Radiochemistry

Corporate Offices-Minneapolis, MN

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Radiochemical Analysis

- How is radiochemistry different?
- North Dakota Regulations
- Acceptable Test Methods
- Understanding Radiochemistry Results

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Radiochemistry vs. Standard Analytical Chemistry

- Measures energy rather than mass
- Å MDCs rather than MDLs
- Å TAT limitations due to in-growth
- Å No hold-time issues or temp requirements
  - Åexcept radon
- ÅRaw instrument result is always reported
  - ÅNegative results

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North Dakota Regulations

- Disposal of TENORM waste is prohibited in municipal solid waste landfills and inert landfills.
- Disposal of radioactive waste not meeting the definition of TENORM or TENORM waste exceeding 50 pCi/g combined radium is prohibited in all landfills.
- Background radionuclide concentrations are required for the groundwater monitoring network and leachate collection system prior to receipt of TENORM.
- Landfills that meet the North Dakota TENORM acceptance regulations, may accept TENORM wastes as long as the combined Radium-226/Radium-228 activity is less than 50 pCi/g.
- Landfills accepting TENORM waste must monitor leachate for radioactivity at the same frequency of their current groundwater monitoring program.

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Leachate Concentrations

Radon:	4000 pCi/L
Combined Radium:	5.0 pCi/L
Adjusted Gross Alpha:	15 pCi/L
Total Uranium:	30 ug/L

* If leachate exceeds these concentrations, groundwater must be monitored for radionuclides.

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Approved Test Methods

http://www.ndhealth.gov/aq/rad/licensed_tenorm_testing.htm

Analytical Methods:

1) HASL-300
2) EPA 901.1M (Gamma Spectroscopy)

Screening Method for Disposal:

1) Gamma Spectroscopy utilizing 186 keV peak

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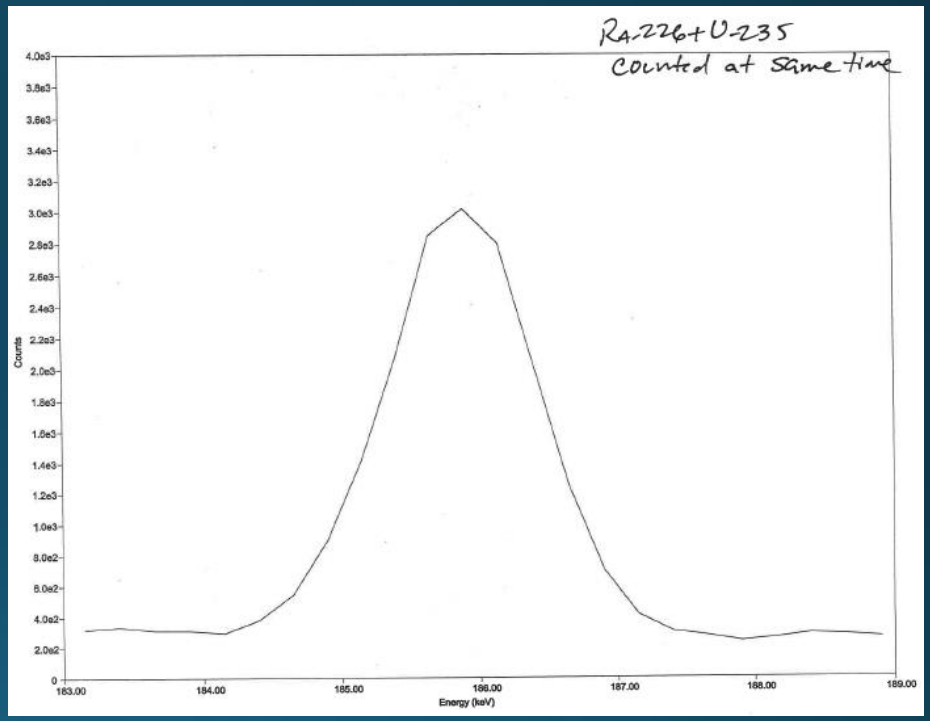
Approved Test Methods

Gamma Spectroscopy

Radium-226 peak at 186.1 keV
Uranium-235 peak at 185.7 keV

Requires 21 day in-growth for secular equilibrium and utilizes progeny to remove interference.

Screening technique ï high bias results.



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Approved Test Methods Landfill Leachate

- North Dakota does not have specific methods required for leachate or aqueous radiochemical samples.
- Standard gamma spectroscopy analysis cannot provide MDCs low enough to achieve the regulatory limits.

Parameter	Typical Method	Regulatory Limit	Typical MDC
Radon	SM 7500-Rn	4000 pCi/L	400 pCi/L
Radium-226	EPA 903.1, EPA 903.0, EPA 9315	5 pCi/L (w/ Ra-228)	1 pCi/L
Radium-228	EPA 904.0, EPA 9320	5 pCi/L (w/ Ra-226)	1 pCi/L
Adjusted Gross Alpha	EPA 900.0, EPA 9310, SM 7110C	15 pCi/L	3 pCi/L
Total Uranium	ASTM D5174, 200.8, EPA 908.0	30 ug/L	< 1.0 ug/L

Gamma Spec Results

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: [redacted]
Pace Project No.: [redacted]

Sample: [redacted] **Lab ID:** [redacted] Collected: 12/21/15 12:05 Received: 12/28/15 10:00 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	**66.289 ± 8.891 (0.782) C:NA T:NA**	pCi/g	01/21/16 12:05	13982-63-3	
Radium-228	EPA 901.1	**9.582 ± 2.001 (1.411) C:NA T:NA**	pCi/g	01/21/16 12:05	15262-20-1	

Sample: [redacted] **Lab ID:** [redacted] Collected: 12/21/15 12:15 Received: 12/28/15 10:00 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	**2.377 ± 0.445 (0.198) C:NA T:NA**	pCi/g	01/21/16 12:21	13982-63-3	
Radium-228	EPA 901.1	**1.732 ± 0.461 (0.356) C:NA T:NA**	pCi/g	01/21/16 12:21	15262-20-1	

Sample: [redacted] **Lab ID:** [redacted] Collected: 12/21/15 12:20 Received: 12/28/15 10:00 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	**8.381 ± 1.238 (0.351) C:NA T:NA**	pCi/g	01/21/16 12:21	13982-63-3	
Radium-228	EPA 901.1	**2.506 ± 0.612 (0.643) C:NA T:NA**	pCi/g	01/21/16 12:21	15262-20-1	

Sample: [redacted] **Lab ID:** [redacted] Collected: 12/21/15 12:30 Received: 12/28/15 10:00 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

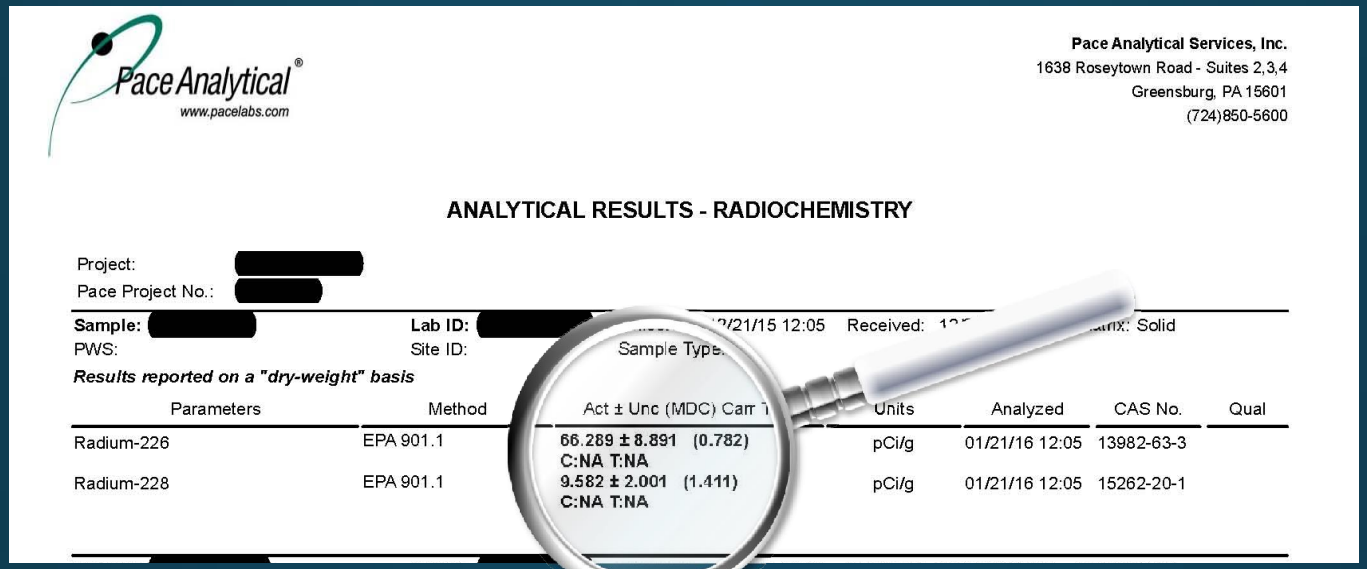
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	**7.972 ± 1.188 (0.290) C:NA T:NA**	pCi/g	01/21/16 12:38	13982-63-3	
Radium-228	EPA 901.1	**2.533 ± 0.531 (0.197) C:NA T:NA**	pCi/g	01/21/16 12:38	15262-20-1	

Sample: [redacted] **Lab ID:** [redacted] Collected: 12/21/15 12:35 Received: 12/28/15 10:00 Matrix: Solid
PWS: Site ID: Sample Type:

Results reported on a "dry-weight" basis

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	**3.052 ± 0.555 (0.158) C:NA T:NA**	pCi/g	01/21/16 12:38	13982-63-3	
Radium-228	EPA 901.1	**1.479 ± 0.483 (0.316) C:NA T:NA**	pCi/g	01/21/16 12:38	15262-20-1	

REPORT OF LABORATORY ANALYSIS



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ANALYTICAL RESULTS - RADIOCHEMISTRY

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Radium-228	EPA 901.1	9.582 ± 2.001 (1.411) C:NA T:NA	pCi/g	01/21/16 12:05	15262-20-1	

Act ± Unc (MDC) Carr Tra

66.289 ± 8.891 (0.782)
C:NA T:NA
9.582 ± 2.001 (1.411)
C:NA T:NA

Analytical Result

Minimum Detectable Concentration (MDC)

Uncertainty

Thank You – Questions?

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