U. S. Army Corps of Filtration System Performance Checklist

Installation Name	_____
Site Name / I.D.	_____
Evaluation Team	_____
Site Visit Date	_____

This checklist is designed to facilitate the performance evaluation of a filtration treatment process used to remove suspended solids from a water stream. It is divided into the following sections:

1) Evaluation team composition
2) Typical treatment objectives
3) References
4) Data collection requirements
5) Performance analysis calculations
6) Adequacy of operations and maintenance
7) Typical performance problems
8) Alternatives for possible cost savings
9) Supplemental notes and data.

The checklist provides suggestions for information gathering, and space has been provided to record data and notes from the site visit. Supplementary notes, if required, should be numbered to correspond to the appropriate checklist sections.

1) Evaluation Team Composition

The following disciplines should be included in the evaluation team for the filtration system.

- Process Engineer (site visit, treatment system evaluation)
- Regulatory Specialist (regulatory requirements)
- Cost Engineer (cost of alternatives)

2) Typical Treatment Objectives

Verify that the treatment objectives established when the filter system was designed and installed are clear and still valid.

Filtration systems are typically used to remove suspended solids and turbidity from a water stream to meet regulatory requirements for surface discharge. Filtration is also used as pretreatment before treatment using carbon adsorption or reverse osmosis, or prior to groundwater injection.

This checklist covers the following filter system components: (1) filter vessel, (2) filtration media, (3) backwash supply pumps, backwash supply and waste backwash holding tanks, and (4) instrumentation and controls.

3) References

Coordinate this checklist with the: Liquid Piping Systems, Process Instrumentation and Control System, and Solids Handling checklists. The following references may also be helpful:

CEGS 11393 [1]: Filtration Systems
ETL 1110-1-159 [2]: Filtration Treatment Systems

4) Data Collection Requirements

Record the following information needed for performance calculations and to check the operation of the filter system. Record the appropriate units with each value.

4.1 General Information

a) Record the nameplate information from the filter, pumps, and other mechanical equipment for future reference.

_____
_____
_____
_____

b) Sketch process flow diagram (PFD), including valves and instrument locations, on the back of this sheet or a separate sheet.

c) Source of influent (e.g., other treatment *[Specify]*, surface water, landfill leachate)		
d) Filtration system type (e.g., pressure, continuous backwash, travelling bridge, cartridge, bag)		
e) Influent flow dynamics (e.g., continuous, intermittent, batch)		
f) Effluent discharge point		
g) Chemical pretreatment (e.g., alum, polymer)		
h) Physical pretreatment (e.g., clarifier, tube settler)		
4.2 Filter Vessel(s)		
a) Number of filter units/cells		
b) Influent and effluent pipe diameters	Influent =	Effluent =
c) Influent distributor type		
d) Effluent collector type		
e) Media material		
f) Media bed depth		
g) Cartridge or bag pore size		
h) Backwash collector type		
4.3 Filter Operation		

a) Actual influent flow rate		
b) Filtration rate (e.g., flow/surface area)		
c) Influent water temperature		
d) Maximum turbidity	Influent =	Effluent =
e) Maximum suspended solids conc.	Influent =	Effluent =

4.3 Filter Operation - continued		
f) Minimum available head		
g) Maximum headloss		
h) Maximum headloss for clean bed		
i) Maximum design flow and filtration rate	Flow =	Filt. Rate =
j) Backwash type		
k) Backwash flow rate		
l) Does backwash include surface wash?		
m) Does backwash include air scour?		
4.4 Instrumentation and Control		
a) Effluent rate controller type		
b) Backwash controller type (e.g., venturi tube, butterfly valve, dif. pressure transmitter)		

5) Performance Analysis Calculations

a) Are the filtration rates the same as those in the original design specifications, and within the typical design range?

_____

_____

[Typical filtration rates for granular media filters are 2-6 gpm/ft^2 (avg=3 gpm/ft^2) for single media and 2-10 gpm/ft^2 (avg=5 gpm/ft^2) for multimedia filters.]

b) Are the backwash rates the same as those in the original design specifications? Perform design calculations and compare to the manufacturers design information to decide if treatment requirements can be met using a reduced backwash volume.

_____

_____

c) What is the ratio of (net) treated water produced to backwash water used?

_____

d) Calculate the maximum water velocity in the influent pipe and effluent pipes. *[Typically this should be less than 8 ft/sec.]*
Influent velocity = _____ ft/sec Effluent velocity = _____ ft/sec

6) Adequacy of Operations and Maintenance

a) Verify that the filter(s) and ancillary equipment are maintained per manufacturers recommendations.

_____

_____

b) What is the general condition of the filter influent and effluent? *(e.g., clear, murky)*

_____

c) Is the piping associated with the unit color coded and are valves tagged?

_____

_____

d) Is the operating documentation complete? (e.g., operating and maintenance instructions)

_____

_____

e) Verify that all controls and alarms are working. Are there provisions to notify an operator of a malfunction when the unit is unattended?

_____

_____

f) Inspect the filter vessel(s), piping, and pumps for corrosion.

_____

_____

g) Verify that the influent and effluent are being sampled and analyzed in accordance with the sampling and analysis plan designed to verify the filter is operating correctly. Determine if any additional monitoring is needed to properly evaluate the operating conditions.

_____

_____

7) Typical Performance Problems

a) If the filtration process is located outside, are there provisions to drain the water lines and/or the filter vessel(s) when the unit is shut down? Inspect the vessel(s) and piping to verify there is adequate insulation to prevent rupture of lines due to freezing.

_____

_____

b) Are there any discernable capacity problems with either backwash pumping or backwash tankage? Have limitations in backwash supply or backwash waste discharge capacity adversely affected system performance?

_____

_____

c) Is there any evidence of media loss during backwash?

_____

_____

d) Is there any evidence of backwash tank overflow?

_____

_____

8) Alternatives for Possible Cost Savings.

The contaminants in the water stream and/or the contaminant concentrations may have changed to the extent that other treatment alternatives are more cost effective. Consider the following:

a) Determine if the filtration operation is still necessary or whether the influent concentrations have decreased so that the operation can be terminated. Can the unit be easily bypassed if this treatment is no longer needed?

_____

_____

b) Are more cost effective treatment alternatives available that will meet the present treatment requirements?

_____

_____

c) Is there a potential for reducing the filter solids loading by improving pre-treatment operations?

_____

_____

[Check clarifier or sedimentation tank surface overflow rate and weir overflow rate at maximum flow.]

9) Supplemental Notes and Data

There are _____ pages of supplemental notes and data attached to this checklist.

[1] CEGS: USACE Guide Specifications for Construction, available at www.usace.army.mil/inet/usace-docs/

[2] ETL: USACE Engineering Technical letters, available at www.usace.army.mil/inet/usace-docs/