AIX Treatment Engineering Checklist for Public Water Systems

This checklist outlines required documentation and important considerations in designing and implementing effective Anion Exchange (AIX) treatment to remove PFAS. The intent is to streamline and expedite the design and Permit to Construct review process for treatment installations at impacted public water systems exceeding the Maximum Contaminant Level (MCL) for PFAS. If more space is needed for the responses, please attach additional pages or reference the section/page of the Engineering Report that covers this. Any proposed variances to the Rule shall be accompanied by supporting documentation and a separate Variance Request (Section 3.7 of the Rule).

Water System Overview and Treatment Space

1. Provide an overview of the water system and a brief description of proposed construction.

2. Describe the treatment system space and consider operational and maintenance space and any potential impacts to the area. Evaluate if the treatment space is heated and ventilated, not in a confined space, not located within in a flood plain, etc.

3. Describe existing facilities that may impact the proposed treatment design. Consider existing wells, pump stations, treatment facilities, and storage facilities.

4. Proposed treatment equipment will be housed in enclosures that provide adequate room for routine operation and maintenance and protection from weather elements. ☐ Yes ☐ No
5. If new structures are needed to house treatment equipment, please provide a description.

6. If standby power is currently available, is it adequate to run the proposed new infrastructure? ☐ Yes ☐ No ☐ Not Applicable
7. Evaluate existing disinfection treatment infrastructure (if applicable). Provide a discussion of any improvements that are necessary to ensure disinfection treatment will meet requirements of Appendix A, Subpart 4.3 and 40 CFR Part 141.

8. A location map is provided. ☐ Yes ☐ No
9. Water System Permitted Source Capacity:
10. Maximum Daily Demand in gallons per minute (gpm):
11. Instantaneous Peak Demand (gpm):
12. Describe any existing infrastructure that is being removed or modified as part of the proposed project.

13. Describe any other proposed improvements to the water system infrastructure (if applicable) such as new storage and new pumping facilities, etc.

Water Quality Characteristics

1. Characterize the contaminants and their concentrations that the proposed treatment is designed to remove.

2. Characterize water quality constituents and their concentrations that may interfere with AIX treatment. Refer to the PFAS Treatment Engineering Document for more details on interfering water quality constituents.

Water Quality Constituent	Concentrations
Nitrate (milligram per liter; mg/L)	
Nitrite (mg/L)	
Phosphate (mg/L)	
Sulfate (mg/L)	
Bicarbonate (mg/L)	
Chloride (mg/L)	
Iron (mg/L)	
Manganese (mg/L)	
Turbidity (nephelometric turbidity units; NTU)	
pH	
Alkalinity (mg/L)	
Hardness (mg/L)	
Total Organic Carbon (mg/L)	

3. Describe how the water quality constituents can impact AIX resin lifespan and whether pretreatment is needed. Refer to the PFAS Treatment Engineering Document for specific water quality constituents.

4. AIX treatment has the potential to increase treated water corrosivity. Describe mitigation measures including operational adjustments, post-treatment corrosion control, or alterations to existing corrosion control.

5. Water quality samples were collected and analyzed in accordance with requirements of Subchapter 21-6. ☐ Yes ☐ No ☐ Unknown
6. Describe water sampling locations and when water samples were collected.

AIX Treatment Design Recommendations

1. Non-Community water system: At least one train of two AIX exchange units are plumbed in series. ☐ Yes ☐ No ☐ Not Applicable
2. Community water system: At least two treatment trains are proposed, each train consisting of two AIX exchange units plumbed in series.
    a. Where only two treatment trains are proposed, each train is capable of meeting the plant design capacity (the projected maximum daily demand) at the approved filtration rate. ☐ Yes ☐ No ☐ Not Applicable

b. Where more than two treatment trains are proposed, the AIX units are capable of meeting the plant design capacity at the approved flow rate with one treatment train removed from service. ☐ Yes ☐ No ☐ Not Applicable

3. All wetted components are NSF 61 certified. ☐ Yes ☐ No
4. All treatment chemicals are NSF 60 certified. If yes, please list the chemicals in the proposed design. ☐ Yes ☐ No ☐ Not Applicable

5. Provide justification for the choice of selected AIX resin considering water quality discussed above, including the resin's preferential list. Provide AIX resin manufacturer and type.

6. Equipment manufacturer's specifications for units, including minimum/maximum operating flow rates, pressures, operating temperatures and other applicable design parameters are provided. ☐ Yes ☐ No
7. AIX vessel type:
8. AIX vessel size (cubic ft):
9. AIX vessel dimensions (inches): diameter height
10. Describe the arrangement of piping and treatment trains, including lateral header and drainpipes installed within units.

11. Describe the underdrains, supporting gravel, and screens that will prevent resin loss.

12. Provide proposed resin depth (inches):
13. Volume of resin in each unit (cubic ft):
14. The amount of headspace and underdrain required for backwashing is accounted for when determining total resin volume. NOTE: Backwashing requirements upon initial startup and resin replacement are manufacturer specific. Operational backwashing using PFAS selective resins is not recommended.
    ☐ Yes ☐ No
15. Provide calculations for the Empty Bed Contact Time (EBCT) for each AIX unit. Calculations should meet or exceed resin manufacturer specifications and be based on the actual volume of resin in the vessels.

16. EBCT meets the minimum as per manufacturer specifications assuming maximum flow rate through the primary (lead) vessel(s). ☐ Yes ☐ No
17. Provide hydraulic loading rate calculations in gallons per minute per square foot (gpm/ft²) of bed area of each unit.

18. AIX units have necessary piping and valves to facilitate ease of operational adjustments to modify the configuration of primary (lead) and secondary (lag) units, and to remove a unit from service while maintaining functionality of treatment process. If no, please justify.
    ☐ Yes ☐ No

19. Pressure gauges are added so that pressure loss across treatment units can be monitored.
    ☐ Yes ☐ No

20. Provide the range and precision of the pressure gauge including maximum operating pressure. Ensure they are appropriately sized to monitor the pressure loss across the units per manufacturer specification (must be provided).

21. Include an expected pressure loss across each AIX unit.

22. If individual water meters for each well need to be installed as part of the project, they are shown on the Engineering Drawings and cut sheets for the proposed meters are submitted.
☐ Yes ☐ No ☐ Not Applicable
23. If new well pumps are proposed, rationales for well pump selection, well pump cut sheets, and well pump operating curves are provided.
☐ Yes ☐ No ☐ Not Applicable
24. If more than one source is used, provide details on well pump operation. (i.e., Do well pumps operate at the same time or are they alternating? What is the flow rate for each well?)

25. If proposing chlorination, treatment is configured such that chlorine will not degrade the AIX resin. ☐ Yes ☐ No
26. Disinfection treatment is provided prior to the entry point to the distribution system.
☐ Yes ☐ No
27. Provide appropriate details for the chlorine injection point and any other details associated with disinfection treatment.

28. If proposing post-AIX chlorination, provide chlorine contact time calculations and ensure storage provides adequate chlorine contact time during peak demand.

29. Sample ports are provided for the inlet and outlet of each unit. ☐ Yes ☐ No
30. Design drawings demonstrate that all sampling ports and gauges are accessible and that the lead/lag changeout can be accomplished. ☐ Yes ☐ No
31. Describe what engineering controls are included in the design to prevent the AIX units from dewatering.

32. Describe filter to waste and backwash provisions per manufacturer specifications for the AIX units during startup and resin changeout.

Pretreatment Considerations

1. Water quality constituents that will prevent successful performance of the proposed AIX treatment are present and pretreatment is necessary. ☐ Yes ☐ No
2. Provide pretreatment rationale and how it can impact water quality and PFAS treatment performance. Consider the treatment processes and sequence of treatment.

3. Treated water below the Vermont PFAS MCL will be used for the backwashing of any pretreatment processes. ☐ Yes ☐ No
4. Clearly explain the pretreatment backwash and/or regeneration processes.

5. Backflow prevention on the pretreatment backwash line is provided. ☐ Yes ☐ No
6. Provide the additional demand on booster pumps and well pumps in gpm.

7. Provide total volume of backwash water and the anticipated frequency of backwashing.

8. Describe any negative impacts or limitations to use/demand during backwash/regeneration of pretreatment.

Operations and Maintenance

1. The Water System has the appropriate Operator Classification for the proposed treatment system. ☐ Yes ☐ No
2. Provide a description of where treatment chemicals will be stored for all chemicals identified in proposed treatment design.

3. Describe how initial backwashing and rinse to waste of the AIX resin will be completed upon installation.

4. Provide a description on how the water system will anticipate resin change outs. While the best practice for monitoring PFAS breakthrough is sampling at midpoint, it is not currently a requirement. However, relying only on routine compliance sampling may result in an MCL violation and inefficient use of resin in a lead/lag filter configuration.

5. Explain how AIX units will be changed out and describe how vessels will be swapped between lead/lag positions.
    a. Consider the size and potential weight of the vessels. Discuss provisions to precondition new AIX resin in accordance with manufacturer recommendations.
    b. Consider the requirements for physically moving/removing/replacing treatment vessels and other large equipment and provide details as appropriate to address requirements.
    c. Outline the anticipated lead time required for the vendor (i.e., How many days/weeks lead time are required for them to complete the changeout of the AIX resin?).
    d. Demonstrate that the AIX units are not being bypassed.
    e. Describe the anticipated disposal process of the spent AIX resin.

6. The Operations and Maintenance Manual or Standard Operating Procedure states that NSF 61 certified resin will be used for all AIX resin changeouts. ☐ Yes ☐ No
7. The Operations and Maintenance Manual or Standard Operating Procedure will include AIX treatment start up procedures. ☐ Yes ☐ No
8. Provide the location of where Raw Water samples will be collected.

9. Provide the location of where Entry Point samples will be collected.