FIELD CHANGE REQUEST FORM

Contract No.:	CTO No.:	Field Change Request Form No.:
N62473-17-D-0006	N6247318F5065	006
Location: Parcel G, Hunters Point Naval Shipyard		**Date:** August 16, 2021
Document Title: Final Parcel G Removal Site Evaluation Work Plan, Former Hunters Point Naval Shipyard, San Francisco, CA		**NIRIS Document #:**4205

RE: Drawing No.: _____ Title _____

Specification Section _____ Title _____

Other: Work Plan (WP) Appendix B, Sampling and Analysis Plan (SAP), Worksheet (WS) #23

Description (items involved, submit sketch, if applicable)

Add Eurofins TA SOP – ST-RC-0058 Sample Preparation for Strontium-89, Strontium-90 and Total Strontium Using Extraction Chromatography, to SAP WS#23

Reason for Change

Recent Parcel G strontium-90 (Sr-90) exceedances could not be replicated through additional laboratory analysis and initiated further evaluation into the Sr-90 analytical procedure. The current laboratory method used for project samples has a higher-than-expected uncertainty due to the sample preparation procedure. In addition, the current method decision level concentration (DLC), which ranges from 0.09 picocurie per gram (pCi/g) to 0.26 pCi/g, is below but very close to the Sr-90 remediation goal (RG; 0.331 pCi/g). The DLC range and the higher-than-expected uncertainty interfere with evaluating very low concentrations near the RG. The measurement uncertainty resulted in a discussion with the Navy and regulatory agencies to evaluate method improvements to lower uncertainty and the DLC. With input from the laboratory (Eurofins-TA), APTIM proposes adding TA-SOP-RC-0058 to SAP WS#23. This preparation method for Sr-90 uses a larger aliquot (2.5 grams) with HNO3/HCl digestion and Eichrom resin (Sr Resin) separation, with a 14-day ingrowth and gas flow proportional counting (GFPC) detection.

Using this sample preparation procedure for Sr-90 soil samples is expected to lower measurement DLC and uncertainty. Previous samples will be reanalyzed using this sample preparation. Eurofins-TA is certified with the Department of Defense and Department of Energy for this preparation method for Sr-90 detection.

As stated above, previous samples will be reanalyzed using the proposed sample preparation. Data from the re-analyzed samples will be included in the Radiological Screening Yard (RSY) pad data package to obtain approval for backfill of the soil, and all results will be discussed in the summary discussion section of the data package. Relevant lab data packages will be attached to the RSY pad data package.

Recommended Disposition (submit sketch, if applicable)

Add Eurofins TA SOP–ST-RC-0058 Sample Preparation for Strontium-89, Strontium-90 and Total Strontium Using Extraction Chromatography, to SAP WS#23 (see attachments).

Additional Details

None

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Will this change result in a contract cost or time change? ☒ Yes ☐ No

Estimate of contract cost or time charge (if any) Potential schedule impact of 30 calendar days for reanalysis of existing samples with results above the action limit.

Preparer (signature)	Date	Technical Lead (Signature)	Date
Rose Cendit	10/04/2021	Raymond A Schl	10/04/2021

Disposition

☒ Approved

☐ Not approved (give reason): _____

Engineer (signature) (if engineering related)	Date	Project Manager (signature)	Date
N/A ☐ Comments (attached) ☐ No Comments		Rose Berick ☐ Comments (attached) ☒ No Comments	10/04/2021
Navy RASO (signature) N/A ☐ Comments (attached) ☐ No Comments	Date	QC Manager (signature) ☐ Comments (attached) ☒ No Comments	Date 10/04/2021
Navy RPM (signature) ☐ Comments (attached) ☐ No Comments	Date	NAVFAC SW QAO (signature) ☐ Comments (attached) ☐ No Comments	Date

FIELD CHANGE REQUEST FORM

Attachments:
Addition to WS#23
TA SOP ST-RC-0058
Updated Laboratory Certification

Distribution:
- Project File
- Copy to Site File
- Project Manager

SAP WORKSHEET #23A—ANALYTICAL SOP REFERENCES – RADIOLOGICAL – FCR-006 ADDITIONAL SOP

Lab SOP Number[a]	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
ST-RC-0058	SAMPLE PREPARATION FOR STRONTIUM-89, STRONTIUM-90 AND TOTAL STRONTIUM USING EXTRACTION CHROMATOGRAPHY 3/31/2021	Sample Preparation Definitive	Soil Strontium-90	Sample Preparation for GFPC	Eurofins TestAmerica St. Louis	N

Notes:

[a] Laboratory SOP and current DoD Certification FCR-006 Attachment

Title: SAMPLE PREPARATION FOR STRONTIUM-89, STRONTIUM-90 AND TOTAL STRONTIUM USING EXTRACTION CHROMATOGRAPHY

Approvals (Signature/Date):

03/26/2021	03/29/2021
Chelsea Mazariegos — Date Department Manager	Michael Ridenhower — Date Health & Safety Manager / Coordinator
3/26/2021	03/29/2021
Kristen Ely — Date Quality Assurance Manager	Sarah Bernsen — Date Operations Manager

This SOP was previously identified as SOP No. ST-RC-0058 Rev. 6

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1.0 SCOPE AND APPLICATION

1.1 This SOP describes the process for sample preparation of strontium-89, strontium-90 and total strontium using extraction chromatography. This procedure is applicable to water and solid matrices.

1.2 This SOP is based on ASTM Method C1507-07 and Eichrom Method SRW01..

1.3 The reporting limits and QC limits are maintained in the Laboratory Information Management System (LIMS).

2.0 SUMMARY OF METHOD

2.1 Strontium is isolated/separated by extraction chromatography. For waters, the strontium is pre-concentrated with calcium as the phosphate, then brought back up into a liquid matrix. For soils, the strontium is transferred from the soil into a liquid matrix prior to loading on the extraction column/cartridge. Interferences from calcium and other radionuclides are effectively removed by the extraction column. The separated strontium is eluted off the column, evaporated to dryness onto a planchet, and weighed for chemical recovery determination. For reporting total strontium (or strontium-89), the planchet is beta counted soon after planchet preparation, For strontium-90 determination, the strontium nitrate with ingrown yttrium-90 is dissolved from the planchet and loaded back onto the extraction chromatography column. The yttrium-90 passes directly through the column, is evaporated to dryness on a planchet, and beta counted. Strontium-90 and total strontium are counted for beta particle activity by gas flow proportional counting (GFPC). The strontium-89 concentration is determined by difference.

3.0 DEFINITIONS

3.1 See the TestAmerica St. Louis Quality Assurance Manual (ST-QAM) for a glossary of common laboratory terms and data reporting qualifiers.

3.2 There are no specific definitions for this procedure.

4.0 INTERFERENCES

4.1 Samples which contain natural strontium cause inaccurate chemical yield determinations. For samples suspected to contain significant elemental strontium, the concentration should be determined by suitable means, and the yield calculation appropriately corrected.

4.2 The extraction resin effectively removes most beta-emitting isotope interferences (e.g. Ba-140 and K-40) utilizing 8 M nitric acid load and rinse solutions. Certain tetravalent elements, if present, (e.g. uranium, plutonium, neptunium, cerium, and ruthenium) are effectively removed using a 3 M nitric acid – 0.05 M oxalic acid wash.

4.3 The extraction resin has limited capacity based upon the number of sites available to bind the strontium. The carrier should be limited to about 5 mg to avoid overloading the column, resulting in lowered chemical recoveries. Alternatively, cartridges could be stacked to increase the load capacity.

5.0 SAFETY

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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, non-absorbent shoes are a minimum.

5.2 SPECIFIC SAFETY CONCERNS OR REQUIREMENTS

5.2.1 None.

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 SDS 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 SDS for each material before using it for the first time or when there are major changes to the SDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Nitric Acid	Corrosive Poison Oxidizer	2 ppm (TWA) 4 ppm (STEL)	Inhalation may cause coughing, choking, and irritation of the nose, throat, and respiratory tract. Skin contact can cause redness, pain, and severe skin burns. Concentrated solutions can stain the skin a yellow-brown color. Vapors are irritating to the eyes and contact may cause severe burns.
Oxalic Acid	Corrosive	1 mg/m3 (TWA) 2 mg/m3 (STEL)	Inhalation symptoms include severe irritation and burns of nose, throat, and respiratory tract. Ingestion symptoms include burns, nausea, severe gastroenteritis and vomiting. Skin contact causes severe irritation and burns. Oxalic Acid is an eye irritant.
Hydrochloric Acid	Poison Corrosive	5 ppm (ceiling)	Inhalation symptoms include coughing, choking, inflammation of the nose, throat, and upper respiratory tract. Skin contact can cause redness, pain, severe skin burns, and discoloration. Vapors are irritating to the eyes. Contact may cause severe burns.
Hydrofluoric Acid	Poison Corrosive	3 ppm (TWA)	Inhalation symptoms may include sore throat, coughing, labored breathing and lung congestion/inflammation. Skin contact may cause serious burns which are not immediately apparent or painful. Symptoms of eye contact include redness, pain, and blurred vision.
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 exposure limit be exceeded.			

6.0 EQUIPMENT AND SUPPLIES

6.1 Analytical Balance (capable of an appropriate precision as required by each measurement within this procedure)

6.2 Centrifuge and centrifuge tubes

6.3 Labware, glass and teflon beakers, various sizes, covers and watch glasses

6.4 Planchets

6.5 Digestion vessels

6.6 Syringes

6.7 Mod block

6.8 Hot plate

6.9 Desiccator

6.10 Strontium-specific extraction chromatography resin – Eichrom Technologies, Inc® Sr resin 2-mL pack cartridge.

7.0 STANDARDS AND REAGENTS

7.1 All standards and reagent preparation, documentation and labeling must follow the requirements of SOP ST-QA-0002, current revision.

7.2 Deionized Water (DI)

7.3 Ammonium hydrogen phosphate (3.2M) (non-critical reagent)
7.3.1 Dissolve 104 g of $(NH_4)_2HPO_4$ in approximately 200 mL of DI water, heat gently to dissolve, and dilute to approximately 250 mL with DI water.

7.4 Ammonium hydroxide (NH_4OH), Reagent.

7.5 Bromocresol Purple indicator solution (non-critical reagent)
7.5.1 Dissolve 0.2 g of Bromocresol Purple (520.24 F.W.) in approximately 250 mL of water, add 1 mL of concentrated Ammonium Hydroxide.

7.6 Calcium nitrate (1.25M) (non-critical reagent)
7.6.1 Dissolve 51 g of $Ca(NO_3)_2$ in approximately 100 mL of DI water and dilute to approximately 250 mL with DI water.

7.7 Hydrochloric acid (12 M HCl) - concentrated, 37.2%.

7.8 Nitric acid (16 N HNO_3) (69 – 71%) - concentrated HNO_3.

7.9 Nitric acid (8 M HNO_3)

7.9.1 Non critical concentration
7.9.2 In a marked 2L bottle, add approximately 1L of DI water. Then SLOWLY and CAREFULLY add approximately 1L of concentrated HNO3
7.9.3 Shake carefully to mix.

7.10 Nitric acid (4 M HNO_3)
7.10.1 Non critical concentration
7.10.2 In a marked 2.5L bottle, add approximately 1875 mL of DI water. Then SLOWLY and CAREFULLY add approximately 625 mL of concentrated HNO3.
7.10.3 Shake carefully to mix.

7.11 Nitric acid (0.05 M HNO_3)
- 7.11.1 Non critical concentration
- 7.11.2 Add approximately 800 mL of DI water to a 1L container. Add approximately 3mL of concentrated HNO3.
- 7.11.3 Dilute to approximately 1L with DI water.
- 7.11.4 Shake carefully to mix.

7.12 Nitric acid (3 M HNO_3)/oxalic acid (0.05 M $C_2H_2O_4$) solution
- 7.12.1 Non critical concentration
- 7.12.2 In a 1L container, disslove 6.3 g of oxalic acid dihydrate in approximately 700 mL of DI water.
- 7.12.3 Add approximately 190 mL of concentrated HNO3 with mixing.
- 7.12.4 Dilute to approximately 1 L with DI water.

7.13 Nitric acid (3 M HNO_3)/boric acid (0.25 M BH_3O_3) solution
- 7.13.1 Non critical concentration
- 7.13.2 In a 1L container, dissolve 15.5 g of boric acid in approximately 700 mL of DI water.
- 7.13.3 Add approximately 190 mL of concentrated HNO3 with mixing.
- 7.13.4 Dilute to approximately 1 L with DI water.

7.14 Hydrofluoric acid, concentrated (29 N HF)

- 7.14.1

7.15 Strontium carrier (standardized) 5 or 25 mg/mL, NIST traceable
- 7.15.1 If the strontium carrier is not already standardized, standardize the strontium carrier using the following procedure with 6 replications:
  - 7.15.1.1 Add 5 mg (or 0.2 mL of 25 mg/mL SrNO3 solution) to 10 mL of 8M HNO3.
  - 7.15.1.2 Follow 11.4 column separation and plating.
  - 7.15.1.3
  - 7.15.1.4 Record gross and final weights in the Rad Standards Log and allow a manager or QA to assess the data to verify the replications are acceptable. Assign a unique number to the solution.

7.16 Strontium-89, NIST traceable

7.17 Strontium-90, NIST traceable

8.0 SAMPLE COLLECTION, PRESERVATIVES 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 Samples may be collected in glass or plastic containers.

9.0 QUALITY CONTROL

9.1 **Batch**
- 9.1.1 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.

9.1.2 Instrument conditions must be the same for all standards, samples and QC samples.

9.1.3 For this analysis, batch QC consists of a method blank, a Laboratory Control Sample (LCS), and Sample Duplicate (DU). In the event that there is insufficient sample to analyze a sample duplicate, an LCS Duplicate (LCSD) is prepared and analyzed.

9.1.4 Matrix Spike (MS) and Matrix Spike Duplicate (MSD) may be performed upon client request, and are noted in the Client Requirement Sheets and Log-in.

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 For **soil** analyses, the method blank is comprised of calcium nitrate.

9.2.4 For water analyses, the method blank is comprised of DI water acidified with nitric acid.

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 An LCS must be prepared with every sample batch.

9.3.3 For **soil** analyses, the LCS is comprised of calcium nitrate fortified with strontium-90.

9.3.4 For water analyses, the LCS is comprised of DI water acidified with nitric acid and fortifide with strontium-90.

9.4 **Matrix Spike/Matrix Spike Duplicate**

9.4.1 A Matrix Spike (MS) is an aliquot of a field sample to which a known amount of target analyte(s) is added, and is processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

9.4.2 MS/MSD samples do not count towards the 20 environmental samples in a sample batch.

9.4.3 MS/MSD samples, when requested, must be performed with every sample batch and every LIMS batch.

9.5 **Sample Duplicate**

9.5.1 A Sample Duplicate is an additional aliquot of a field sample taken through the entire analytical process to demonstrate precision.

9.5.2 If there is insufficient sample to perform a Sample Duplicate, a duplicate LCS is analyzed. A NCM is written to document the insufficient volume and utilizing of an LCSD for demonstration of precision.

9.6 **Procedural Variations/ Nonconformance and Corrective Action**

9.6.1 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.

10.0 CALIBRATION AND STANDARDIZATION

10.1 Balance and automatic pipetter calibrations must be checked daily when used. Refer to SOP ST-QA-0005, "Calibration and Verification Procedure for Laboratory Support Equipment."

10.2 See analytical SOP ST-RD-0403, "Low Background Gas Flow Proportional Counting (GFPC) System", for instrument calibration requirements.

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11.0 PROCEDURE

11.1 Water Samples

11.1.1 Initiate sample preparation worksheet.

11.1.2 Ensure that the sample container is capped tightly and shake it thoroughly.

11.1.3 Transfer sample aliquot to a beaker; generally 1L is used.

11.1.3.1 Upon visual inspection, if the aqueous sample is suspected to have a high density (> 1.2 g/mL, e.g. a brine or waste) or a low density (< 0.98 g/mL, e.g. mixed solvent), the sample density will be measured and the volume determined arithmetically (sample mass divided by the density equals the volume).

11.1.3.2 Create the MB and LCS using DI water and acidify to a pH <2 with nitric acid

11.1.4 Add 5 mg strontium equivalent of standardized strontium carrier (either 0.2 mL of 25 mg/mL carrier or 1 mL of 5 mg/mL carrier) to samples and QC. Add about 5x the client's requested limit of Sr-90 spike to the LCS and MS/MSD, if applicable.

11.1.5 Add 2 mL of 1.25M $Ca(NO_3)_2$ to each sample and QC.

11.1.6 Add 5mL of 3.2M $(HN_4)_2HPO_4$ solution per liter of sample.

11.1.7 Add enough bromocresol purple indicator, while stirring, to see the color of the indicator (should be yellow at this point). If the samples are purple instead of yellow, check the pH and add more concentrated nitric acid to ensure the sampels are acidic.

11.1.8 Place samples on a hot plate and begin heating to near boiling. After the sample has reached near boiling (should see steam from the sample), turn the heat down to about medium.

11.1.9 While stirring add enough NH_4OH to reach the purple indicator end point and form $Ca_3(PO_4)_2$ precipitate. Allow the sample to heat for another 20-30 minutes.

11.1.10 Remove from the hot plate, and allow the sample to cool and the precipitate to settle.

11.1.11 Decant the excess supernate to a base waste container.

11.1.12 Transfer the precipitate to a labeled centrifuge tube and centrifuge the preicipitate for approximately 5 minutes at 2000 rpm.

11.1.13 Decant the supernate and discard to base waste.

11.1.14 Wash the precipitate with 10 mL of DI water. Vortex or shake to ensure the precipitate is thoroughly washed.

11.1.15 Centrifuge for approximately 5 minutes at 2000 rpm.

11.1.16 Decant the supernate and discard to base waste.

11.1.17 Dissolve the precipitate in 10 mL of 8M nitric acid.

11.1.18 Proceed to column loading (11.3).

11.2 Soil Samples (aliquot of less than 2.5 g or non-soil solids such as resin beads)

11.2.1 For soil samples, prepare sample as per SOP ST-RC-0003, "Drying and Grinding of Soil and Solid Samples."

11.2.2 Weigh approximately 1 g of sample into a labeled beaker. Larger aliquots (up to 10 g) may be utilized, but acid volumes need to be adjusted accordingly. See your supervisor or technical director for instructions.

11.2.3 Add sufficient calcium nitrate to cover the bottom of the method blank and LCS beakers.

11.2.4 Add a small amount of DI water to all soil samples.

11.2.5 Add 5 mg strontium equivalent of standardized strontium carrier (either 0.2 mL of 25 mg/mL carrier or 1 mL of 5 mg/mL carrier) to samples and QC. Add about 5x the client's requested limit of Sr-90 spike (usually 1 mL) to the LCS and MS/MSD, if applicable.

11.2.6 Gently dry the beakers on a hotplate.

11.2.7 Place in muffle oven at 600° and allow to muffle for 4 hours. Allow to cool.

11.2.8 Add 10 mL concentrated hydrochloric acid to the beakers and cover with a watchglass. Heat at a low temperature (approximately 200 degrees) for 20-30 minutes to reflux solids off the bottom of the beaker.

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11.2.9 Using a cut transfer pipette, scrape the sides and bottom of the inside of the beaker and rinse the solids with concentrated nitric acid (about 5 mL) into a teflon beaker or digestion tube, completely removing the sample.

11.2.10 Add 10 mL concentrated hydrofluoric acid to the teflon beakers or digestion tubes. Cook until samples are completely dry.

11.2.11 Add 5 mL concentrated nitric acid, 5 mL concentrated hydrochloric acid, and 10 mL concentrated hydrofluoric acid to the teflon beakers or digestion tubes, and cook until completely dry once more.

11.2.12 Add 10 mL 8M HNO3 to samples and cover with a watchglass, heating for about 15-20 minutes to dissolve the solids.

11.2.13 Transfer samples to 50 mL centrifuge tubes. Proceed to column separation section 11.4.

11.3 Soil Samples (aliquot of 2.5 g of soil or larger)

11.3.1 For soil samples, prepare sample as per SOP ST-RC-0003, "Drying and Grinding of Soil and Solid Samples."

11.3.2 Weigh up to 2.5 g of sample into a labeled beaker. Larger aliquots (up to 10 g) may be utilized, but acid volumes need to be adjusted accordingly. See your supervisor or technical director for instructions.

11.3.3 Add sufficient calcium nitrate to cover the bottom of the method blank and LCSbeakers.

11.3.4 Add a small amount of DI water to all soil samples.

11.3.5 Add 5 mg strontium equivalent of standardized strontium carrier (either 0.2 mL of 25 mg/mL carrier or 1 mL of 5 mg/mL carrier) to samples and QC. Add about 5x the client's requested limit of Sr-90 spike to the LCS and MS/MSD, if applicable.

11.3.6 Gently dry the beakers on a hotplate.

11.3.7 Place in muffle oven at 600° and allow to muffle for 4 hours. Allow to cool.

11.3.8 Add 10 mL of concentrated hydrochloric acid to all crucibles and cover with a plastic watch glass. Reflux on a hotplate for 20-30 minutes at approximately 200-300 degrees.

11.3.9 Use a cut transfer pipet and scrape the inside of the beaker to remove all solids. Transfer to digestion tube using approximately 5 mL of concentrated nitric acid.

11.3.10 Add an additional 25 mL of concentrated nitric acid to each digestion tube.

11.3.11

11.3.12 Digest in mod block at > 110° for 1-2 hours

11.3.13 Allow the solution to cool.

11.3.14 Transfer the solution/solids to a labeled centrifuge tube with minimal DI water and centrifuge. Carefully transfer the supernatant to a labeled beaker.

11.3.15 Add 10 mL of concentrated nitric acid to the solids remaining in the centrifuge tube and vortex to loosen the solids. Transfer the solids/solution to the original digestion tube. Rinse the tube with 10 mL concentrated nitric acid to ensure all the soil transfers and add to the digestion tube. Add 10 mL more nitric acid and 10 mL concentrated hydrochloric acid to the digestion tube.

11.3.16 Digest in mod block at > 110° for 1-2 hours.

11.3.17 Allow the solution to cool.

11.3.18 Transfer the solution/solids to a labeled centrifuge tube with minimal DI water and centrifuge. Carefully transfer/combine the supernatant with the supernatant from the first digestion.

11.3.19 For samples which are not expected to contain refractory strontium, proceed to step 11.1.15. The following steps are to be used for samples expected to contain refractory strontium or for which the client requires total dissolution. The client should notify the lab if the sample(s) received may contain refractory strontium.

11.3.19.1 Add 10 mL of concentrated nitric acid to the solids remaning in the centrifuge tube and vortex to loosen the solids. Transfer the solids/solution to a labeled teflon beaker.

11.3.19.2 Add 30 mL of concentrated hydrofluoric acid.

11.3.19.3 Cover the beaker and digest for several hours at low heat.

11.3.19.4 Remove the cover and evaporate to dryness.
11.3.19.5 If necessary to dissolve remaining residue, add 10 mL of concentrated nitric acid and 30 mL of concentrated hydrofluoric acid and repeat the digestion/evaporation steps above.
11.3.19.6 Add 15 mL 3 M nitric acid/0.25 M boric acid and evaporate to dryness.
11.3.19.7 Add 10 mL 8 M nitric acid, cover, and heat just to boiling for 5 minutes.
11.3.19.8 Cool, and then transfer the solids/solution to a centrifuge tube with minimal DI water and centrifuge. Carefully transfer/combine the supernatant with the supernatant from the initial digestions.

11.3.20 Carefully evaporate the combined supernatant to dryness.
11.3.21 Add 15 mL of 4 M nitric acid to the beaker and reflux for 10-15 minutes. Do not allow the volume to drop below 5 mL.
11.3.22 Transfer the solution to a labeled mod block tube.
11.3.23 Rinse the beaker with 5 mL of 4 M nitric acid. Transfer to the labeled mod block tube.
11.3.24 Carefully reduce the volume to 10 mL. If the volume drops below 10 mL, but greater than 5 mL, bring up to 10 mL with DI water. If the volume drops below 5 mL, consult your supervisor or technical director for instruction.
11.3.25 Proceed to column loading (11.4)

11.4 Initial Column Loading/Eluting

11.4.1 Prepare a labeled 2 mL extraction cartridge with a reservior (e.g. syringe barrel) and waste container and condition with 5 mL of 8 M nitric acid on a vacuum box setup.
11.4.2 Transfer the 10 mL sample to the reservior and allow to load at 1 mL per minute (approximately 1 drop every 3 seconds).
11.4.3 Rinse the cartridge with 5 mL of 8 M nitric acid at approximately 3 mL per minute (approximately 1 drop every second).
11.4.4 Rinse the cartridge with 5 mL of 3 M nitric acid/0.05 M oxalic acid solution at approximately 3 mL per minute.
11.4.5 Rinse the cartridge with 5 mL of 8 M nitric acid at approximately 3 mL per minute.
11.4.5.1 **Note: Record in LIMS, the date/time of this step as the final strontium rinse, indicating the beginning of the yttrium-90 ingrowth ("T1").**
11.4.6 Remove the acid waste container (discard to acid waste) and replace with a labeled collection tube.
11.4.7 Elute the strontium from the column with 10 mL of 0.05 M nitric acid at 1 mL per minute.
11.4.8 Evaporate the strontium eluant onto a cleaned/pre-weighed planchet (tare weight should be recorded in LIMS) by adding small portions (3-5 mL) to the plancheton a hot plate and allowing each portion to evaporate to near dryness between additions.
11.4.9 Evaporate completely to dryness, cool in a dessicator, and re-weigh. Record the final gross weight in LIMS.The expected strontium mass added (based on the amount added as a standardized carrier) is used to calculate strontium carrier recovery gravimetrically.
11.4.10 For total strontium or strontium-89 analysis, submit the prepared planchet(s) to the count room for analysis. Store in a dessicator until count is performed.
11.4.11 Save the labeled extraction cartridge and planchet if strontium-90 analysis is to be performed.

11.5 Yttrium-90 preparation

11.5.1 For strontium-90 analysis, hold the planchet and allow the yttrium-90 to ingrow for 7-14 days.
11.5.2 Condition the extraction cartridge from the initial strontium separation.
11.5.2.1 Prepare the labeled extraction cartridge saved from the initial strontium separation (or a new cartridge) with a reservoir (e.g. syringe barrel) and acid waste container on a vacuum box.
11.5.2.2 For a *new cartridge*, proceed to 11.4.2.4.

11.5.2.3 For a *reused cartridge*, rinse with 5 mL of 0.05 M nitric acid at 3 mL per minute. Note: the 0.05 M nitric acid removes Bi-210 that might be present due to Pb-210 from the sample tightly bound to the resin.

11.5.2.4 Condition the cartridge with 5 mL of 8 M nitric acid at 3 mL per minute.

11.5.2.5 Remove the acid waste container (discard acid waste) and replace with a labeled collection tube.

11.5.3 Dissolve the strontium nitrate residue from the planchet with up to 3 portions of 5 mL of warm 8 M nitric acid and store in a tube to be loaded onto the cartridge.

11.5.4 Load the 8 M nitric acid solution containing the dissolved residue onto the prepared cartridge at 1mL per minute a collect the rinse that falls through the resin for plating.

11.5.5 Rinse each cartridge with an additional 5 mL of 8 M nitric acid. Collect this rinse with the rinse from step 11.4.4.

11.5.6 Record in LIMS, the time of the last rinse as the stop time for the yttrium-90 ingrowth ("**T2**").

11.5.7 Evaporate the yttrium eluant (combined from steps 11.4.3 and 11.4.4) onto a cleaned/pre-weighed planchet (tare weight should be recorded in LIMS) by adding small portions (3-5 mL) to the planchet on a hot plate and allowing each portion to evaporate to near dryness between additions.

11.5.8 Evaporate completely to dryness, cool in a dessicator, and reweigh. Record the final gross weight in LIMS, to be used in the efficiency determination. The yttrium yield is assumed to be 100%.

11.5.9 Submit the prepared planchet(s) to the count room for analysis. Store in a dessicator until count is performed.

12.0 DATA ANALYSIS AND CALCULATIONS

12.1 There are no calculations pertaining to this sample preparation procedure.

12.2 Commonly used calculations (e.g. precent recovery and realtive precent difference "RPD") and standard instrument software calculations are given in the TestAmerica St. Louis QAM (ST-QAM). Specific analysis calculations are given in the applicable analysis SOP.

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. The requested limits (RL), minimum detectable amount (MDA) and QC limits are maintained in the Laboratory Information Management System (LIMS).

14.2. Demonstration of Capability

14.2.1. Initial and continuing demonstrations of capability requirements are established in ST-QAM.

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 ST-QAM.

14.4. Annually, the analyst must successfully demonstrate proficiency to continue to perform this analysis. See requirements in ST-QAM

15.0 VALIDATION

15.1 This method is based upon a published ASTM procedure which presents performance results for over 30 measurements made over 8 years using 16 different samples in duplicate from the Department of Energy – Environmental Measurements Laboratory – Quality Assurance Program. The laboratory has also validated this method using a MARLAP Level C type protocol for total strontium.

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 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 Sample waste with a Basic pH is generated. All base waste will be accumulated in the appropriate waste accumulation container, labeled as Drum Type "A" or "B".

16.2.1.3 Contaminated disposable glass or plastic materials utilized in the analysis are disposed of in the sanitary trash. If the labware 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 labware will be collected in waste barrels designated for solid rad waste for disposal by the EH&S Coordinator.

17.0 REFERENCES

17.1 ASTM Method C1507-07, "Standard Test Method for Radiochemical Determination of Strontium-90 in Soil". Current edition approved June 1, 2007.

17.2 Eichrom Technologies, Inc., Analytical Procedure SRW01 ("Strontium-89/90 in Water"), February 2003.

17.3 TestAmerica Quality Assurance Manual (ST-QAM), current revision

17.4 TestAmerica Corporate Environmental Health and Safety Manual (CW-E-M-001) and St. Louis Facility Addendum (SOP ST-HS-0002), current revisions.

17.5 Associated SOPs (Current Revisions)

17.5.1 ST-RC-0002, Planchet Preparation for Radiochemistry and Radiological Screening Analysis

17.5.2 ST-RC-0003, Drying and Grinding of Soil and solid Samples

17.5.3 ST-RC-0004, Preparation of Soil, Sludge, Filter, Biota and Oil & Grease Samples for Radiochemical Analysis

17.5.4 ST-RC-5006, Decontamination of Laboratory Glassware. Labware and Equipment
17.5.5 ST-RD-0403, Low Background Gas Flow Proportional Counting (GFPC) System
17.5.6 ST-QA-0002, Standards and Reagent Preparation
17.5.7 ST-QA-0005, Calibration and Verification Procedure for Laboratory Support Equipment
17.5.8 ST-QA-0036, Non-conformance Memorandum (NCM) and Corrective Action Processes
17.5.9 ST-PM-0002, Sample Receipt and Chain of Custody

18.0 CLARIFICATIONS, MODIFICATIONS TO THE REFERENCE METHOD

18.1 Modifictions to method C1507-07:
- 18.1.1 The reference method is geared for 10 g sample aliquot. This SOP is scaled for smaller aliquot volumes as needed.
- 18.1.2 Total dissolution with HF is only performed for samples expected to contain refractory strontium or when required by the client.
- 18.1.3 A 3 M nitric acid/0.05 M oxalic acid rinse is used in the initial strontium portion of the procedure based upon extraction resin manufacturer (Eichrom Technologies, Inc) recommendation to remove possible interferences.
- 18.1.4 Based upon recommendation by Eichrom, boric acid is utilized following the HF digestion step to help destroy residual HF, which can interfere with the ensuing process.

18.2 Modifications to method SRW01:
- 18.2.1 The final load solution of 15 mL nitric acid/aluminum nitrate was changed to just 10 mL of 8M nitric acid to be consistent with the soil load solution.

19.0 CHANGES TO PREVIOUS REVISION

19.1 New procedure (no previous revision).

19.2 Rev. 1:
- 19.2.1 In section 11.2.8 updated the amounts needed to perform an ICP metals analysis for chemical yields.

19.3 Rev 2: (07/31/2014)
- 19.3.1 Grammatical errors fixed throughout SOP
- 19.3.2 Removed references to Quantims, replaced with LIMS
- 19.3.3 Updated text in Section 14

19.4 Annual Review – No Changes (04/04/2016)

19.5 Revision 3: (02/27/2017):
- 19.5.1 Updated section 5.0 – replaced MSDS with SDS
- 19.5.2 Updated section 7.0
  - 19.5.2.1 DI water source
  - 19.5.2.2 Clarified how to make reagents
- 19.5.3 Updated section 9
  - 19.5.3.1 Updated abbreviation for sample duplicate to match LIMS
  - 19.5.3.2 Removed duplicate paragraph from section 9.6
- 19.5.4 Updated section 11.0 – replaced Rad Capture with LIMS

19.6 Revision 4: (12/12/2017 Technical Review S. Bernsen/QA Review: M. Ward):
- 19.6.1 Updated section 7.4- added ICP Rinse/Diluent as a reagent.
- 19.6.2 Updated section 11.1.1- fixed the SOP from ST-RC-003 to ST-RC-0003.
- 19.6.3 Updated section 11.1.4- added 50 mL digestion tube
- 19.6.4 Updated section 11.2.2- added approximately 1 drop every 3 seconds.
- 19.6.5 Updated section 11.2.3- added approximately 1 drop every 1-2 seconds
- 19.6.6 Grammatical Errors Fixed

19.7 Revision 5: (11/9/2018 Technical Review: S. Bernsen, T. Romanko)

19.7.1 Updated signature page
19.7.2 Updated Title, Section 1 and Section 2 to add water to the matrices
19.7.3 Updated section 9.0- added calcium nitrate to method blank and LCS
19.7.4 Updated section 11.0
19.7.5 Added procedure for spiking and tracing samples prior to muffling
19.7.6 Updated digestion procedure to accommodate spiking and tracing prior to muffling
19.7.7 Added section 11.2 for water samples.
19.7.8 Clarified step 11.3.5 in the Yttrium 90 preparation.
19.7.9 Updated section18.

19.8 Added Eurofins logo and updated copyright information (4/16/2019)

19.9 Revision 6 (01/31/2020) Technical Review C. Mazariegos/ QA Review K. Ely
19.9.1 Removed references to quarts crucibles and ICP in section 6.0
19.9.2 Removed instructions for non-standardized Sr carriers in section 7.0
19.9.3 Generalized creation of MB and LCS samples and simplified requirements for spike amount in section 11.0
19.9.4 Removed instructions for Sr yield determination by ICP and added information on gravimentric carrier recovery determination in section 11.3
19.9.5 Corrected step references on Strontium Flow Chart
19.9.6 Added Yttrium Flow Chart (attachment 2)
19.9.7 Corrected spelling and grammar throughout
19.9.8 Section 9 – removed language pertaining to old LIMS system
19.9.9 Updated SOP names throughout.

19.10 Revision 7 (3/31/2021) Tech Review C. Mazariegos; QA Review M Ward/K. Ely
19.10.1 Added additional instructions (now standard prep) for alternative digestion of soils less than 2.5 g or solid samples that dissolve easily such as resin.
19.10.2 Corrected some spelling errors.
19.10.3 Adjusted step numbers to correlate to cahnges.

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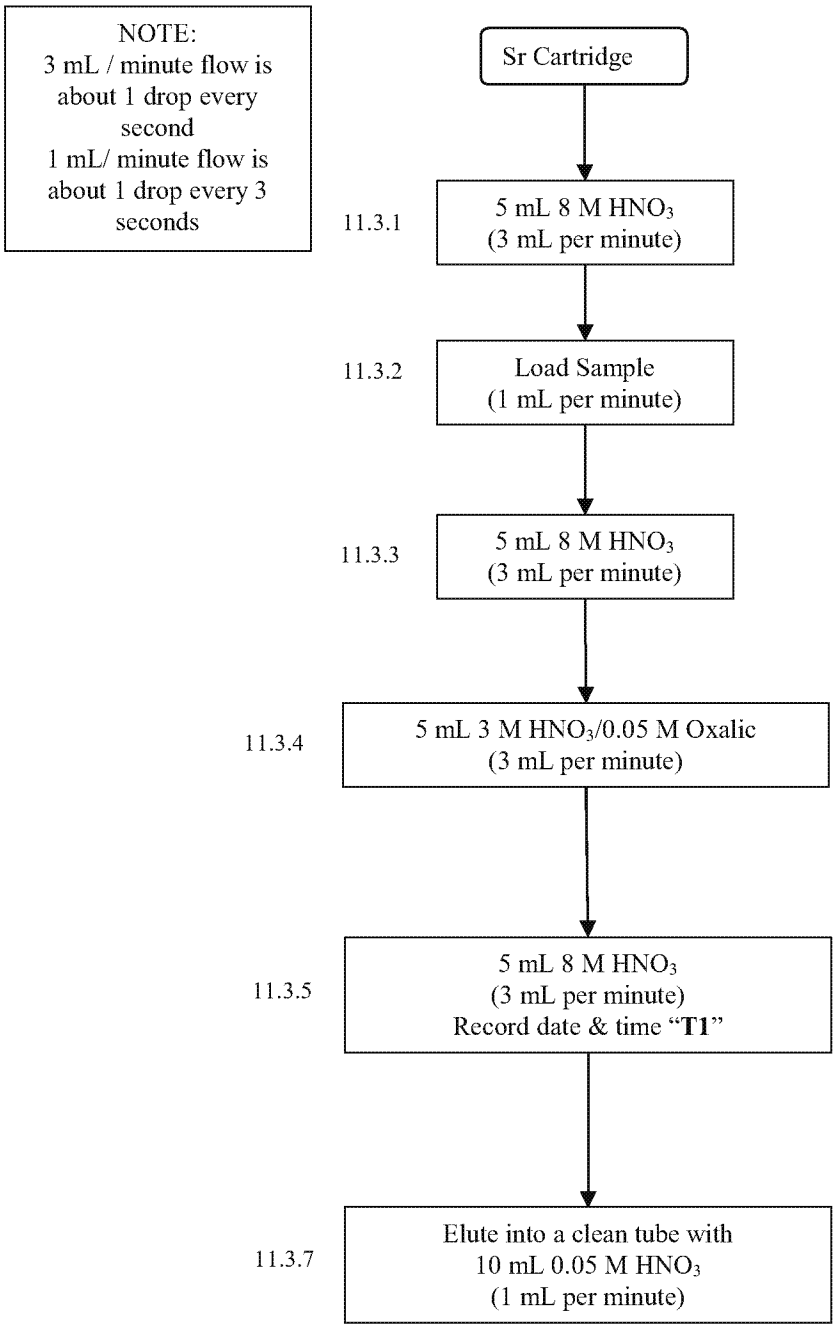
Attachment 1

Strontium via Sr-Specific Resin



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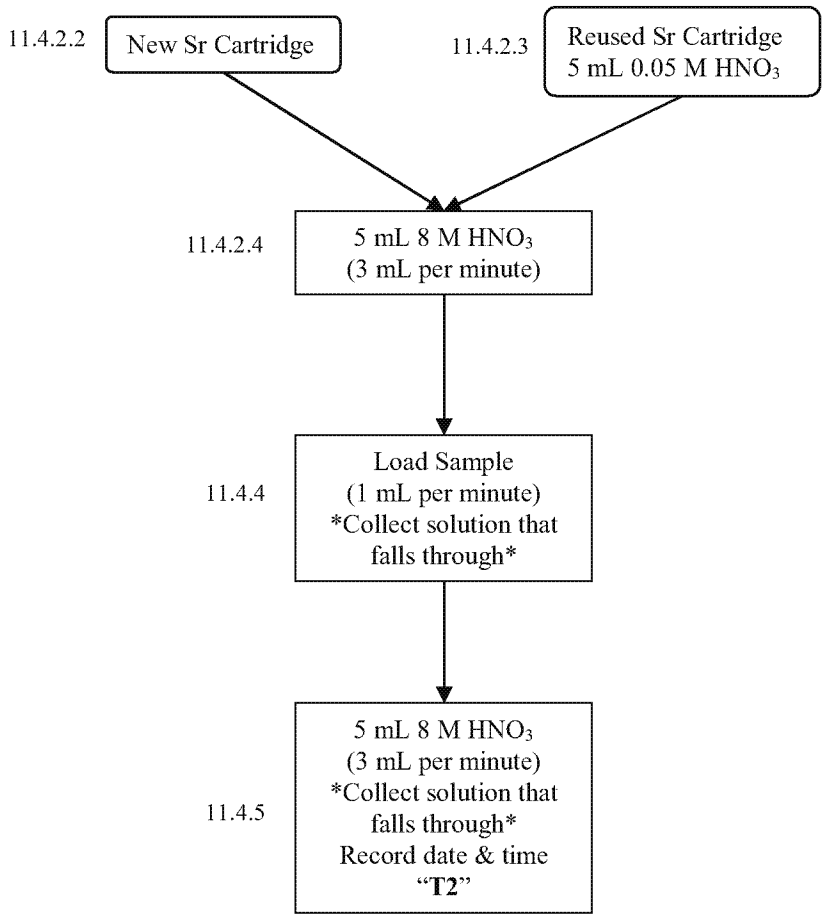
Attachment 2

Yttrium via Sr-Specific Resin



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CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Eurofins TestAmerica, St. Louis Facility

13715 Rider Trail North
Earth City, Missouri 63045

Fulfills the requirements of

ISO/IEC 17025:2017

and the

U.S. Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (DoD QSM V5.3)

In the field of

TESTING

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 06 April 2022
Certificate Number: L2305

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

ANSI National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017 and U.S. DEPARTMENT OF DEFENSE (DoD) QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL LABORATORIES (DoD QSM V5.3)

Eurofins TestAmerica, St. Louis Facility
13715 Rider Trail North
Earth City, Missouri 63045
Kristen Ely
314-298-8566

TESTING

Valid to: **April 6, 2022** Certificate Number: **L2305**

Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Aluminum
ICP-AES	EPA 6010B/6010C/6010D	Antimony
ICP-AES	EPA 6010B/6010C/6010D	Arsenic
ICP-AES	EPA 6010B/6010C/6010D	Barium
ICP-AES	EPA 6010B/6010C/6010D	Beryllium
ICP-AES	EPA 6010B/6010C/6010D	Bismuth
ICP-AES	EPA 6010B/6010C/6010D	Boron
ICP-AES	EPA 6010B/6010C/6010D	Cadmium
ICP-AES	EPA 6010B/6010C/6010D	Calcium
ICP-AES	EPA 6010B/6010C/6010D	Chromium
ICP-AES	EPA 6010B/6010C/6010D	Cobalt
ICP-AES	EPA 6010B/6010C/6010D	Copper
ICP-AES	EPA 6010B/6010C/6010D	Iron
ICP-AES	EPA 6010B/6010C/6010D	Lead
ICP-AES	EPA 6010B/6010C/6010D	Lithium
ICP-AES	EPA 6010B/6010C/6010D	Magnesium
ICP-AES	EPA 6010B/6010C/6010D	Manganese

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Molybdenum
ICP-AES	EPA 6010B/6010C/6010D	Nickel
ICP-AES	EPA 6010B/6010C/6010D	Phosphorus
ICP-AES	EPA 6010B/6010C/6010D	Potassium
ICP-AES	EPA 6010B/6010C/6010D	Selenium
ICP-AES	EPA 6010B/6010C/6010D	Silicon
ICP-AES	EPA 6010B/6010C/6010D	Silver
ICP-AES	EPA 6010B/6010C/6010D	Sodium
ICP-AES	EPA 6010B/6010C/6010D	Strontium
ICP-AES	EPA 6010B/6010C/6010D	Sulfur
ICP-AES	EPA 6010B/6010C/6010D	Thallium
ICP-AES	EPA 6010B/6010C/6010D	Thorium
ICP-AES	EPA 6010B/6010C/6010D	Tin
ICP-AES	EPA 6010B/6010C/6010D	Titanium
ICP-AES	EPA 6010B/6010C/6010D	Vanadium
ICP-AES	EPA 6010B/6010C/6010D	Zinc
GC/MS	EPA 8260B/8260C/8260D	Acetone
GC/MS	EPA 8260B/8260C/8260D	Acetonitrile
GC/MS	EPA 8260B/8260C/8260D	Acrolein
GC/MS	EPA 8260B/8260C/8260D	Acrylonitrile
GC/MS	EPA 8260B/8260C/8260D	Benzene
GC/MS	EPA 8260B/8260C/8260D	Benzyl chloride
GC/MS	EPA 8260B/8260C/8260D	Bromobenzene
GC/MS	EPA 8260B/8260C/8260D	Bromochloromethane
GC/MS	EPA 8260B/8260C/8260D	Bromodichloromethane
GC/MS	EPA 8260B/8260C/8260D	Bromoform
GC/MS	EPA 8260B/8260C/8260D	Bromomethane
GC/MS	EPA 8260B/8260C/8260D	n-Butanol
GC/MS	EPA 8260B/8260C/8260D	2-Butanone
GC/MS	EPA 8260B/8260C/8260D	n-Butylbenzene
GC/MS	EPA 8260B/8260C/8260D	sec-Butylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C/8260D	tert-Butylbenzene
GC/MS	EPA 8260B/8260C/8260D	Carbon disulfide
GC/MS	EPA 8260B/8260C/8260D	Carbon tetrachloride
GC/MS	EPA 8260B/8260C/8260D	Chlorobenzene
GC/MS	EPA 8260B/8260C/8260D	2-Chloro-1,3-butadiene
GC/MS	EPA 8260B/8260C/8260D	Chlorodibromomethane
GC/MS	EPA 8260B/8260C/8260D	Chloroethane
GC/MS	EPA 8260B/8260C/8260D	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B/8260C/8260D	Chloroform
GC/MS	EPA 8260B/8260C/8260D	Chloromethane
GC/MS	EPA 8260B/8260C/8260D	Allyl chloride
GC/MS	EPA 8260B/8260C/8260D	2-Chlorotoluene
GC/MS	EPA 8260B/8260C/8260D	4-Chlorotoluene
GC/MS	EPA 8260B/8260C/8260D	Cyclohexane
GC/MS	EPA 8260B/8260C/8260D	Cyclohexanone
GC/MS	EPA 8260B/8260C/8260D	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260B/8260C/8260D	1,2-Dibromoethane
GC/MS	EPA 8260B/8260C/8260D	Dibromomethane
GC/MS	EPA 8260B/8260C/8260D	1,2-Dichlorobenzene
GC/MS	EPA 8260B/8260C/8260D	1,3-Dichlorobenzene
GC/MS	EPA 8260B/8260C/8260D	1,4-Dichlorobenzene
GC/MS	EPA 8260B/8260C/8260D	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/8260C/8260D	Dichlorodifluoromethane
GC/MS	EPA 8260B/8260C/8260D	1,1-Dichloroethane
GC/MS	EPA 8260B/8260C/8260D	1,2-Dichloroethane
GC/MS	EPA 8260B/8260C/8260D	cis-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C/8260D	trans-1,2-Dichloroethene
GC/MS	EPA 8260B/8260C/8260D	1,1-Dichloroethene
GC/MS	EPA 8260B/8260C/8260D	1,2-Dichloroethene (total)
GC/MS	EPA 8260B/8260C/8260D	1,2-Dichloropropane
GC/MS	EPA 8260B/8260C/8260D	1,3-Dichloropropane
GC/MS	EPA 8260B/8260C/8260D	2,2-Dichloropropane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C/8260D	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C/8260D	trans-1,3-Dichloropropene
GC/MS	EPA 8260B/8260C/8260D	1,1-Dichloropropene
GC/MS	EPA 8260B/8260C/8260D	1,2-Dichloro-1,1,2,2-tetrafluoroethane
GC/MS	EPA 8260B/8260C/8260D	Dimethyl disulfide
GC/MS	EPA 8260B/8260C/8260D	1,4-Dioxane
GC/MS	EPA 8260B/8260C/8260D	Ethyl acetate
GC/MS	EPA 8260B/8260C/8260D	Ethylbenzene
GC/MS	EPA 8260B/8260C/8260D	Ethyl ether
GC/MS	EPA 8260B/8260C/8260D	Ethyl methacrylate
GC/MS	EPA 8260B/8260C/8260D	Hexachlorobutadiene
GC/MS	EPA 8260B/8260C/8260D	n-Hexane
GC/MS	EPA 8260B/8260C/8260D	2-Hexanone
GC/MS	EPA 8260B/8260C/8260D	Iodomethane
GC/MS	EPA 8260B/8260C/8260D	Isobutanol
GC/MS	EPA 8260B/8260C/8260D	Isopropylbenzene
GC/MS	EPA 8260B/8260C/8260D	p-Isopropyltoluene
GC/MS	EPA 8260B/8260C/8260D	Methacrylonitrile
GC/MS	EPA 8260B/8260C/8260D	Methyl acetate
GC/MS	EPA 8260B/8260C/8260D	Methylcyclohexane
GC/MS	EPA 8260B/8260C/8260D	Methylene chloride
GC/MS	EPA 8260B/8260C/8260D	Methyl methacrylate
GC/MS	EPA 8260B/8260C/8260D	4-Methyl-2-pentanone
GC/MS	EPA 8260B/8260C/8260D	MTBE
GC/MS	EPA 8260B/8260C/8260D	Naphthalene
GC/MS	EPA 8260B/8260C/8260D	2-Nitropropane
GC/MS	EPA 8260B/8260C/8260D	Nonanal
GC/MS	EPA 8260B/8260C/8260D	Pentachloroethane
GC/MS	EPA 8260B/8260C/8260D	Propionitrile
GC/MS	EPA 8260B/8260C/8260D	n-Propylbenzene
GC/MS	EPA 8260B/8260C/8260D	Styrene
GC/MS	EPA 8260B/8260C/8260D	1,1,1,2-Tetrachloroethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/8260C/8260D	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/8260C/8260D	Tetrachloroethene
GC/MS	EPA 8260B/8260C/8260D	Tetrahydrofuran
GC/MS	EPA 8260B/8260C/8260D	Toluene
GC/MS	EPA 8260B/8260C/8260D	1,3,5-Trichlorobenzene
GC/MS	EPA 8260B/8260C/8260D	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/8260C/8260D	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/8260C/8260D	1,1,1-Trichloroethane
GC/MS	EPA 8260B/8260C/8260D	1,1,2-Trichloroethane
GC/MS	EPA 8260B/8260C/8260D	Trichloroethene
GC/MS	EPA 8260B/8260C/8260D	Trichlorofluoromethane
GC/MS	EPA 8260B/8260C/8260D	1,2,3-Trichloropropane
GC/MS	EPA 8260B/8260C/8260D	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B/8260C/8260D	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/8260C/8260D	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/8260C/8260D	Vinyl acetate
GC/MS	EPA 8260B/8260C/8260D	Vinyl chloride
GC/MS	EPA 8260B/8260C/8260D	m-Xylene & p-Xylene
GC/MS	EPA 8260B/8260C/8260D	o-Xylene
GC/MS	EPA 8260B/8260C/8260D	Xylenes (total)
GC/MS	EPA 8260B/8260C/8260D SIM	1,4-Dioxane
ICP-MS	EPA 6020/6020A/6020B	Aluminum
ICP-MS	EPA 6020/6020A/6020B	Antimony
ICP-MS	EPA 6020/6020A/6020B	Arsenic
ICP-MS	EPA 6020/6020A/6020B	Barium
ICP-MS	EPA 6020/6020A/6020B	Beryllium
ICP-MS	EPA 6020/6020A/6020B	Bismuth
ICP-MS	EPA 6020/6020A/6020B	Boron
ICP-MS	EPA 6020/6020A/6020B	Cadmium
ICP-MS	EPA 6020/6020A/6020B	Calcium
ICP-MS	EPA 6020/6020A/6020B	Cerium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A/6020B	Cesium
ICP-MS	EPA 6020/6020A/6020B	Chromium
ICP-MS	EPA 6020/6020A/6020B	Cobalt
ICP-MS	EPA 6020/6020A/6020B	Copper
ICP-MS	EPA 6020/6020A/6020B	Gold
ICP-MS	EPA 6020/6020A/6020B	Hafnium
ICP-MS	EPA 6020/6020A/6020B	Iron
ICP-MS	EPA 6020/6020A/6020B	Lanthanum
ICP-MS	EPA 6020/6020A/6020B	Lead
ICP-MS	EPA 6020/6020A/6020B	Lithium
ICP-MS	EPA 6020/6020A/6020B	Magnesium
ICP-MS	EPA 6020/6020A/6020B	Manganese
ICP-MS	EPA 6020/6020A/6020B	Molybdenum
ICP-MS	EPA 6020/6020A/6020B	Neodymium
ICP-MS	EPA 6020/6020A/6020B	Nickel
ICP-MS	EPA 6020/6020A/6020B	Niobium
ICP-MS	EPA 6020/6020A/6020B	Palladium
ICP-MS	EPA 6020/6020A/6020B	Phosphorus
ICP-MS	EPA 6020/6020A/6020B	Platinum
ICP-MS	EPA 6020/6020A/6020B	Potassium
ICP-MS	EPA 6020/6020A/6020B	Praseodymium
ICP-MS	EPA 6020/6020A/6020B	Rhenium
ICP-MS	EPA 6020/6020A/6020B	Rhodium
ICP-MS	EPA 6020/6020A/6020B	Ruthenium
ICP-MS	EPA 6020/6020A/6020B	Samarium
ICP-MS	EPA 6020/6020A/6020B	Selenium
ICP-MS	EPA 6020/6020A/6020B	Silver
ICP-MS	EPA 6020/6020A/6020B	Sodium
ICP-MS	EPA 6020/6020A/6020B	Strontium
ICP-MS	EPA 6020/6020A/6020B	Tantalum
ICP-MS	EPA 6020/6020A/6020B	Tellurium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A/6020B	Thallium
ICP-MS	EPA 6020/6020A/6020B	Thorium
ICP-MS	EPA 6020/6020A/6020B	Tin
ICP-MS	EPA 6020/6020A/6020B	Titanium
ICP-MS	EPA 6020/6020A/6020B	Tungsten
ICP-MS	EPA 6020/6020A/6020B	Uranium
ICP-MS	EPA 6020/6020A/6020B	Uranium 233
ICP-MS	EPA 6020/6020A/6020B	Uranium 234
ICP-MS	EPA 6020/6020A/6020B	Uranium 235
ICP-MS	EPA 6020/6020A/6020B	Uranium 236
ICP-MS	EPA 6020/6020A/6020B	Uranium 238
ICP-MS	EPA 6020/6020A/6020B	Vanadium
ICP-MS	EPA 6020/6020A/6020B	Yttrium
ICP-MS	EPA 6020/6020A/6020B	Zinc
ICP-MS	EPA 6020/6020A/6020B	Zirconium
ICP-MS	EPA 6020/6020A/6020B	Total Hardness
ICP-MS	EPA 6020/6020A/6020B	Dysprosium
ICP-MS	EPA 6020/6020A/6020B	Erbium
ICP-MS	EPA 6020/6020A/6020B	Europium
ICP-MS	EPA 6020/6020A/6020B	Gadolinium
ICP-MS	EPA 6020/6020A/6020B	Gallium
ICP-MS	EPA 6020/6020A/6020B	Holmium
ICP-MS	EPA 6020/6020A/6020B	Lutetium
ICP-MS	EPA 6020/6020A/6020B	Rubidium
ICP-MS	EPA 6020/6020A/6020B	Terbium
ICP-MS	EPA 6020/6020A/6020B	Thulium
ICP-MS	EPA 6020/6020A/6020B	Ytterbium
ICP-MS	EPA 200.8	Aluminum
ICP-MS	EPA 200.8	Antimony
ICP-MS	EPA 200.8	Arsenic
ICP-MS	EPA 200.8	Barium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 200.8	Beryllium
ICP-MS	EPA 200.8	Boron
ICP-MS	EPA 200.8	Cadmium
ICP-MS	EPA 200.8	Calcium
ICP-MS	EPA 200.8	Cerium
ICP-MS	EPA 200.8	Cesium
ICP-MS	EPA 200.8	Chromium
ICP-MS	EPA 200.8	Cobalt
ICP-MS	EPA 200.8	Copper
ICP-MS	EPA 200.8	Gold
ICP-MS	EPA 200.8	Iron
ICP-MS	EPA 200.8	Lead
ICP-MS	EPA 200.8	Lithium
ICP-MS	EPA 200.8	Magnesium
ICP-MS	EPA 200.8	Manganese
ICP-MS	EPA 200.8	Molybdenum
ICP-MS	EPA 200.8	Nickel
ICP-MS	EPA 200.8	Phosphorus
ICP-MS	EPA 200.8	Platinum
ICP-MS	EPA 200.8	Potassium
ICP-MS	EPA 200.8	Rhodium
ICP-MS	EPA 200.8	Selenium
ICP-MS	EPA 200.8	Silver
ICP-MS	EPA 200.8	Sodium
ICP-MS	EPA 200.8	Strontium
ICP-MS	EPA 200.8	Tantalum
ICP-MS	EPA 200.8	Thallium
ICP-MS	EPA 200.8	Thorium
ICP-MS	EPA 200.8	Tin
ICP-MS	EPA 200.8	Titanium
ICP-MS	EPA 200.8	Tungsten

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 200.8	Uranium
ICP-MS	EPA 200.8	Vanadium
ICP-MS	EPA 200.8	Zinc
ICP-MS	EPA 200.8	Zirconium
ICP-AES	EPA 200.7	Aluminum
ICP-AES	EPA 200.7	Antimony
ICP-AES	EPA 200.7	Arsenic
ICP-AES	EPA 200.7	Barium
ICP-AES	EPA 200.7	Beryllium
ICP-AES	EPA 200.7	Bismuth
ICP-AES	EPA 200.7	Boron
ICP-AES	EPA 200.7	Cadmium
ICP-AES	EPA 200.7	Calcium
ICP-AES	EPA 200.7	Chromium
ICP-AES	EPA 200.7	Cobalt
ICP-AES	EPA 200.7	Copper
ICP-AES	EPA 200.7	Iron
ICP-AES	EPA 200.7	Lead
ICP-AES	EPA 200.7	Lithium
ICP-AES	EPA 200.7	Magnesium
ICP-AES	EPA 200.7	Manganese
ICP-AES	EPA 200.7	Molybdenum
ICP-AES	EPA 200.7	Nickel
ICP-AES	EPA 200.7	Phosphorus
ICP-AES	EPA 200.7	Potassium
ICP-AES	EPA 200.7	Selenium
ICP-AES	EPA 200.7	Silicon
ICP-AES	EPA 200.7	Silver
ICP-AES	EPA 200.7	Sodium
ICP-AES	EPA 200.7	Strontium
ICP-AES	EPA 200.7	Sulfur

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Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 200.7	Thallium
ICP-AES	EPA 200.7	Thorium
ICP-AES	EPA 200.7	Tin
ICP-AES	EPA 200.7	Titanium
ICP-AES	EPA 200.7	Vanadium
ICP-AES	EPA 200.7	Zinc
CVAA	EPA 245.1/7470A	Mercury
Ion Chromatrography	EPA 300.0/9056/9056A	Bromide
Ion Chromatrography	EPA 300.0/9056/9056A	Chloride
Ion Chromatrography	EPA 300.0/9056/9056A	Fluoride
Ion Chromatrography	EPA 300.0/9056/9056A	Nitrate
Ion Chromatrography	EPA 300.0/9056/9056A	Nitrite
Ion Chromatrography	EPA 300.0/9056/9056A	Sulfate
Ion Chromatrography	EPA 300.0/9056/9056A	Ortho-phosphate
Ion Chromatrography	EPA 300.0/9056/9056A	Iodide
Probe	EPA 9040C EPA 150.1 SM 4500-H+ B -2011	pH
Colormetric	EPA 7196A	Hex Chromium
Gas Flow Proportional Counter	EPA 900.0 EPA 9310 SM 7110C	gross alpha/beta
Gas Flow Proportional Counter	ST-RC-0036 ST-RD-0403	Chlorine-36
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	total radium
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02 DOE HASL 300 Sr-03	Strontium-90
Liquid Scintillation Counter	SM 7500-Rn B	Radon-222

Non-Potable Water		
Technology	**Method**	**Analyte**
Liquid Scintillation Counter	ST-RC-0079	Selenium-79
Liquid Scintillation Counter	EPA 906.0	Tritium
Liquid Scintillation Counter	Eichrom Technologies TCW01/TCS01 HASL 300 Tc-02-RC	Tecnetium-99
Liquid Scintillation Counter	EERF C-01-C14	Carbon-14
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141

Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212

Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46

Non-Potable Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95
Alpha Spectroscopy	DOE HASL 300 A-01-R	Alpha spec analysis:
Alpha Spectroscopy	DOE HASL 300 A-01-R DOE HASL 300 U-02-RC	Isotopic Uranium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Thorium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Americium

Non-Potable Water		
Technology	**Method**	**Analyte**
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Plutonium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Neptunium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Curium
Alpha Spectroscopy	ST-RC-0301	Radium-226
Liquid Scintillation Counter	Eichrom Technologies OTW01, OTS01	Lead-210
Alpha Spectroscopy	ST-RC-0210	Polonium-210
Liquid Scintillation Counter	Eichrom Technologies FEW01	Iron-55
Liquid Scintillation Counter	DOE RP-300	Nickel 59/63
Liquid Scintillation Counter	SM 7500-IB	Iodine-129
Extraction Chromatography	ST-RC-0058	Strontium-90
Preparation	**Method**	**Type**
Volatile Prep	EPA 5000	Sample Preparation for Volatile Organic Compounds
Acid Digestion (Aqueous samples)	EPA 3010A EPA 3005A	Acid Digestion for Metals (Aqueous samples)
Purge & Trap	EPA 5030C	Purge & Trap for Aqueous Volatile
TCLP Extraction	EPA 1311	TCLP Extraction
SPLP Extraction	EPA 1312	SPLP Extraction
CWET Extraction	CA Title 22	CWET Extraction

Drinking Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 200.8	Uranium
Alpha Spectroscopy	DOE HASL 300 U-02-RC	Isotopic Uranium
Gas Flow Proportional Counter	EPA 900.0 EPA 9310	Gross alpha/beta
Gas Flow Proportional Counter	SM 7110C	Gross alpha

Drinking Water		
Technology	**Method**	**Analyte**
Gas Flow Proportional Counter	ST-RC-0036 ST-RD-0403	Chlorine-36
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02	Strontium-90
Liquid Scintillation Counter	SM 7500-Rn B	Radon-222
Liquid Scintillation Counter	ST-RC-0079	Selenium-79
Liquid Scintillation Counter	EPA 906.0	Tritium
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231

Drinking Water		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Aluminum
ICP-AES	EPA 6010B/6010C/6010D	Antimony
ICP-AES	EPA 6010B/6010C/6010D	Arsenic
ICP-AES	EPA 6010B/6010C/6010D	Barium
ICP-AES	EPA 6010B/6010C/6010D	Beryllium
ICP-AES	EPA 6010B/6010C/6010D	Bismuth
ICP-AES	EPA 6010B/6010C/6010D	Boron
ICP-AES	EPA 6010B/6010C/6010D	Cadmium
ICP-AES	EPA 6010B/6010C/6010D	Calcium
ICP-AES	EPA 6010B/6010C/6010D	Chromium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C/6010D	Cobalt
ICP-AES	EPA 6010B/6010C/6010D	Copper
ICP-AES	EPA 6010B/6010C/6010D	Iron
ICP-AES	EPA 6010B/6010C/6010D	Lead
ICP-AES	EPA 6010B/6010C/6010D	Lithium
ICP-AES	EPA 6010B/6010C/6010D	Magnesium
ICP-AES	EPA 6010B/6010C/6010D	Manganese
ICP-AES	EPA 6010B/6010C/6010D	Molybdenum
ICP-AES	EPA 6010B/6010C/6010D	Nickel
ICP-AES	EPA 6010B/6010C/6010D	Phosphorus
ICP-AES	EPA 6010B/6010C/6010D	Potassium
ICP-AES	EPA 6010B/6010C/6010D	Selenium
ICP-AES	EPA 6010B/6010C/6010D	Silicon
ICP-AES	EPA 6010B/6010C/6010D	Silver
ICP-AES	EPA 6010B/6010C/6010D	Sodium
ICP-AES	EPA 6010B/6010C/6010D	Strontium
ICP-AES	EPA 6010B/6010C/6010D	Sulfur
ICP-AES	EPA 6010B/6010C/6010D	Thallium
ICP-AES	EPA 6010B/6010C/6010D	Thorium
ICP-AES	EPA 6010B/6010C/6010D	Tin
ICP-AES	EPA 6010B/6010C/6010D	Titanium
ICP-AES	EPA 6010B/6010C/6010D	Vanadium
ICP-AES	EPA 6010B/6010C/6010D	Zinc
ICP-MS	EPA 6020/6020A/6020B	Aluminum
ICP-MS	EPA 6020/6020A/6020B	Antimony
ICP-MS	EPA 6020/6020A/6020B	Arsenic
ICP-MS	EPA 6020/6020A/6020B	Barium
ICP-MS	EPA 6020/6020A/6020B	Beryllium
ICP-MS	EPA 6020/6020A/6020B	Bismuth
ICP-MS	EPA 6020/6020A/6020B	Boron
ICP-MS	EPA 6020/6020A/6020B	Cadmium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A/6020B	Calcium
ICP-MS	EPA 6020/6020A/6020B	Cerium
ICP-MS	EPA 6020/6020A/6020B	Cesium
ICP-MS	EPA 6020/6020A/6020B	Chromium
ICP-MS	EPA 6020/6020A/6020B	Cobalt
ICP-MS	EPA 6020/6020A/6020B	Copper
ICP-MS	EPA 6020/6020A/6020B	Gold
ICP-MS	EPA 6020/6020A/6020B	Hafnium
ICP-MS	EPA 6020/6020A/6020B	Iron
ICP-MS	EPA 6020/6020A/6020B	Lanthanum
ICP-MS	EPA 6020/6020A/6020B	Lead
ICP-MS	EPA 6020/6020A/6020B	Lithium
ICP-MS	EPA 6020/6020A/6020B	Magnesium
ICP-MS	EPA 6020/6020A/6020B	Manganese
ICP-MS	EPA 6020/6020A/6020B	Molybdenum
ICP-MS	EPA 6020/6020A/6020B	Neodymium
ICP-MS	EPA 6020/6020A/6020B	Nickel
ICP-MS	EPA 6020/6020A/6020B	Niobium
ICP-MS	EPA 6020/6020A/6020B	Palladium
ICP-MS	EPA 6020/6020A/6020B	Phosphorus
ICP-MS	EPA 6020/6020A/6020B	Platinum
ICP-MS	EPA 6020/6020A/6020B	Potassium
ICP-MS	EPA 6020/6020A/6020B	Praseodymium
ICP-MS	EPA 6020/6020A/6020B	Rhenium
ICP-MS	EPA 6020/6020A/6020B	Rhodium
ICP-MS	EPA 6020/6020A/6020B	Ruthenium
ICP-MS	EPA 6020/6020A/6020B	Samarium
ICP-MS	EPA 6020/6020A/6020B	Selenium
ICP-MS	EPA 6020/6020A/6020B	Silver
ICP-MS	EPA 6020/6020A/6020B	Sodium
ICP-MS	EPA 6020/6020A/6020B	Strontium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A/6020B	Tantalum
ICP-MS	EPA 6020/6020A/6020B	Tellurium
ICP-MS	EPA 6020/6020A/6020B	Thallium
ICP-MS	EPA 6020/6020A/6020B	Thorium
ICP-MS	EPA 6020/6020A/6020B	Tin
ICP-MS	EPA 6020/6020A/6020B	Titanium
ICP-MS	EPA 6020/6020A/6020B	Tungsten
ICP-MS	EPA 6020/6020A/6020B	Uranium
ICP-MS	EPA 6020/6020A/6020B	Uranium 233
ICP-MS	EPA 6020/6020A/6020B	Uranium 234
ICP-MS	EPA 6020/6020A/6020B	Uranium 235
ICP-MS	EPA 6020/6020A/6020B	Uranium 236
ICP-MS	EPA 6020/6020A/6020B	Uranium 238
ICP-MS	EPA 6020/6020A/6020B	Vanadium
ICP-MS	EPA 6020/6020A/6020B	Yttrium
ICP-MS	EPA 6020/6020A/6020B	Zinc
ICP-MS	EPA 6020/6020A/6020B	Zirconium
CVAA	EPA 7471A/7471B	Mercury
Ion Chromatrography	EPA 300.0/9056A	Bromide
Ion Chromatrography	EPA 300.0/9056A	Chloride
Ion Chromatrography	EPA 300.0/9056A	Fluoride
Ion Chromatrography	EPA 300.0/9056A	Nitrate
Ion Chromatrography	EPA 300.0/9056A	Nitrite
Ion Chromatrography	EPA 300.0/9056A	Sulfate
Ion Chromatrography	EPA 300.0/9056A	Ortho-phosph
Ion Chromatrography	EPA 300.0/9056A	Iodide
Probe	EPA 9045D	pH
Gas Flow Proportional Counter	EPA 900.0 EPA 9310	gross alpha/beta
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	Radium-226
Gas Flow Proportional Counter	EPA 903.0 EPA 9315	total radium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gas Flow Proportional Counter	EPA 904.0 EPA 9320	Radium-228
Gas Flow Proportional Counter	EPA 905.0 DOE HASL 300 Sr-02 DOE HASL 300 Sr-03	Strontium-90
Liquid Scintillation Counter	ST-RC-0079	Selenium-79
Liquid Scintillation Counter	EPA 906.0	Tritium
Liquid Scintillation Counter	Eichrom Technologies TCW01/TCS01 HASL 300 Tc-02-RC	Tecnetium-99
Liquid Scintillation Counter	EERF C-01-C14	Carbon-14
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Gamma Emitters:
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 227 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Actinium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Americium 241
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 124
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Antimony 125
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium/Lanthanum-140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 133
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Barium 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Beryllium 7
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 211 eq Th-227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 207
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth-210M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 212

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Bismuth 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 141
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 139
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cerium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 134
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cesium 137
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 56
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 57
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 58
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Cobalt 60
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 152
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 154
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Europium 155
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Hafnium 181
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iodine 131
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iridium 192
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Iron 59
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lanthanum 140
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 210
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 211

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 212
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Lead 214
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Manganese 54
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Mercury 203
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 237
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Neptunium 239
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 94
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Niobium 95
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Potassium 40
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 144
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 146
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Promethium 147
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234M
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Protactinium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium (226)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 223 (assumes equilibrium w/ Th-227)
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Radium 224
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Ruthenium 106

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Scandium 46
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 22
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Sodium 24
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Strontium 85
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thallium 208
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 227
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 228
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 230
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 231
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 232
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Thorium 234
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Tin 113
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 235
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Uranium 238
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Vanadium-48
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Yttrium 88
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zinc 65
Gamma Spectroscopy	EPA 901.1 / DOE HASL 300 Ga-01-R	Zirconium 95
Alpha Spectroscopy	DOE HASL 300 A-01-R	Alpha spec analysis:
Alpha Spectroscopy	DOE HASL 300 A-01-R DOE HASL 300 U-02-RC	Isotopic Uranium

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Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Thorium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Americium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Plutonium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Neptunium
Alpha Spectroscopy	DOE HASL 300 A-01-R	Isotopic Curium
Alpha Spectroscopy	ST-RC-0301	Radium-226
Liquid Scintillation Counter	Eichrom Technologies OTW01, OTS01	Lead-210
Alpha Spectroscopy	Laboratory SOP ST-RC-0210	Polonium-210
Liquid Scintillation Counter	Eichrom Technologies FEW01	Iron-55
Liquid Scintillation Counter	DOE RP-300	Nickel 59/63
Liquid Scintillation Counter	SM 7500-IB	Iodine-129
Preparation	**Method**	**Type**
Volatile Prep	EPA 5000	Sample Preparation for Volatile Organic Compounds
Acid Digestion (Aqueous samples)	EPA 3010A	Acid Digestion for Metals (Aqueous samples)
Acid Digestion (solids)	EPA 3050B	Acid Digestion for Metals of Sedimtent/Soils
Purge & Trap	EPA 5030C	Purge & Trap for Aqueous Volatile Samples
Closed System Purge & Trap and Extraction for Volatiles	EPA 5035A	Closed System Purge & Trap and Extraction for Volatiles
TCLP Extraction	EPA 1311	TCLP Extraction
SPLP Extraction	EPA 1312	SPLP Extraction
CWET Extraction	CA Title 22	CWET Extraction
Extraction Chromatography	Eichrom Technologies FEW01	Iron-55
Extraction Chromatography	ST-RC-0058	Strontium-90

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. L2305.

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