TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

PTR SECTION STAFF GUIDANCE

MONITORING, OPERATING, AND REPORTING REQUIREMENTS FOR BAG AND CARTRIDGE FILTERS

Rules Affected: Title 30 Texas Administrative Code (30 TAC) §290.42(c)(1), §290.42(d)(1), §290.46(e), §290.46(m)(3), §290.46(s), §290.47 and §290.111

Background:
This Staff Guidance document provides information, guidance, and regulations regarding Bag and Cartridge filters. Both Bag and Cartridge filters are pressure-driven devices which are constructed to remove particulate matter larger than 1.0 micron using an engineered porous filtration media through either surface or depth filtration. Prior to a Public Water System using a Bag or Cartridge filter, the filter must have been tested by an independent, third party in accordance with the challenge study requirements as specified in Title 40 of the Code of Federal Regulations (CFR) §141.719(a)(2). Bag filters are typically constructed of a non-rigid, fabric filtration media housed in a pressure vessel in which the direction of flow is from the inside of the bag to the outside. Cartridge filters are usually constructed as rigid or semi-rigid, self-supporting filter elements housed in pressure vessels in which flow is from the outside of the cartridge to the inside.

Systems that treat surface water, groundwater under the influence of surface water, rain water, or groundwater through treatment plants with open basins must achieve at least a 2.0-log (99%) removal or inactivation of Cryptosporidium parvum (Crypto), 3.0-log (99.9%) removal or inactivation of Giardia lamblia (Giardia), and a 4.0-log (99.99%) removal or inactivation of viruses. Some systems will need to provide extra treatment for Crypto based on source water quality. This Staff Guidance document applies to systems which use Bag or Cartridge filters to achieve the removal of these microorganisms.

This Staff Guidance document is intended to help Plan and Technical Review (PTR) Section staff members when reviewing exception requests to use Bag or Cartridge filters. This document also provides guidance to staff regarding site-specific monitoring, operating, and reporting requirements for public water systems (PWSs) that use Bag or Cartridge filter technologies to meet the treatment technique requirements for Crypto, Giardia, and viruses. In addition, this Staff Guidance is to be used (in conjunction with the plan approval letter and the CT Study approval letter) by field inspectors during the comprehensive compliance investigation of installations that use bag or cartridge filters.

PRIMARY VERSUS SECONDARY FILTERS
To receive biological removal credits, all filter assemblies must meet federal and state design/operating requirements. Also, 100% of the water flow must be treated by the bag and cartridge filters. Bag and cartridge filters can be used as either primary or secondary treatment. Typically granular media filters or membrane filters are the primary method for achieving biological removal. But if the bag or cartridge filters are the only filters, they will be considered the primary filters. Bag and cartridge filters will be considered primary filters, unless all the water that passes through the units also passes through another type of filter, and the other filter is designed and monitored to meet regulatory requirements for pathogen removal.
Figure 1 - Example 1: A plant has a granular media filter which meets the individual filter effluent and combined filter effluent turbidities. The plant also has a cartridge filter installed after the granular media filter. The cartridge filter would be considered a secondary filter.

Figure 1 - Example 2: A plant has membrane filters which meets the individual filter effluent and combined filter effluent turbidities. The plant also has a cartridge filter installed before the membrane filters. The cartridge filter would be still considered a secondary filter even though it is before the membrane filter.

**FIGURE 1 - EXAMPLES OF PRIMARY AND SECONDARY FILTERS**

**Example 1**

![Diagram of Example 1](image1)

**Example 2**

![Diagram of Example 2](image2)

**REGULATORY REQUIREMENTS**

This staff guidance document focuses on the information a PWS needs to monitor and document at a plant including turbidity, process control tests, pressure tests, and operating requirements to be compliant with rules specified by the United States Environmental Protection Agency (USEPA) and the Texas Commission on Environmental Quality (TCEQ) as applicable to Bag and Cartridge filtration processes. The rules are listed in Title 30 of the Texas Administrative Code (30 TAC) §290.111, and 30 TAC §290 Subchapter D. Specifically, these monitoring requirements apply only if the PWS uses a Bag or Cartridge filter to receive biological removal credits for treating surface water. Please note that Bag or Cartridge filtration is only one part of the treatment process, and other regulations will apply to pretreatment, chemical disinfection, etc.

**MONITORING REQUIREMENTS**

1. **INDIVIDUAL FILTER EFFlUENT (IFE) TURBIDITY**
   a. **Primary Filter** - The turbidity of the water leaving each individual Bag or Cartridge assembly shall be continuously monitored and recorded every 15 minutes. This requirement is for primary filters only. A primary filter is defined as:
      - One Bag or Cartridge Filter, or
      - A Bag or Cartridge Filter pair in series

      If there are two filters in series, the turbidity must be monitored between the two filters.
Please note: Per TCEQ regulations, Bag and Cartridge filter systems are allowed to continuously monitor another performance parameter in lieu of turbidity if approved by TCEQ. Currently, no other performance parameters have been approved because filter manufacturers have not recommended or requested approval of other parameters. Until another parameter is approved, turbidity monitoring will be required for all Bag and Cartridge filter systems. In the future, if another parameter is approved, turbidity monitoring will still be required, and must be recorded at a minimum of once per day.

There are specific turbidity limits for primary IFE. Table 1 notes these limits, along with the affected filters, and the response(s) which the PWS needs to take based on these turbidity readings.

### TABLE 1-IFE TURBIDITY LIMITS FOR PRIMARY FILTERS COMBINATIONS

<table>
<thead>
<tr>
<th>Filter Type</th>
<th>Turbidity Limit</th>
<th>Trigger</th>
<th>Required Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Individual Filter</td>
<td>1.0 NTU</td>
<td>2 or more consecutive 15-minute readings</td>
<td>Filter Profile Report¹</td>
</tr>
<tr>
<td>Any Individual Filter at a system that serves 10,000 or more people</td>
<td>0.5 NTU</td>
<td>2 or more consecutive 15-minute readings at the end of 4 hours after the filter is returned to service after backwash or shutdown</td>
<td>Filter Profile Report¹</td>
</tr>
<tr>
<td>Any Individual Filter</td>
<td>1.0 NTU</td>
<td>2 or more consecutive 15-minute readings on 3 separate occasions during the last 3 months</td>
<td>Filter Assessment Report²</td>
</tr>
<tr>
<td>Any individual filter or combination of filters</td>
<td>2.0 NTU</td>
<td>2 or more consecutive 15-minute readings on 2 separate occasions during the last 2 months</td>
<td>Comprehensive Performance Evaluation³</td>
</tr>
</tbody>
</table>

¹ **Filter Profile Report**: If the system reports any individual filter with turbidity readings (2 or more consecutive readings 15 minutes apart) that exceed 1.0 NTU, the system must either identify the cause of each exceedance (in writing), or create and submit a Filter Profile Report for each exceedance. The only exception to this requirement applies to systems that have an approved individual filter corrective action plan or plant-wide corrective action plan schedule that allows for exemption to this rule. (30 TAC §290.111(e)(4)(A)(i))

² **Filter Assessment Report**: If the system reports an individual filter as producing water with effluent turbidity readings above 1.0 NTU on 3 or more separate occasions during the last 3 months, the system must complete and submit a Filter Assessment Report for that unit. The system may be exempt from this additional monitoring requirement if it has an approved individual filter corrective action plan or plant-wide corrective action plan schedule that allows for this exception. (30 TAC §290.111(e)(4)(A)(ii))

³ **Comprehensive Performance Evaluation**: A system must participate in a mandatory Comprehensive Performance Evaluation (CPE) each time the system has reported a turbidity reading above 2.0 NTU for any individual filter or combination of filters during the past 2 months. The SWMOR-Alt will determine if the system must submit a Request for Compliance CPE. The system will only be exempt from this requirement if it has an approved plant-wide corrective action schedule. (30 TAC §290.111(e)(4)(A)(iii))

b. **Secondary Filter** - The turbidity of the water leaving each individual Bag or Cartridge assembly shall be monitored once per day.
2. COMBINED FILTER EFFLUENT (CFE) TURBIDITY

a) **Primary Filter** - The turbidity of the water entering the clearwell or filtered water storage tank shall be monitored and recorded as follows:

i) **Plants that serve fewer than 500 people**: Must monitor and record water turbidity entering the clearwell at least once each day.

ii) **Plants that serve at least 500 people**: Must monitor and record water turbidity entering the clearwell at least once every four hours.

If the facility only has one filter, the CFE sample can be obtained in one of the following methods:

i) The plant can choose times each day that they will designate as the CFE sample times and use the recorded on-line reading at those times for the CFE measurement.

ii) The plant can choose to take grab samples at a designated time each day and use the results as the CFE measurement.

iii) Any other monitoring approach approved by TCEQ.

There are specific CFE turbidity limits for primary filters. Table 2 notes these limits, and the result(s) and responses which the PWS needs to take based on the turbidity readings.

*Please note:* The combined filter effluent monitoring point will be located after the primary filters but before the secondary filters.

**TABLE 2-CFE TURBIDITY LIMITS FOR PRIMARY FILTERS.**

<table>
<thead>
<tr>
<th>Filter Effluent Result Type</th>
<th>Turbidity Limit</th>
<th>Trigger</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Filter Effluent</td>
<td>0.3 NTU</td>
<td>At least 95% of the samples each month must be below 0.3 NTU</td>
<td>Treatment Technique Violation&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Combined Filter Effluent</td>
<td>1.0 NTU</td>
<td>Must never exceed</td>
<td>Treatment Technique Violation&lt;sup&gt;1&lt;/sup&gt; or Acute Treatment Technique Violation&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Combined Filter Effluent</td>
<td>5.0 NTU</td>
<td>If ever exceeded</td>
<td>Acute Treatment Technique Violation&lt;sup&gt;2&lt;/sup&gt; and Boil Water Notice&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup> **Treatment Technique Violation**: A Notice of Surface Water Treatment Technique Violation (Monthly) will be required to be filled out by the PWS and posted. The notice is required to be posted in a public place, or copies distributed by hand or mail. (30 TAC §290.111(i)(5))

<sup>2</sup> **Acute Treatment Technique Violation**: An Acute Surface Water Turbidity Violation Notice will be required to be filled out by the PWS and posted. The notice is required to be posted in a public place, or copies distributed by hand or mail. (30 TAC §290.111(i)(3))

<sup>3</sup> **Boil Water Notice**: Per §290.46(q), initial public notice must be issued to customers (bilingual notification if appropriate) within 24 hours of a finished water turbidity exceedance of 5.0 NTU using the format as stated in §290.47(e). Once a PWS issues a Boil Water Notification, the TCEQ must be informed within 24 hours, and provided a copy of the notice. The notice must remain in effect until water entering the distribution system has a turbidity lower than 1.0 NTU, the distribution system has been thoroughly flushed, a minimum of 0.2 mg/L free chlorine residual or 0.5 mg/L chloramine is present throughout the system and...
water samples collected for microbiological analysis are negative for coliform organisms. Once the boil water notification is no longer in effect, public notification must be issued in the same manner as the original notice. Other measures may be required at the discretion of the TCEQ.

b) **Secondary Filter** - There is no CFE turbidity monitoring requirement for secondary filters.

### 3. PROCESS-CONTROL TESTS

Process-control tests are non-regulatory tests performed to assure that the filters are working properly or if a corrective action needs to be taken. These tests must be conducted and the results kept on site for review by TCEQ investigators.

a) **Process-Control Tests:** The following are Process Control tests for Bag and Cartridge filters:
   
i) Pressure at the cartridge assembly inlet and outlet must be monitored and recorded at least once each day.
   
ii) The pressure drop that occurs across the cartridge assembly must be monitored and recorded at least once each day.
   
iii) Additional process-control tests should be conducted in accordance with the manufacturer’s recommendations and the results recorded.

b) **Limits for Pressure:** To maintain pressure across both primary and secondary filters without impacting structural integrity, several factors need to be considered including:
   
i) The pressure at the assembly inlet will not exceed the manufacturer’s recommended maximum allowable pressure.
   
ii) The pressure drop across the cartridge assembly will fall within the specified range provided by the manufacturer and used during the Challenge Test.

### 4. REPORTING REQUIREMENTS

Operators shall complete and submit an SWMOR-ALT, Form TCEQ-00102D, containing data needed to demonstrate the plant is producing water that meets all state and federal requirements for PWSs.

The turbidity of the water leaving each Bag or Cartridge assembly must be recorded and reported as directed in the document “How to Complete the Bag and Cartridge Filtration Worksheet” of the SWMOR-Alt. This document can be found at:

OPERATING REQUIREMENTS

The Bag or Cartridge filter assembly shall be operated and maintained in accordance with manufacturer’s recommendations and good public health sanitation practices (30 TAC §290.46(m)(3)).

a) Facilities that use Bag or Cartridge filters shall maintain an adequate stock of replacement filters at all times.

b) The plant shall maintain enough replacement filters to completely exchange the filters in a single filter assembly. If the plant has multiple assemblies that contain different numbers or models of filters, the plant must be able to exchange the filters in at least one of each assembly type.

c) Replacement filters must meet manufacturer’s requirements, be certified in accordance with the requirements of ANSI/NSF Standard 61, and be approved for achieving the required log reduction of Crypto and Giardia.

d) When a filter in any assembly requires replacement, all the filters within that assembly must be replaced.

e) Used filters must be properly discarded and may not be reinstalled.

OPERATORS

a) The Bag and Cartridge filter installations at a PWS must be operated under the direct daily supervision of a competent, qualified water works operator.

b) Bag and Cartridge filter installations used to treat surface water must be operated under the direct supervision of a Class C or higher surface water operator at all times. Additional licenses are required depending on the size and operation of the system (30 TAC §290.46(e)(6)).

c) Bag and Cartridge filter installations used to treat groundwater that is under the direct influence of surface water must be operated under the direct supervision of either of the following operators at all times (30 TAC §290.46(e)(5)):

i) A Class C or higher surface water operator; or,

ii) A Class C or higher groundwater operator who is familiar with the monthly monitoring and reporting requirements for systems treating groundwater that is under the direct influence of surface water.

d) A qualified operator must be present at Bag and Cartridge filter installations during all routine and corrective maintenance activities, and during unusual operating conditions, such as:

i) Anytime the Bag or Cartridges are replaced and/or any repairs are made to the cartridge assembly,

ii) Anytime changes are made to the treatment process,

iii) Anytime the Bag or Cartridge filter operating parameters are changed, and

iv) Anytime water is being treated unless the plant is equipped with continuous turbidity and disinfectant monitors, alarms, and automatic shutdowns.
ANALYTICAL REQUIREMENTS

All parameters monitored per this guidance document and 30 TAC §290.111 must meet the analytical requirements specified in 30 TAC §290.111(f)(3).

a) Turbidimeters must be able to accurately read and record from 0.1 to above 5.0 NTU
b) Turbidimeters shall be properly calibrated as required in 30 TAC §290.46(s)(2)(B).
c) Flow-measuring devices shall be calibrated at least once every 12 months as required in 30 TAC §290.46(s)(1).
c) If there is a failure in the continuous turbidity monitoring equipment the system must conduct grab samples every 4 hours in lieu of continuous monitoring, but this can only occur for:
   i) No more than five working days following the failure for a system serving greater than 10,000 people per 30 TAC §290.111(f)(3)(D)(i).
   ii) No more than fourteen working days following the failure for a system serving fewer than 10,000 people as required in 30 TAC §290.111(f)(3)(D)(ii).

Finalized and Approved by:

Joel Klumpp, Manager, 1/29/2015

If no formal expiration date has been established for this staff guidance, it will remain in effect until superseded or canceled.

Revision History:

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<td>Approved</td>
<td>Buck Henderson</td>
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<td>1/27/2015</td>
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<td>1/29/2015</td>
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