Treatment Residual Disposal Options
Overview

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- Liquid Residual Types
- Solid Residual Types
- Liquid Residual Disposal Options
- Solid Residual Disposal Options
- Transporting Waste & Waste Brokers
- Alternatives
## Acronyms & Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>Activated Alumina</td>
</tr>
<tr>
<td>BAT</td>
<td>Best Available Technology</td>
</tr>
<tr>
<td>CESQG</td>
<td>Conditionally Exempt Small Quantity Generator</td>
</tr>
<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
<tr>
<td>DOT</td>
<td>U.S. Department of Transportation</td>
</tr>
<tr>
<td>ED/EDR</td>
<td>Electrodialysis/Electrodialysis Reversal</td>
</tr>
<tr>
<td>HMO</td>
<td>Hydrous Manganese Oxide</td>
</tr>
<tr>
<td>IX</td>
<td>Ion Exchange</td>
</tr>
<tr>
<td>LLRW</td>
<td>Low Level Radioactive Waste</td>
</tr>
<tr>
<td>LQG</td>
<td>Large Quantity Generator</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
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</table>
# Acronyms & Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>PFLT</td>
<td>Paint Filter Liquids Test</td>
</tr>
<tr>
<td>POTW</td>
<td>Publicly Owned Treatment Works</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
</tr>
<tr>
<td>SQG</td>
<td>Small Quantity Generator</td>
</tr>
<tr>
<td>SSCT</td>
<td>Small System Compliance Technology</td>
</tr>
<tr>
<td>TBLLs</td>
<td>Technically Based Local Limits</td>
</tr>
<tr>
<td>TCLP</td>
<td>Toxicity Characteristic Leaching Procedure</td>
</tr>
<tr>
<td>TENORM</td>
<td>Technologically Enhanced Naturally Occurring Radioactive Material</td>
</tr>
<tr>
<td>UIC</td>
<td>Underground Injection Control</td>
</tr>
<tr>
<td>USDW</td>
<td>Underground Source of Drinking Water</td>
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</table>
Disposal Options Depend On…

- **Waste characteristics**
  - Liquid or solid
  - Type and concentration of contaminants
  - Classification of waste
    - TENORM
    - Hazardous Waste
    - Source Material
    - Mixed Waste
    - Radioactive waste
Disposal Options Depend On…

- Federal, state, & local regulations
- Disposal facility policies
- System & disposal site location
<table>
<thead>
<tr>
<th>BAT/SSCT</th>
<th>Brine</th>
<th>Backwash</th>
<th>Rinse Water</th>
<th>Acid Neut. Water</th>
<th>Concentrate</th>
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<tbody>
<tr>
<td>IX</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>RO</td>
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<td>AA</td>
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<tr>
<td>Coagulation/Filtration</td>
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<tr>
<td>Lime Softening</td>
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<tr>
<td>Green Sand Filtration</td>
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<tr>
<td>Co-Precip. w/ Barium Sulfate</td>
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<tr>
<td>ED/EDR</td>
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<td>X</td>
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<tr>
<td>Pre-formed HMO Filtration</td>
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</table>
## Solid Residuals

<table>
<thead>
<tr>
<th>BAT/SSCT</th>
<th>Spent Resins/Media</th>
<th>Spent Membranes</th>
<th>Sludge</th>
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<tbody>
<tr>
<td>IX</td>
<td>X</td>
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<tr>
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<tr>
<td>Pre-formed HMO Filtration</td>
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## Disposal Options

<table>
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<tr>
<th>Residuals</th>
<th>Possible Disposal Options</th>
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<tr>
<td></td>
<td>Direct Discharge</td>
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<tr>
<td>Liquids</td>
<td>X</td>
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<tr>
<td>Sludge</td>
<td></td>
</tr>
<tr>
<td>Spent Resins/Media</td>
<td></td>
</tr>
<tr>
<td>Spent Membranes</td>
<td></td>
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</tbody>
</table>
Liquid Disposal: Direct Discharge

- Must have accessible & appropriate receiving body

- NPDES permit limitations
  - No federal regulations in place for radionuclides
Liquid Disposal: Discharge to POTW

- Must meet TBLLs
- POTW can refuse waste if it will:
  - Interfere with treatment process
  - Contaminate POTW sewage sludge
  - Cause NPDES permit violation
- May need local permit or contract
Liquid Disposal: Discharge to POTW, cont.

- Domestic sewage exclusion
- Restrictions on source material
- State TENORM regulations may apply
Liquid Disposal: Underground Injection

- UIC regulations define “radioactive”
- Additional state restrictions may apply
- Class I wells
  - Possible option for radioactive & hazardous residuals
  - Stringent requirements
  - Limited disposal of sludge/solids
Liquid Disposal: Underground Injection, cont.

- Class V wells
  - Shallow wells
  - May not accept radioactive waste
  - No hazardous waste disposal
### Liquid Residuals Disposal

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer 1</th>
<th>Answer 2</th>
<th>Answer 3</th>
<th>Answer 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there access to a receiving body?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Does the liquid meet direct discharge requirements (CWA/NPDES, state, and local limits)?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Is direct discharge the most cost-effective or practical (or only) option?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
| Secure a permit from the state.                                         | Direct discharge. | Discharge to POTW. | Secure a permit from the state. | Consider intermediate processing and/or waste minimization methods or other disposal options.

**Considerations and Additional Information**

- **Is there access to a POTW?**
- **Is underground injection available?**
  - Yes
  - No
  - Would injection to a Class I well be the most cost-effective or practical (or only) option?
    - Yes
    - No
    - Contact the appropriate EPA regional or state UIC program office to see whether Class I injection (below a USDW) is a disposal option.
- **Is the liquid considered radioactive and/or hazardous according to 10 CFR Part 20, Appendix B, Table II, Column 2 and 40 CFR 261.3 respectively?**
  - Yes
  - No
  - Would injection to a Class V well be the most cost-effective or practical (or only) option?
    - Yes
    - No
    - Contact the appropriate EPA regional or state UIC program office to see whether Class V injection (into or above a USDW) is a disposal option.
- **Is discharge to a POTW the most cost-effective or practical (or only) option?**
  - Yes
  - No
  - Contact the appropriate EPA regional or state UIC program office to see whether Class I injection (below a USDW) is a disposal option.

**Additional Notes**

- If the POTW accepts the residual waste, discharge to a POTW.
- If the system’s discharge cause pass-through or interference at the POTW?
- Consider intermediate processing and/or waste minimization methods or other disposal options.
- Contact the appropriate EPA regional or state UIC program office to see whether Class I injection (below a USDW) is a disposal option.
- Does the liquid containing Ra or U meet POTW discharge requirements (CWA, state limits, TBLLs)?
- Will the POTW accept the residual waste?
- Secure a permit from the state.
- Direct discharge.
Solid Residuals: Pre-testing

- Determine if waste is hazardous
  - Process knowledge and/or
  - Analytical testing

- TCLP
  - Predicts leaching of hazardous waste
  - Levels set for 8 metals & 32 organics
    - Does not apply to radionuclides
Solid Waste: Pre-testing, cont.

- Testing for free liquids
  - Paint filter liquids test
  - > 20% solids

- Landfills do not accept waste containing free liquids
Solid Waste: Pre-testing, cont.

- Intermediate processing to remove liquids
- No federal requirement to test residuals for radionuclides
### Hazardous Waste Generators

<table>
<thead>
<tr>
<th>Status</th>
<th>Generation</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditionally Exempt Small Quantity Generator (CESQG)</td>
<td>&lt; 100 kg</td>
<td>&lt; 1,000 kg</td>
</tr>
<tr>
<td>Small Quantity Generator (SQG)</td>
<td>100 – 1,000 kg</td>
<td>1,000 – 5,999 kg</td>
</tr>
<tr>
<td>Large Quantity Generator (LQG)</td>
<td>&gt; 1,000 kg</td>
<td>&gt; 6,000 kg</td>
</tr>
</tbody>
</table>
Solid Residuals: Municipal & Industrial Landfills

- RCRA - Subtitle D

- Municipal solid waste landfills
  - Non-hazardous TENORM
  - Hazardous waste from CESQGs

- Industrial solid waste landfills
  - Non-hazardous TENORM

- Landfills may monitor waste
Solid Residuals: Hazardous Waste Landfills

- RCRA – Subtitle C
- All generator classes
- Land Disposal Restrictions (SQGs & LQGs)
- May not accept TENORM
- Possible permit conditions
Solid Residuals – LLRW Landfills

- **Barnwell - South Carolina**
  - Limited use after June 2008

- **Richland - Washington**
  - Certain types of TENORM
  - Limited licensed source material disposal
  - No hazardous or mixed waste

- **EnergySystems – Clive, Utah**
  - Dedicated TENORM disposal
  - Certain kinds of mixed waste
Solid Residuals – Mixed Waste Facilities

- EnergySystems – Clive, Utah
- Perma-Fix Environmental Services
  - East Tennessee M&EC
- NSSI
Solids Residual Disposal

1. **Identify the quality and quantity of the residual**
   - Are there free liquids, according to the PFLT?
     - Yes: Use intermediate processing to separate out the liquids
     - No: Proceed to next step.

2. **Sludge, Resin, Granular Media, AA Media, Spent Membranes**
   - Is the waste hazardous?
     - No: Dispose of liquid residuals
     - Yes: Proceed to next step.

3. **Does the waste contain radionuclides?**
   - Yes: Dispose in a hazardous waste landfill and meet all RCRA Subtitle C requirements
   - No: Proceed to next step.

4. **Does the waste contain non-exempt quantities of uranium or beta/photon emitters?**
   - Yes: Dispose in a LLRW landfill permitted to accept hazardous waste or a hazardous waste landfill licensed to accept TENORM waste
   - No: Dispose in a landfill licensed to accept mixed waste**
Transporting Waste

- DOT radioactivity limits may apply

- Transporting hazardous waste
  - May require EPA ID number
  - Uniform Hazardous Waste Manifest

- Costs can be significant
Waste Brokers & Transporters

- Private firms that may
  - Remove residuals from on-site
  - Process residuals as necessary
  - Transport residuals to disposal site

- Treatment vendors may offer similar services
Alternative Options

- Incineration
- Evaporation ponds
- Surface impoundments
- Sludge dewatering

Intermediate processing methods create additional residual streams

Land application or soil mixing

Not encouraged unless there is a demonstrated benefit, weighed against potential hazards & risks
Questions?