The Radionuclides Rule Analytical Issues and Considerations

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The Radionuclides Rule/Key Analytical Considerations

- Set all Maximum Contaminant Level Goals (MCLGs) for radionuclides at 0
- Retained the combined Maximum Contaminant Level (MCL) for Ra-226 and Ra-228 at 5pCi/L
- Ra-226 and Ra-228 are monitored separately
- Retained “adjusted” Gross Alpha MCL at 15pCi/L

The Radionuclides Rule/Key Analytical Considerations (cont'd)

- Set MCL for uranium at 30 μg/L
- Retained the MCL for beta particle and photon radioactivity
- Established complex monitoring framework for radionuclides
- Acknowledged that measurable levels of Ra-224 in drinking water are more prevalent than previously thought

The Radionuclides Rule/Key Analytical Considerations (cont'd)

- Stated that further occurrence data will be collected for Po-210 and Ra-224

- Clearly established the analytical result as the activity concentration value (not adding or subtracting the uncertainty value)

Analytical Methods Approved for Radionuclide Monitoring

- Listed in 40 CFR 141.25, Table 1-8
- Methods are from various sources: EPA, SM, ASTM, USGS, DOE, NY, NJ
- More than 80 analytical methods listed
- Required Regulatory Detection Limits listed in 40 CFR 141.25, Table 1-9

Gross Alpha Analyses

- Radionuclides Rule retained “adjusted” MCL of 15 pCi/L (excluding Rn and U)
- Two basic analytical methodologies – evaporation and coprecipitation
- Required Regulatory Detection Limit of 3 pCi/L

Gross Alpha Analyses (cont'd)

- Gross Alpha results may be substituted for uranium and Ra-226 measurements if less than 15 and 5 pCi/L respectively

- Depending on gross alpha values, substitution for uranium and Ra-226 measurements will impact monitoring frequency

- Relatively inexpensive analyses:
  - Coprecipitation – approximately $60
  - Evaporation – approximately $40

Ra-226 Analysis

- Radionuclides Rule retained the combined MCL of 5 pCi/L for Ra-226 and Ra-228
- Two basic analytical methodologies – radiochemical and emanation
- Can substitute Gross Alpha analysis if less than 5 pCi/L
- Approximate cost - $120 per sample

Ra-228 Analysis

- Radionuclides Rule retained the combined MCL of 5 pCi/L for Ra-226 and Ra-228
- Single basic analytical methology – radiochemical
- Required Regulatory Detection Limit of 1 pCi/L
- No substitution for the Ra-228 measurement
- Approximate cost - $120 per sample

Uranium Analysis

- Radionuclides Rule established an MCL of 30 μg/L
- Several methodologies available – radiochemical, fluorometric, alpha spectrometry and laser phosphorimetry
- EPA is currently proposing a Detection Limit of 1ppb
- Can substitute Gross Alpha result if less than 15 pCi/L (conversion factor 0.67 pCi/μg)
- Analytical cost varies depending on methodology (range $30 - $160 per sample)

Beta Particle and Photon Radioactivity Monitoring

- Radionuclides Rule retained the MCL of 4 mrem/year for beta particle and photon radioactivity
- Several analytical methodologies available depending on the radionuclide – gamma ray spectrometry, radiochemical, and liquid scintillation
- Required Regulatory Limit depends on the radionuclide:
  - Cs-134 10 pCi/L
  - Sr-89 10 pCi/L
  - Sr-90 2 pCi/L
  - H-3 1,000 pCi/L

Beta Particle and Photon Radioactivity Monitoring (cont'd)

- Monitoring framework depends on several factors (e.g., vulnerable system, utilization of water contaminated by effluents from nuclear facilities, etc.)
- Radionuclides Rule allows subtraction of beta activity from K-40 from the gross beta measurement to determine compliance status
- Laboratory can measure total elemental potassium in units of mg/L and multiply the result by 0.82 to determine activity from K-40

Beta Particle and Photon Radioactivity Monitoring (cont'd)

- Analytical costs vary depending on the radionuclide – approximate costs for select radionuclides
  - H-3 $50
  - Sr 89, 90 $170
  - Gamma Spectrometry $110

Current Activities

- Georgia Tech Method for Ra-226 and Ra-228 by gamma spectrometry in recent Proposed Rule
- Uranium in drinking water by ICP/MS (EPA Method 200.8, SM 3125, and ASTM D5673-03) in recent Proposed and Direct Final Rule
- Development underway of a Protocol for EPA Approval of Alternate Test Procedures and New Methods for Analyzing Radioactive Contaminants in Drinking Water