

Options for Managing Per and Polyfluorinated Substances (PFAS) in Landfill Leachate, Fire Water and other Wastewaters

Environmental Federation of Oklahoma

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Agenda

- Regulatory Comments
- Sources of PFAS Liquids
- Options to Manage PFAS Liquids
- Options to Manage PFAS Treatment Residuals
- Considerations for Selecting an Option
- References
- Questions

Regulatory Comments

- Regulations are changing and can be retroactive.
 - » Regulations started with PFOA and PFOS; Other PFAS compounds are now being considered
 - » EPA Health Advisory of 70 ppt was >200 about 10 years ago; There is no certainty what it will be in the future and what PFAS compounds will be included
 - » Use of PFAS in mist suppression in Chromic Acid plating was encouraged/mandated; Now these products are banned from use; These sites now have legacy contamination clean-up issues
 - » Industry eliminated production of C8 PFAS and went to “safer” C6 PFAS. Some of these compounds are coming under scrutiny and actual regulation in many jurisdictions
- PFAS found in drinking water is driving State regulations and increased level of testing across the country
- Although the EPA is not likely to list PFAS as a Hazardous Waste, they are more likely to be added to Hazardous Substances list under CERCLA, adding reporting and structure to legacy clean up
- Unregulated Contaminant Monitoring Rule (UCMR) is expected to add more PFAS compounds when finalized

Sources of PFAS Liquids

- Chemical production at facilities manufacturing fluorinated compounds using PFAS or PFAS intermediates
- Secondary facilities that use compounds with PFAS in the products like coated paper mills, textile plants, lubricants, cosmetics, etc.
- Landfill leachate from Non-Hazardous Subtitle D landfills. Potential high concentrations from years of taking products with PFOA, PFOS, and other PFAS
- Facilities that make, use, or test AFFF fire fighting foams; Users include airports, US Military, airlines, chemical plants, storage terminals, and petroleum refineries; Contamination potential in ground, groundwater, and water collected after use
- Legacy contamination from sites using PFAS including plating facilities

Options to Manage PFAS Liquids

- Ion Exchange Resin (IX)
- Granular Activated Carbon (GAC)
- Reverse Osmosis (RO)
- Deepwell Injection
- Landfills
- Other Technologies

Options to Manage PFAS Liquids

Ion Exchange Resin

Advantages

- Fully demonstrated technology with targeted resins for PFAS
- Generally higher adsorption capacity than GAC
- Scalable, capable of managing large water volumes
- Can be used in combination with GAC

Disadvantages

- Regeneration fluid or single use requires off-site disposal or incineration
- Multiple species of contaminants can reduce efficiency
- May not remove all PFAS compounds
- How clean is “clean”

Options to Manage PFAS Liquids

Granular Activated Carbon (GAC)

Advantages

- Demonstrated option for PFAS removal
- Better for PFAS with greater than 6 carbon atoms
- Scalable, can manage large volumes of water
- Source of GAC is important
- Can be used with other technologies

Disadvantages

- Break through risk
- Requires regeneration or incineration of spent GAC
- Multiple species can reduce efficiency of GAC

Options to Manage PFAS Liquids

Reverse Osmosis (RO)

Advantages

- A developed technology to remove PFAS from water
- Scalable, can manage large volumes of water
- May be better for 6 carbon chain PFAS

Disadvantages

- High concentration RO reject stream may require off-site treatment
- Non-target compounds may increase corrosivity

Options to Manage PFAS Liquids Hazardous Underground Injection

Advantages

- No discharges to water
- Meet potential regulation as a hazardous waste or hazardous substance today
- Constituent level and variety are generally not an issue
- Large capacity
- No CAPEX
- Lower cost vs. incineration

Disadvantages

- Transportation cost to disposal site
- Potentially cost effective in up to 5 to 10 million gallons per year
- Water properties should be amenable to underground injection

Options to Manage PFAS Liquids Landfill

Advantages

- Locations near generating sites could result in overall lower off-site cost

Disadvantages

- Risk to PFAS in landfill leachate
- Limits on volume of water waste
- Risk of future regulation

Options to Manage PFAS Liquids

Other Options

- Biochar- Partially demonstrated technology
- Other absorption technologies- Partially developed
- Precipitation, Flocculation, Coagulation- Lab/bench scale testing
- Nanofiltration- Partially developed
- Redox Manipulation- Lab/bench scale testing
- “Necessity is the Mother of Invention” New technologies are being developed at a number of universities and private companies

Options to Manage PFAS Liquids Treatment Residues

- Ion Exchange Resins
 - » Single Use- Incineration in RCRA Incinerator
 - » Regeneration Residue- Incineration in a RCRA Incinerator or injection in an Underground Injection facility
- Granular Activated Carbon
 - » Regeneration
 - » Single Use- Incineration in a RCRA Incinerator
- Reverse Osmosis
 - » RO Reject Stream- Incineration in RCRA incinerator or injection in an Underground Injection facility

Considerations for Selecting an Option

- Volumes:
 - > 5 million gallons/year generally favor on-site options
 - < 5 million gallons/year or discrete projects; Off-site options may become competitive
- Distance to off-site options. Is truck or rail available
- Concentrations:
 - High concentrations; Adds to cost for on-site options
- Segregate sources of high PFAS to utilize multiple strategies
- Contaminants:
 - Multiple or variable contaminant levels can add to cost of on-site options.
 - Technology may not be effective on all types of PFAS
- Risk of Future Regulations
 - Does the technology meet potential future regulations
- Discharge Risk:
 - Off-site options are considered on a cost/benefit basis

References

- Interstate Technology Regulatory Council, ITRC.
https://www.itrcweb.org/wp-content/uploads/2018/03/pfas_fact_sheet_remediation_3_13_18.pdf
- National Association for Surface Finishing, NASF
<https://nasf.org/pfas/pfas-in-surface-finishing/>
- **USEPA. EPA's Per- and Polyfluorinated Substances (PFAS) Action Plan, EPA 823R18004, February 2019**
- **Association of State Drinking Water Administrators (ASDWA)**
www.asdwa.org/PFAS