Division of Drinking and Ground Waters

Guidance for High Rate Filtration for Iron and Manganese Removal at Groundwater Treatment Plants	Division:	DDAGW
	Number:	ENG-xx-001
	Category:	Engineering – Guidance
	Status:	Draft
	Issued:	09/16/2016

I. PURPOSE:

The purpose of this document is to provide guidance on the minimum criteria necessary to obtain approval of filter media for use in rapid rate gravity or pressure filtration units at groundwater treatment plants for the removal of iron and/or manganese, which fall outside the design criteria listed in Recommended Standards for Water Works, otherwise known as the "Ten State Standards" (TSS), 2012 edition. Deviations from these guidelines can be accepted if justification is provided.

II. BACKGROUND:

Ohio Administrative Code (OAC) 3745-91-09 requires community water systems to provide treatment for removal of iron and/or manganese to meet the secondary maximum contaminant levels (SMCLs) set forth in OAC rule 3745-82-02 as follows:

- For a new community water system, treatment is required if the level of iron and/or manganese in water entering the water plant exceeds the SMCLs.

- For existing community water systems which develop a new source or change a source, treatment is required, if the level of iron and/or manganese at the entry point to the distribution system increases and exceeds the SMCLs.

The objective of this guidance is to achieve consistency throughout the State of Ohio in administering provisions of the OAC rule 3745-91-09 and standard design criteria in regard to iron and manganese removal at groundwater water treatment plants (WTPs). Additionally, surface water systems considering high-rate filtration must also meet SMCLs for iron and manganese. Lastly, this guidance is not applicable to systems with arsenic above the maximum contaminant level of 10 µg/L.

III. REFERENCES:

A. The Great Lakes Upper Mississippi River Board of State Public Health and Environmental Managers, Recommended Standards for Water Works or TSS, 2012 Edition.
B. Civardi, J., Tompeck, M., Iron and Manganese Removal Handbook, Second Edition.
C. American Water Works Association, Water Quality and Treatment: A Handbook on Drinking Water, Sixth Edition.

D. Approved Capacity Planning and Design Criteria for Establishing Approved Capacity for: 1) Surface Water and Ground Water Supply Sources, 2) Drinking Water Treatment Plants (WTPs), and 3) Source/WTP Systems (Approved Capacity document), March 2010.

IV. GUIDANCE:

1.0 General Criteria

1.1 The filtration design parameters are those listed in the 2012 edition of TSS, Section 4.3.2.2 and the Approved Capacity document.

1.2 Prior to performing a demonstration study, it is recommended a protocol for this study be agreed upon with the Ohio EPA. The demonstration study shall be performed as required by TSS Section 1.1.8, and should use an existing, full-scale WTP or, if this is impractical, a pilot-scale unit.

1.3 Demonstration studies are classified into three categories:

1.3.1 The use of a complete, pilot-scale treatment plant for those cases in which there is no existing, full-scale WTP.

1.3.2 The use of a pilot-scale clarifier and/or filter unit operated at higher rates for comparison with the full-scale clarifier(s) and/or filters of an existing WTP.

1.3.3 The isolation of full-scale detention tanks, clarifier(s) and/or filter(s) at an existing WTP operated at higher rates for comparison with all or some of the remaining full-scale clarifiers and/or filters. It may be necessary to install a pilot-scale filter to accept water from the high-rate clarifier (if it exists) when the pre-treated water cannot be conveyed to an individual filter.

1.4 The SMCLs for iron and manganese shall not have been exceeded prior to performance of a demonstration study for an existing full-scale WTP.

1.5 Additional requirements to be met prior to performing a demonstration study for an existing WTP are as follows:

1.5.1 The WTP shall be under the responsible charge of a properly certified operator (OAC 3745-7-02).

1.5.2 The WTP shall meet the redundancy requirements in Section D.7. of the Approved Capacity document.

1.5.3 Components must be in-service in accordance with Section D.7. of Approved Capacity document.

2.0 DEMONSTRATION STUDY CRITERIA

2.1 Prior to the performance of a demonstration study, it is strongly recommended that a protocol be submitted and accepted. The protocol should include:

2.1.1 Results from analysis of raw water iron and/or manganese data for the previous three-month period for each well, if any are available.

2.1.2 Statement of objectives and conclusions from an evaluation of the raw water quality identifying critical source water wells and conditions to be evaluated during the demonstration study.

2.1.3 Schematic drawings and detailed descriptions of the facilities to be used.

2.1.4 Mode(s) of operation to be tested.

2.1.5 Time schedules for each mode of operation, in relation to the critical source water wells to be evaluated (Item 2.1.2 of this guidance).

2.1.6 Sampling locations to be monitored.

2.1.7 Parameters to be monitored at each sampling location.

2.1.8 Frequency of monitoring for each parameter.

2.1.9 Description of on-line and bench analytical equipment to be used for monitoring each parameter.

2.1.10 Quality assurance and quality control procedures to be used.

2.1.11 Description of analyses to be used for evaluating the data collected.

2.2 The Demonstration Study should include:

2.2.1 Existing Ohio EPA approved filter media. If new media is to be installed, it must meet ANSI/NSF 61 certification as required by OAC rule 3745-83-01(D).

2.2.2 A description of the filter media configuration (e.g., anthracite/green sand, etc.), bed depths, and filter media specifications (e.g., effective size, uniformity coefficient, specific gravity, etc.).

2.2.3 A record of which wells were operating during the Demonstration Study to demonstrate that a worst-case source water condition was tested. When multiple wells exist, the source water well combination for the pilot should be representative of the water quality of the wells during most challenging conditions under a normal operating scenario for iron and/or manganese.

2.3 A demonstration study shall be conducted for at least eight hours per day, for two consecutive five-day periods (e.g., Monday through Friday).

2.4 The following data shall be collected for the demonstration study:

2.4.1 Total iron and/or manganese:

2.4.1.1 In raw water at least every two hours.

2.4.1.2 In high-rate filter influent at least every two hours (if pretreatment exists).

2.4.1.3 In high-rate filter effluent at least every two hours.

2.4.2 Filtration rate and method of control.

2.4.3 Other data:

2.4.3.1 Pretreatment chemical feed points and dosages.

2.4.3.2 Basis of Design table; refer to the Approved Capacity document for an example).

2.4.3.3 Flow data every two hours.

2.4.3.4 Initial and terminal headloss for each filter run.

2.4.3.5 Backwash volume and rate for full-scale demonstration studies.

2.4.4. Samples may be analyzed with iron and manganese test kits. At least one split sample per week must be also analyzed for iron and manganese with a bench instrument at an Ohio EPA certified laboratory. The split samples must be within 10% of each other.

2.5 It is strongly recommended that data analysis consist of at least:

2.5.1 Total iron and/or manganese:

2.5.1.1 In raw water, high-rate filter influent, and high-rate filter effluent, maximum, average, minimum and standard deviation for each filter run; and for the time frame in which the demonstration study is conducted.

2.5.2 Other data:

2.5.2.1 Gross water production (gal/sf) for each filter run.

3.0 APPROVAL CRITERIA

3.1. A report shall be submitted in which the data collected, results of the data analysis, and the conclusions and recommendations are presented and clearly summarized. The iron and/or manganese data should be presented in tabular and graphical formats. Data should also be submitted in electronic format (preferably, Microsoft Excel). The report should also include all other data collected during start-up prior to the demonstration study, or other operation periods.

For each operation mode performed during the demonstration study, the pertinent parameters (e.g., raw water source, pretreatment, etc.) should be clearly defined and presented in the report.

3.2. Iron from high-rate filter shall:

3.2.1 Be less than 0.3 mg/L for at least ninety percent of the samples for the time period in which the pilot-scale or full-scale demonstration study is conducted.

3.2.2 Be less than 0.4 mg/L at all times.

3.3 Manganese from high-rate filter shall:

3.3.1 Be less than 0.05 mg/L for at least ninety percent of the samples for the time period in which the pilot-scale or full-scale demonstration study is conducted.

3.3.2 Be less than 0.07 mg/L at all times.

IV. HISTORY:

The Division of Drinking and Ground Waters first issued this document on _____.