of original adoption or, in the case of revision, the year of last revision"). As such, it was used extensively in the U.S. and abroad for testing uranium sorption as evidenced by numerous scientific articles and regulatory guidance documents including *Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil* (Yu et al. 1993). ASTM D4319-93 was withdrawn without explanation or warning concerning issues with continued use of the standard. Finally, TestAmerica has experience applying the SOP in the evaluation of sorption/desorption of uranium and other radiologic and non-radiologic species in soil.

Using TestAmerica's SOP also allows the flexibility of conducting site-specific tests. As written, ASTM's short-term batch method measures ion exchange-adsorption reactions only. However, historical soil sampling and visual observations made at JPG in the DU Impact Area confirm that surface and near-surface adsorption appears to be limiting subsurface migration. For this reason, it appears that understanding and quantifying desorption reactions are crucial for evaluating the fate and transport mechanisms related to the 1,000-year period of interest. TestAmerica's SOP includes the procedures based on ASTM D4319-93 to evaluate adsorption and it also has been adapted to address the site-specific need for evaluating desorption processes. To



conduct adsorption and desorption tests, this study includes six tests using background soils with radiotracers or spiked stable tracers to measure adsorption and 18 tests using uranium contaminated soil collected from under DU penetrators with rainwater as the leachant to evaluate desorption. The following table summarizes the tests by soil-type groupings that will be performed:

Test	Avonsburg/Cobbsfork	Cincinnati/Rossmoyne	Grayford/Ryker	Total
Adsorption	Soil from 2 background locations	Soil from 2 background locations	Soil from 2 background locations	6
Desorption	8 above/under penetrators	8 above/under penetrators	2 above/under penetrators	18
Total	10	10	4	24

The following depths for the adsorption and desorption tests were planned based on an assumption that field crews would not encounter auger refusal (e.g., bedrock, subsurface debris, cobbles). Hand-auger soil sampling was completed to the following depth intervals for the adsorption tests: ground surface to 15 cm (0.5 ft) below land surface (BLS), 15 to 30 cm (0.5 to 1 ft) BLS, 30 to 60 cm (1 to 2 ft) BLS, and 60 to 120 cm (2 to 4 ft) BLS. In most cases, soil for the desorption tests were collected from the following intervals (except where refusal was encountered at shallower depths): between ground surface and top of penetrator (approximately half of the penetrators are planned to be collected BLS), top of penetrator to 15 cm (0.5 ft) beneath penetrator, 15 to 30 cm (0.5 to 1 ft) beneath penetrator, 30 to 60 cm (1 to 2 ft) beneath penetrator, and 60 to 120 cm (2 to 4 ft) beneath penetrator. Soil for the adsorption and desorption tests was placed in plastic bags and provided to TestAmerica. The bags were marked with unique identification numbers, dates and times of collection, locations, approximate depths, and collector's names.

Soil collected from the horizons listed above also will be analyzed for total and isotopic uranium using ASTM-D3972-90M by the Alabama laboratory recently purchased by GPL Laboratories, LLLP's (formerly Sanford Cohen & Associates, Montgomery, AL). In addition, one sample will be collected for each K_d test (12 from surface interval and 12 from deepest interval) and analyzed for the following non-radiological parameters to be measured by Empirical Laboratories, LLC (Nashville, TN):

- Moisture content (ASTM D2216-05)
- Soil pH (ASTM D4972-01/EPA 9045C)
- Particle size distribution (ASTM D422-63)
- Total organic carbon (SW9060A)
- Total carbon (SW9060A)
- Total iron (SW 6010)
- Total manganese (SW 6010).

In addition, rainwater from JPG was collected to prepare contact solutions to be used in the laboratory K_d tests. Samples of the rainwater will be analyzed for ^{234}U , ^{235}U , and ^{238}U activities, major cations (calcium, potassium, magnesium, and sodium), major anions (chloride, nitrate, sulfate), total iron, and total manganese.



Before the K_d tests are initiated, the Army will review the total and isotopic uranium levels. For the adsorption tests, the Army will review the results to ensure uranium concentrations are consistent with expected background levels. For the desorption tests, the Army will select the soil containing uranium at levels spanning a range of concentrations from levels greater than background (based on the ranges of concentrations identified in the samples) to approximately 1,000 parts per million (~160 pCi/g) to avoid causing solubility limit issues. The 1,000 part per million limit is based on the highest concentration (989 mg/Kg) successfully tested by Pacific Northwest National Laboratory (*300 Area Uranium Leach and Adsorption Project, PNNL-14022, Serne et al. 2002*) in multiple K_d tests run with various pH levels, carbonate concentrations, uranium concentrations, and total ionic strengths.

Soil will be mixed with the contact solution (rainwater) until steady state (i.e., consistency in uranium levels measured in leachate solution) is achieved. For the adsorption tests, the contact solution (rainwater) will be spiked with uranium concentrations ranging from approximately 100 to 1,000 $\mu\text{g/L}$ to simulate the range of concentrations of soil pore water expected below DU penetrators. The contact solution will not be spiked for the desorption tests. To ensure that the longer desorption processes have reached equilibrium, the duration of the contact between the leachant and the soil will be extended beyond the 14-day period recommended in the ASTM method. If necessary, the test will be extended up to 45 days. TestAmerica's SOP describes the procedures that laboratory personnel will follow when completing the 6 adsorption and 18 desorption K_d tests using SOP No. ST-IP-0018 entitled *K_d Leaching Procedure*.

If you have any questions, please contact Mr. Paul Cloud, Jefferson Proving Ground (JPG) License Radiation Safety Officer, U.S. Army JPG at (410) 436-2381, E-mail address: paul.d.cloud@us.army.mil.

Sincerely,

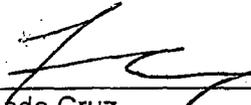
A handwritten signature in black ink that reads "Joseph N. Skibinski". The signature is written in a cursive, flowing style.

Joseph N. Skibinski
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cc: Paul Cloud
Brooks Evens
SAIC Central Records Project File (transmittal memo only)

Title: K_d LEACHING PROCEDURE

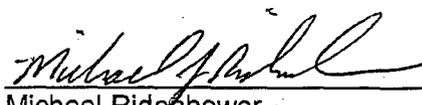
Approvals (Signature/Date):



Fernando Cruz
Metals Supervisor

10/31/08

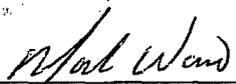
Date



Michael Ridenhower
Health & Safety Manager / Coordinator

10/31/08

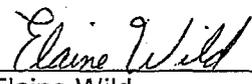
Date



Marti Ward
Quality Assurance Manager

10-31-08

Date



Elaine Wild
Laboratory Director

10/31/08

Date

This SOP was previously identified as SOP No. ST-IP-0018 Rev. 3

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1.0 SCOPE AND APPLICATION

- 1.1. This SOP describes the procedure used by the laboratory when a " K_d leach" is requested. Results from this leaching may be used by the client for determination of the *distribution ratio* (R_d), which estimates the value of the *distribution coefficient* (K_d). The distribution coefficient can be used to quantify certain sorption reactions which occur in geologic medium for modeling or other purposes.
- 1.2. This SOP is based on the leaching section of ASTM method D 4319.
- 1.3. It is beyond the scope of this SOP to interpret laboratory data for modeling or predictive purposes.
- 1.4. This procedure is applicable to the analysis of radiological, organic and inorganic parameters.
- 1.5. The laboratory target analytes supported by this method, the reporting limits, method detection limits and QC limits are maintained in the Information Management System (QuantIMS). A copy of the Structure and Analysis Code (SAC), which lists this information, is included in the appendix of the applicable analytical SOPs

2.0 SUMMARY OF METHOD

- 2.1. A portion of a soil sample is maintained in contact with site water provided by the client for a specific number of days. After each interval, a portion of extract is decanted for analysis.

3.0 DEFINITIONS

- 3.1. See the St. Louis Quality Assurance Manual (QAM) for a glossary of common laboratory terms and data reporting qualifiers.
- 3.2. *Distribution coefficient* (K_d): Can be used to assess the degree to which a chemical species will be removed from solution as a fluid migrates through geologic media.
- 3.3. *Distribution ratio* (R_d): A laboratory determination used for the estimation of K_d .
- 3.4. *Contact liquid*: The liquid utilized in the leaching process of the solid phase used to determine the distribution ratio of a geologic media. Examples of contact liquids are groundwater, simulated groundwater (prepared in laboratory), and rainwater.
- 3.5. *Spiked contact liquid*: Contact liquid which has been spiked with a know amount of analyte of interest. This spiked contact liquid may be used in the process to act as a control sample (e.g. LCS) or, in the case of an adsorption study, to monitor the affinity of the analyte in the fluid to the geologic media.

4.0 INTERFERENCES

- 4.1. All laboratory ware must be cleaned in a manner consistent with the analyses to be performed. Reference SOPs ST-RC-5006 "Decontamination of Laboratory Glassware, Labware and Equipment", ST-OP-0001 "Labware Preparation for Organic Analysis", ST-IP-0004 "Labware Preparation for Inorganic and Trace Metal Analysis".

5.0 SAFETY

5.1. Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001), Radiation Safety Manual and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.2. SPECIFIC SAFETY CONCERNS OR REQUIREMENTS

5.2.1. Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

5.3. PRIMARY MATERIALS USED

5.3.1. The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Sodium Hydroxide	Corrosive	2 mg/m ³ (Ceiling)	Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Contact with skin can cause irritation or severe burns and scarring with greater exposures. Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison	1 mg/m ³ (TWA)	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Nitric Acid	Corrosive Oxidizer Poison	2 ppm (TWA) 4 ppm (STEL)	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			
TWA – Time Weighted Average			

STEL – Short Term Exposure Limit
Ceiling – At no time should this limit be exceeded

6.0 EQUIPMENT AND SUPPLIES

- 6.1. Bottles, plastic, 125 ml, 250 ml, 1 L.
- 6.2. Membrane filtering apparatus, 0.45 μm , disposable.
- 6.3. Centrifuge capable of holding 250 ml plastic bottles and maintaining 1000 RPM.
- 6.4. TCLP rotator
- 6.5. pH meter and probe capable of reading to the nearest 0.01 units, and with automatic temperature compensation.
- 6.6. Conductivity meter, calibrated.
- 6.7. Balance.
- 6.8. Drying oven (for radiological analyses).
- 6.9. Ball mill (for radiological analyses).

7.0 REAGENTS AND STANDARDS

- 7.1. All standards and reagent preparation, documentation and labeling must follow the requirements of SOP ST-QA-0002, current revision.
- 7.2. DI water obtained from Milli-Q system.
- 7.3. Contact liquid (supplied by client).
- 7.4. Sulfuric acid (H_2SO_4), 36N, reagent grade.
 - 7.4.1. Sulfuric acid, 1N: Prepare by carefully adding 28 ml of concentrated reagent grade H_2SO_4 to 800 ml of reagent water. Cool and dilute to 1L with reagent water. CAUTION - Sulfuric acid is extremely corrosive. Liquid and mist cause severe burns to all body tissue.
- 7.5. Nitric acid (HNO_3), 16N, reagent grade.
 - 7.5.1. Nitric acid, 1N: Prepare by carefully adding 64 ml of concentrated reagent grade HNO_3 to 800 ml of reagent water. Cool and dilute to 1L with reagent water. CAUTION - Nitric acid is a strong oxidizer. Contact with other material may cause fire. CORROSIVE. Liquid and mist cause severe burns to all body tissue.
 - 7.5.2. Nitric acid, 8N (1:1) – Prepare by carefully adding 500 ml of concentrated HNO_3 to 500 ml of reagent water while stirring. Mix well.
- 7.6. Sodium hydroxide (NaOH), 1N, reagent grade. CAUTION - Sodium hydroxide is corrosive. Causes burns to any area of contact. Reacts with water, acids and other materials.
- 7.7. pH calibration solutions: buffered to a pH of 4, 7, and 10. Commercially available.

8.0 SAMPLE COLLECTION, PRESERVATION AND STORAGE

- 8.1. TestAmerica St. Louis supplies sample containers and chemical preservatives in accordance with the method. TestAmerica St. Louis does not perform sample collection. Samplers should reference the methods referenced and other applicable sample collection documents for detailed collection procedures. Sample volumes and preservative information is given in ST-PM-0002.
- 8.2. Specific guidelines for sampling techniques are beyond the scope of this SOP.
- 8.3. Proper precautions should be taken to preserve the integrity of the samples water, and in particular to protect against oxidation-reduction, exposure to light for extended periods, and temperature variation.
- 8.4. Analyses shall be completed within the holding times specified by the appropriate methodology.

9.0 QUALITY CONTROL

9.1 Batch

- 1.1.1 A sample batch is a maximum of 20 environmental samples, which are prepared together using the same process and same lot(s) of reagents. Where no preparation method exists (e.g. water sample volatile organics, water sample anion analysis) the batch is comprised of a maximum of 20 environmental samples which are analyzed together with the same process, lots of reagents and personnel.
- 1.1.2 Each LEACHATE batch may contain up to 20 environmental samples and a method blank of each contact liquid.
- 1.1.3 Samples having different QC codes, due to non-standard client specific QC requirements, must be batched separately in the LIMS.

9.2 Method Blank

- 9.2.1 A method blank is a blank matrix processed simultaneously with, and under the same conditions as, samples through all steps of the procedure.
- 9.2.2 A method blank must be prepared with every sample batch.
- 9.2.3 One leachate (method) blank must be prepared and leached for each leachate batch.
- 9.2.4 One leachate blank is prepared for each contact liquid used. The leachate blank must consist of the same contact liquid as used for the samples.

9.3 Laboratory Control Sample

- 9.3.1 An LCS is a blank matrix spiked with a known amount of analyte(s), processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.
- 9.3.2 A Laboratory Control Sample (contact liquid fortified with the appropriate target analyte(s)) is prepared with each batch of samples.

9.4 Sample Replicates

- 9.4.1 All samples are prepared and analyzed in triplicate.

9.5 Procedural Variations/ Nonconformance and Corrective Action

- 9.5.1 Any variation shall be completely documented using a Nonconformance Memo and approved by the Supervisor and QA Manager. See SOP ST-QA-0036 for details regarding the NCM process.
- 9.5.2 Any deviations from QC procedures must be documented as a nonconformance, with applicable cause and corrective action approved by the Supervisor and QA Manager. See SOP ST QA-0036 for details regarding the NCM process.

10.0 CALIBRATION AND STANDARDIZATION

- 10.1. Calibrate the pH meter daily when used. The pH meter is calibrated in accordance with SOP ST-WC-0011.
- 10.2. Calibrate the balance daily when used. The balance is calibrated in accordance with SOP, ST-QA-0005.
- 10.3. Calibrate the conductivity meter when used. The conductivity meter is calibrated in accordance with SOP, ST-WC-0025.

11.0 PROCEDURE

- 11.1. To insure timely completion of the project, it is recommended that enough samples be prepared to accommodate a client's request for multiple contact days for the extractions.
Example: For a requested contact period duration of 3, 7, 10, and 14, days, sample aliquots should be weighed out for Day 3, and Day 7, and Day 10, and Day 14. A total of 4 portions of each sample are required.
All contact periods are started at the same time.

Contact Period Duration	Number of portions per sample
Day 3	1
Day 7	2
Day 10	3
Day 14	4

- 11.2. Soil samples are dried and ground in the ball mill if radiological parameters are to be tested. Follow the client's instructions for additional preparation or if non-radiological analyses are to be performed.
- 11.3. Weigh out a portion of sample that is adequate to produce enough filtrate for the analytical purpose and place into an appropriate centrifuge tube or bottle. Add contact liquid to the sample to create a 1:4 ratio of sample to liquid. (Example: 20g portions of a representative sample into 250ml plastic bottles with 80 mL of contact liquid).
- 11.4. Prepare one extraction blank for each contact period containing the same volume of contact liquid in an empty container as used for the samples.
- 11.5. Prepare one spiked contact liquid sample (fortified with appropriate target analyte(s) in a similar configuration as the samples. Utilize the appropriate amount of target analyte to end up with the desired concentration as requested by the client. Adjust the pH of the spiked contact liquid to equal the pH of the original contact liquid.
- 11.6. Agitate the sample mixture (including the extraction blank and spiked contact liquid) for 15 minutes.
- 11.7. If a desorption study is being perform, skip steps 11.8 through 11.11.
- 11.8. Centrifuge the samples at 1000 rpm for 5 minutes. **Caution:** Do not exceed 1000 rpm. When using the 250mL plastic bottles, excess rpm causes the bottles to collapse, resulting in lost sample.
- 11.9. Decant the supernatant from the samples. Do not decant the liquid from the extraction blank or the spiked contact liquid.
- 11.10. Repeat the fluid addition, agitation, centrifuging and decanting twice.
- 11.11. Add spiked contact liquid to the sample to create a 1:4 ratio of sample to liquid. (When an adsorption study is being performed, a spiked contact liquid should be utilized. Add the appropriate amount of

target analyte(s) to the contact liquid end up with the desired concentration as requested by the client. Adjust the pH of the spiked contact liquid to equal the pH of the original contact liquid.) Agitate the sample for 15 minutes to suspend the solid material.

- 11.12. Measure the pH and conductivity of the samples and record the information in the extraction log.
- 11.13. Adjust pH of samples to equal the pH of the contact liquid. Use 1N NaOH or 1N H₂SO₄ for the pH adjustment
- 11.14. **Ensure that steps 11.3 thru 11.13 are all performed in one day.**
- 11.15. The samples must be agitated for 6 hours every three days. Ensure that the agitation occurs at least one day before the samples are to be filtered.
- 11.16. Samples are removed on predetermined days. Measure and record the pH of the samples.
- 11.17. Centrifuge the samples at 1000 rpm for 5 minutes.
- 11.18. Filter the samples using a 0.45µm membrane disposable filter (keep filter and solid portion and set aside) and transfer filtrate into a 125 ml plastic bottles.
- 11.19. For radiological and metal analyses, preserve the extract with a ratio of approximately 0.5 ml of nitric acid (1:1) per 80 ml of extract to bring the pH of the sample to < 2. The samples are now ready for analysis by the appropriate methodology.

12.0 DATA ANALYSIS AND CALCULATIONS

- 12.1. Commonly used calculations (e.g. % recovery and RPD) and standard instrument software calculations are given in the QAM.
- 12.2. Analysis
 - 12.2.1. Each sample must have pH and specific conductance requested at login for reporting purposes.
- 12.3. Calculations
 - 12.3.1. Results are reported in standard activity or mass per unit volume according to the appropriate analytical method.
 - 12.3.2. *Distribution ratio (R_d)* (for informational purposes):

$$R_d (ml/g) = \frac{\text{(mass of solute on the solid phase per unit mass of solid phase)}^c}{\text{(mass of solute in solution per unit volume of the liquid phase)}}$$

13.0 DATA ASSESSMENT AND ACCEPTANCE CRITERIA; CORRECTIVE ACTIONS FOR OUT OF CONTROL DATA

- 13.1 Data assessment does not pertain to this sample preparation procedure.
- 13.2 Samples requiring re-preparation are submitted to the preparation lab with a NCM detailing the issue. The NCM process is described in SOP: ST-QA-0036. Specific information is given in the applicable analysis SOP.

14.0 METHOD PERFORMANCE AND DEMONSTRATION OF CAPABILITY

- 14.1. Method performance data, Reporting Limits, and QC acceptance limits, are given in the associated analytical SOP
- 14.2. Demonstration of Capability
 - 14.2.1. Initial and continuing demonstrations of capability requirements are established in QAM section 18.3.
- 14.3. Training Qualification
 - 14.3.1. The manager/supervisor has the responsibility to ensure that this procedure is performed by an analyst who has been properly trained in its use and has the required experience.
 - 14.3.2. The analyst must have successfully completed the initial demonstration capability requirements prior to working independently. See requirements in QAM section 18.3
- 14.4. Annually, the analyst must successfully demonstrate proficiency to continue to perform this analysis. See requirements in QAM section 18.3.

15.0 VALIDATION

- 15.1. Laboratory SOPs are based on standard reference EPA Methods that have been validated by the EPA and the lab is not required to perform validation for these methods. The requirements for lab demonstration of capability are included in QAM. Lab validation data would be appropriate for performance based measurement systems or non-standard methods. TestAmerica St. Louis will include this information in the SOP when accreditation is sought for a performance based measurement system or non-standard method.

16.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

- 16.1. All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."
- 16.2. Waste Streams Produced by the Method
 - 16.2.1. The following waste streams are produced when this method is carried out.
 - 16.2.1.1. Acidic sample waste generated. All acidic waste will be accumulated in the appropriate waste accumulation container, labeled as Drum Type "A" or "B."
 - 16.2.1.2. Contaminated disposable glass or plastic materials utilized in the analysis are disposed of in the sanitary trash. If the lab ware was used for the analysis of radioactive samples and contains radioactivity at a level of 100 cpm over background as determined by a GM meter, the lab ware will be collected in waste barrels designated for solid rad waste for disposal by the EH&S Coordinator.

17.0 REFERENCES

- 17.1. American Society for Testing and Materials (ASTM), method D 4319, "Standard Test Method for Distribution Ratios by the Short-Term Batch Method."
- 17.2. St. Louis Quality Assurance Manual (QAM), current revision

- 17.3. Corporate Safety Manual (CW-E-M-001) and St. Louis Facility Addendum (SOP ST-HS-0002).
- 17.4. Associated SOPs, current revisions:
 - 17.4.1. ST-IP-0004, Labware Preparation for Inorganic and Trace Metal Analysis.
 - 17.4.2. ST-OP-0001 Labware Preparation for Organic Analysis
 - 17.4.3. ST-PM-0002, Sample Receipt and Chain of Custody
 - 17.4.4. ST-QA-0002, Standard and Reagent Preparation
 - 17.4.5. ST-QA-0005, Calibration and Verification Procedure for Thermometers, Balances, Weights and Pipettes
 - 17.4.6. ST-QA-0036, Non-conformance Memorandum (NCM) Process
 - 17.4.7. ST-RC-5006, Decontamination of Laboratory Glassware, Labware and Equipment
 - 17.4.8. ST-WC-0011, Analysis of pH in Water
 - 17.4.9. ST-WC-0025, Conductivity in Water and Solids

18.0 CLARIFICATIONS, MODIFICATIONS TO THE REFERENCE METHOD

- 18.1. None.

19.0 CHANGES FROM THE PREVIOUS REVISION

- 19.1. Added sections 3.4 and 3.5
- 19.2. Revised procedures section 11.3 through 11.19.