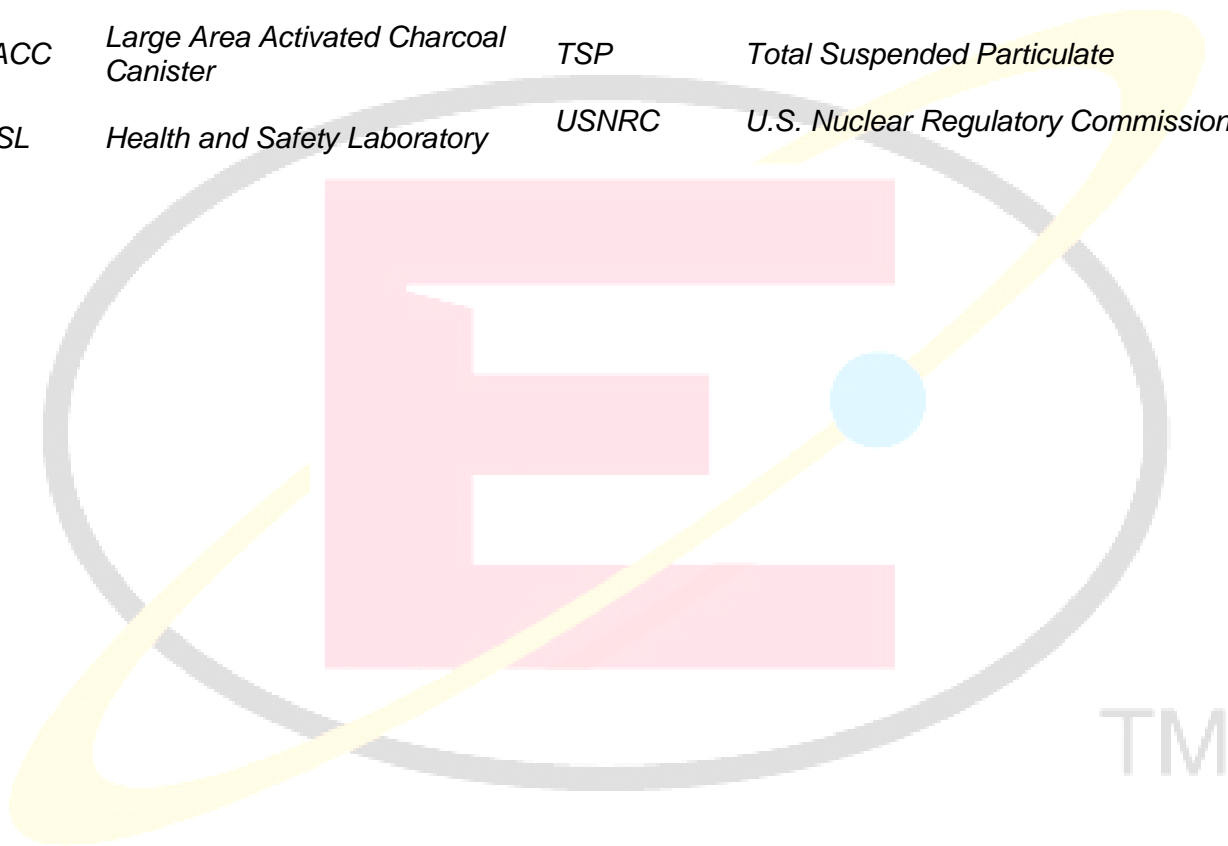


RADIOCHEMISTRY

List of Acronyms

<i>A</i>	<i>Standard Methods</i>	<i>NERHL</i>	<i>North Eastern Health Radiological Laboratory</i>
<i>ASTM</i>	<i>American Society for Testing & Materials</i>	<i>NORM</i>	<i>Naturally Occurring Radioactive Materials</i>
<i>E or EPA</i>	<i>US Environmental Protection Agency</i>	<i>MDC</i>	<i>Minimum Detection Concentration</i>
<i>HNO₃</i>	<i>Nitric Acid</i>	<i>SW</i>	<i>Solid Waste – 846</i>
<i>LAACC</i>	<i>Large Area Activated Charcoal Canister</i>	<i>TSP</i>	<i>Total Suspended Particulate</i>
<i>HASL</i>	<i>Health and Safety Laboratory</i>	<i>USNRC</i>	<i>U.S. Nuclear Regulatory Commission</i>



RADIOCHEMISTRY

1. MATRIX DIGESTIONS – Prior to analysis

MATRIX	PREPARATION TECHNIQUE	AMOUNT OF SAMPLE REQUIRED
Drinking Water	HNO ₃ to pH <2	1000 mL plastic
Drinking Water – ²²² Radon	None Required	40 mL VOA vial – no headspace
Mine and Process Water – Soluble Constituents	Filtration, HNO ₃ to pH <2	2000 mL plastic
Mine and Process Water – Total Constituents	HNO ₃ to pH <2	2000 mL plastic
Solids – Core, Sediments, Sludges, Soils, Rock	Acid Digestion	100 g
Vegetation – USNRC Guidelines	Ashing, Acid Digestion	20 Kg
Biomass – USNRC Guidelines	Ashing, Acid Digestion	20 Kg
Air Filters	Acid Leaching	Filter sample and blank filter
Oils	Acid Leaching	100 g
Gamma Sample Preparation	Drying, Pulverizing and Canning	500 g

2. RADIOCHEMICAL ANALYSES – Drinking Water

ANALYSIS	METHOD	Drinking Water MCL	MIN. REQUIRED REPORTING LIMIT	UNITS
Gamma Emitting Radionuclides	E901.1	NA	dependent on sample size	pCi/L
Gross Alpha and Beta Radioactivity	E900.0	15/50 ^(see note)	3.0/4.0	pCi/L
Gross Radium Alpha (minus Radon & Uranium)	E900.1	15	3.0	pCi/L
²²⁶ Radium (Alpha Emitting Isotopes)	E903.0	5.0 ^(see note)	1.0	pCi/L
²²⁸ Radium	RA-05	5.0 ^(see note)	1.0	pCi/L
²²² Radon	ASTM D5072-92	NA	100	pCi/L
Radioactive Strontium	E905.0	NA ^(see note)	2.0	pCi/L
Tritium	E906.0	NA ^(see note)	1000	pCi/L
Isotopic Uranium (²³⁴ U, ²³⁵ U, ²³⁸ U)	E908.0	NA	0.67	pCi/L
Uranium	E200.8	30	1	ug/L
Sample Location: Entry point to distribution				
Notes: Gross Beta Activity MCL = 4 mRem/year ~ = 50 pCi/L. Regulation specifies monitoring for vulnerable systems. The Radium MCL is for a combined Radium 226+Radium 228 = 5.0 pCi/L				

RADIOCHEMISTRY

3. RADIOCHEMICAL ANALYSES - Applicable to most matrices listed above (after digestion) Reporting Limits are matrix dependent.

ANALYSIS	METHOD	MIN. REQUIRED REPORTING LIMIT	UNITS
Gamma Emitting Radionuclides	E901.1	dependent on sample size	pCi/L
Gross Alpha and Beta Radioactivity	E900.0	1.0/2.0	pCi/L
Gross Radium Alpha (minus Radon & Uranium)	E900.1	1.0	pCi/L
²¹⁰ Lead	E909.0	1.0	pCi/L
²¹⁰ Polonium	HASL-300 Po-02-RC	1.0	pCi/L
⁴⁰ Potassium	E901.1	dependent on sample size	pCi/L
²²⁶ Radium (Alpha Emitting Isotopes)	E903.0	0.2	pCi/L
²²⁸ Radium	RA-05	1.0	pCi/L
²²² Radon	ASTM D5072-92	100	pCi/L
Radioactive Strontium	E905.0	10	pCi/L
Isotopic Thorium (²²⁸ Th, ²³⁰ Th, ²³² Th)	E908.0	0.2 per Isotope	pCi/L
²³⁰ Thorium	E908.0	0.2	pCi/L
²³² Thorium	E200.8/SW6020	1.0	pCi/L
Tritium	E906.0	1200	pCi/L
Isotopic Uranium (²³⁴ U, ²³⁵ U, ²³⁸ U)	A7500-U-C	0.2 per Isotope	pCi/L
Uranium, natural	E200.8/SW6020	0.2	pCi/L
Uranium, natural – low level	E200.8/SW6020	-	pCi/L

4. BIOASSAY - Uranium and other radionuclides in urine per USNRC Guideline 8.22.

ANALYSIS	REQUIRED VOLUME, mL	QC REQUIRED	MIN. REQUIRED REPORTING LIMIT	UNITS
Isotopic Uranium	1000 plastic	client specific	0.1	pCi/L
Uranium	100 plastic	25%	5.0	µg/L

5. Closed can gamma by Radium 226 converted to U₃O₈

ANALYSIS	METHOD	MIN. REQUIRED VOLUME, GMS	QC REQUIRED	MIN. REQUIRED REPORTING LIMIT	UNITS
U3O8	901.1	200	Duplicates & LCS	60	mg/kg-dry ¹
Uranium	901.1	200	Duplicates & LCS	50	mg/kg-dry ¹

Prep, if required, is \$25.00 per sample. Includes: Drying, pulverizing and canning.

1. Uranium data is reported using assumed secular equilibrium with the measured analyte.

RADIOCHEMISTRY

6. RADIOLOGICAL FIELD SERVICES

SERVICE
Radon - inside air by charcoal canister method (Ramses II Detector)
Consulting Radiation Safety Officer – USNRC Accepted
Surface Gamma Surveys - baseline, decontamination and decommissioning, process operations
Air Quality Sampling - TSP, High Volume Air Sampling
Equipment Decontamination and Release Surveys
Emanation Coefficient
Naturally Occurring Radioactive Materials (NORM) Surveys – oilfield related
Large Area Activated Charcoal Canister (LAACC) Tailings Surveys - Radon Flux by Method E115
Indoor Radon and Radon Progeny Measurements – Single or Multiple Site
Custom Radiation Safety Courses - mining, milling, and reclamation projects

