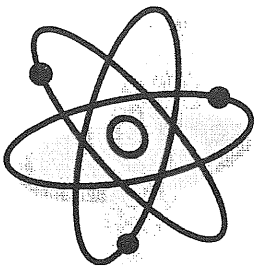
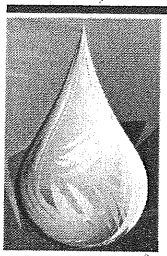


"TENORM" Technologically Enhanced Naturally Occurring Radioactive Materials

Overview: Disposal of Residuals from Water Treatment Systems



What is TENORM?

TENORM is defined as naturally occurring materials, such as rocks, minerals, soils, and water whose radionuclide concentrations or potential for exposure to humans or the environment is enhanced as a result of human activities such as water treatment

Safe Drinking Water Act

- Revised Radionuclides Rule became effective December 8, 2003
- Regulated radionuclides include:
  - Radium-226
  - Radium-228
  - Gross alpha particle activity
  - Uranium
  - And beta particle and photon radioactivity

EPA Drinking Water Radionuclide Rule

- Radionuclide removal from drinking water will produce different types of wastes with varying contaminant concentrations. Discussion will be limited to the Solid Waste Portion:
  - Spent resins, filter media, membranes, and sludge

Nuclear Regulatory Commission Regulations

- **New Mexico is an Agreement State**
- If your residuals contain uranium or thorium, the waste is considered "source material" and may be subject to NRC licensing requirements. Radium is not considered a source material.
- **Water treatment residuals would not meet the definition of LLRW as defined 42 USC 2014 (e) (2) because not from ore processing**

Exempt Material

- If the Uranium or thorium makes up less than **0.05 % by weight** of the residuals **it is exempt from NRC regulations**, because;
- Considered "unimportant quantity" (10 CFR 40.13)
- For reference, a system with filter media weighing 30,000 pounds, 0.05 % by weight equal to **15 pounds of uranium**

Treatment Residual Characteristics Can be Affected By:

- Concentration of radionuclides in source water
- Frequency of resin/medial/membrane replacement
- Type, operation expertise &Treatment efficiency
- Frequency of ion exchange & activated alumina regeneration
- Filter backwash frequency (granular media filters)

Table 4: Residual Type by Treatment Technology

Treatment	Types of Residuals							
	Solid			Liquid				
	Spent Resins/ Media	Spent Membranes	Sludge	Brine	Backwash Water	Rinse Water	Acid Neutralization Water	Concentrate
IX	✓			✓	✓	✓		
RO		✓						✓
Lime Softening	✓		✓		✓			
Green Sand Filtration	✓		✓		✓			
Co-precipitation with Barium Sulfate	✓		✓		✓			
Electrodialysis/ Electrodialysis Reversal		✓						✓
Pre-formed Hydrous Manganese Oxide Filtration	✓		✓		✓			
AA	✓			✓	✓	✓	✓	
Coagulation/Filtration	✓		✓		✓			

Radionuclides and Associated Co-Contaminants

Technology	Radionuclides	Co-Contaminant
Coagulation Filtration	Uranium	Arsenic
Lime Softening	Radium and Uranium	None
Ion Exchange	Radium, Barium, and Uranium	None
Reverse Osmosis	Radium and Uranium	None
Activated Alumina	Uranium	Arsenic
Green Sand Filtration	Radium and Barium	None

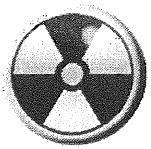
NMED Radiation Bureau General License

- If source material is **>0.05% by weight** (or estimated at **about 335 picocuries per gram** for natural uranium, and
- the total amount in your possession at any time is **<15 pounds or no more than 150 pounds in any one calendar year**, you have a "small quantity" of source material that is subject to a general license (10 CFR 40.22)

If exceed small quantity threshold you must apply for specific licenses from NMED

Applicable New Mexico Solid Waste Rules

- **20.9.2-20.9.10 NMAC** Municipal Solid Waste Landfill (RCRA Subtitle D category)
- **20.9.2.10 Prohibited Acts (4) and (10)**
  - Dispose of waste in a landfill that does not have a Special Waste Permit for the type of waste generated
  - Process, recycle, transfer, transform or dispose of radioactive waste
- **20.9.8.16 Special Waste (Sludge)** specific requirements



20.9.2-7(R) (1) Radioactive Waste Definition

- ☐ a. high level radio waste or spend nuclear fuel NRC Act 1982
- ☐ b, c, d, and e. Transuranic waste, waste source material, special nuclear material, waste by-product material as defined Atomic Energy Act 1954
- ☐ f. low level radioactive waste as defined by NRC
- ☐ g. radioactive material that requires licensure by NMED radiation protection regulations 20.3.3 NMAC

New Rules prohibit disposal of TENORM in New Mexico

Other Testing and Regulatory Authority

- **Testing for free liquids (Paint Filter Test, EPA Method 9095)** to determine if waste contains any "free" liquids. Liquids cannot be disposed of at NM landfills.
- There is no federal requirement to test waste residuals specifically for radionuclides, and
- There is no federal regulation governing landfill disposal of TENORM residuals or sludges.

Hazardous Waste

- The presence of radionuclides does not make waste hazardous;
- Hazardous waste generation will most likely be the result of treatment removal of co-contaminant such as arsenic. (Type of media can mitigate)
- Arsenic in high concentrations could make the resulting residuals hazardous of defined "mixed waste". (Toxicity Characteristic)

Hazardous Waste Determination

- **Water system operators are required to determine if the waste generated is hazardous.**
- Knowledge of waste generation process, and analytical testing will be required.
- Analytical testing will involved TCLP (Toxicity Characteristic Leaching Procedure (Method 1311).
- If tests hazardous must be managed under Subtitle C Regulations of Hazardous Waste Bureau.

Mixed Waste

- A system generating hazardous waste does not have mixed waste if the amount of source material generated is an "unimportant quantity" (uranium or thorium makes up less than 0.05% by weight,) or;
- If the waste contains only radium (since radium is not considered source or byproduct material when present in water treatment residuals).

Disposal Options

- May be allowed by EPA to dispose of residuals in solid waste landfill; **However, please note that landfill owners, with special waste permits, can refuse to accept any waste and have discretion to return waste to the generator;**
- Hazardous waste landfill; and
- Low Level Radioactive Waste LF in Utah, may not take waste from Rocky Mountain Compact states. Richland, Washington may take LLRW from New Mexico.

Additional Information Questions?

- www.nmenv.state.nm.us (Select Solid Waste from Program Menu on left of main page) Rules, Annual Report with special waste landfills and contacts available for printing on-line
- Auralie Ashley-Marx, Solid Waste Bureau Chief (505) 827-2775 auralie.ashley-marx@state.nm.us
- US EPA Regulatory Guide to the Management of Radioactive Residuals from Drinking Water Treatment Technologies