

TURBIDITY and TOTAL SUSPENDED SOLIDS

FACT SHEET



See related Fact Sheets: Acronyms & Abbreviations; Glossary of Terms; Cost Assumptions; Raw Water Composition; Total Plant Costs; and WaTER Program.

1. CONTAMINANT DATA

A. Chemical Data: Turbidity is the reduction of clarity in water due to the presence of suspended or colloidal particles. Turbidity is measured by the amount of light which is reflected by the particles. Turbidity is commonly used as an indicator for the general condition of the water.

The suspended or colloidal particles, commonly referred to as total suspended solids (TSS), are all the extremely small suspended solids in water which will not settle out by gravity. TSS is measured on a sample of water (which has been settled) and are those particles which will not pass through a very fine filter (usually 0.45 micron). The filter is pre-weighed prior to passing of the water, and post-weighed. The difference in the two weights is the TSS concentration (in mg/L).

B. Source in Nature: Turbidity in surface water is comprised of several naturally occurring or introduced organic matter and inorganic minerals, including clays, silts, industrial wastes, sewage, algae, and plankton. Turbidity increases during spring runoff and seasonal precipitation events as a result of increased overland flow and erosion. Turbidity is carried in both gentle and fast currents. Groundwater is usually less susceptible to turbidity because of the natural filtering capabilities of the earth layers it passes through. Turbidity in a water distribution system can result from a watermain break, watermain construction, or excessive flowrates which may disrupt pipe sedimentation.

C. SDWA Limits: For systems required to use the treatment technique (TT), the MCL is <5.0 NTU at all times; <0.5 NTU in 95% of all samples using conventional and direct filtration; and <1.0 NTU in 95% of all samples using diatomaceous earth, slow sand, and all other filtration techniques.. EPA requires daily monitoring for turbidity.

D. Health Effects of Contamination: Turbidity may be harmless, but may be an indicator of harmful water constituents, is aesthetically unpleasant, and is likely to cause color, odor, and taste problems. The major concern with turbidity is that it interferes with the disinfection process. Turbidity can harbor or carry pathogens, and can interfere with disinfection by taking up or using the disinfectant intended for the pathogens in the water. The pathogens which are not killed can result in several waterborne diseases. Depending on the type and concentration of inorganics present, health effects may or may not be a concern.

2. REMOVAL TECHNIQUES

A. USEPA BAT: For community surface and groundwater (under the direct influence of surface water) systems TT is required. In this case, the accepted treatment technique is the use of the conventional treatment processes of chemical addition, coagulation and flocculation, clarification, and dual media filtration. Benefits: proven; reliable. Limitations: initial investment.

B. Alternative Methods of Treatment: Direct filtration may be substituted for the complete treatment where the utility has demonstrated, through adequate pilot-plant studies, that the water will consistently meet the USEPA MCL. Such pilot-plant studies should be conducted during all seasons of the year in order to study the various water conditions and achieve a complete range of raw water qualities.

C. Safety and Health Requirements for Treatment Processes: General industry safety, health, and self protection practices for process equipment should be followed, including proper use of chemicals and tools. When dealing with waterborne diseases, take precautions to prevent infection through open cuts/wounds, or illnesses from ingestion. Wear PPE and wash hands thoroughly.

3. BAT PROCESS DESCRIPTION AND COST DATA

General Assumptions: Refer to: Raw Water Composition Fact Sheet for ionic concentrations; and Cost Assumptions Fact Sheet for cost index data and process assumptions. All costs are based on ENR, PPI, and BLS cost indices for March 2001. General sitework, building, external pumps/piping, pretreatment, or off-site sludge disposal are not included.

3A. TT:

Process - For community surface and groundwater (under the direct influence of surface water) systems, conventional treatment techniques, including chemical coagulation and flocculation, final settling or clarification, and dual media filtration ensure protection of both surface and groundwaters. These TTs work to remove TSS and turbidity prior to disinfection. Processes and dosages may vary by site, so actual process and dosage selection depends on careful review of overall raw water quality and characteristics. Chemical coagulation and flocculation consists of adding a chemical coagulant combined with mechanical flocculation to allow fine suspended and some dissolved solids to clump together (floc). Costs presented below include alum (230 ppm) as the coagulant, rapid mix for 30 seconds, and flocculation for 30 minutes. Final settling or clarification consists of settling of the floc matter. Filtration consists of final removal by filtering of all floc; suspended; and, based on filtration method/size, most dissolved solids, including pathogens. These TTs result in lowering overall TSS/TDS and turbidity, which in turn allows greater disinfection contact time on any remaining pathogens.

Maintenance - Proper monitoring, operation, and maintenance procedures, especially of the final filter, are essential to ensure the reliability of TT processes. Recycled filter backwash may concentrate pathogens and result in a significant source of increased turbidity and pathogen infestation. As a result, a period of filter-to-waste flow may be required after post-backwash cleaning periods. Because turbidity removal can parallel pathogen removal, finished water turbidity monitoring (<0.5 NTU) is required for indicating the degree of pathogen removal. Depending on filtration process, recharging or clean installation of media is required.

Waste Disposal - Pretreatment waste streams and spent filter material require approved disposal.

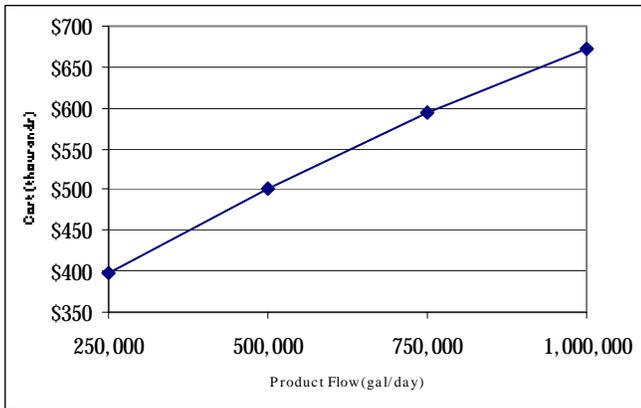
Advantages -

- ! Well established and reliable.
- ! Low operator requirements.

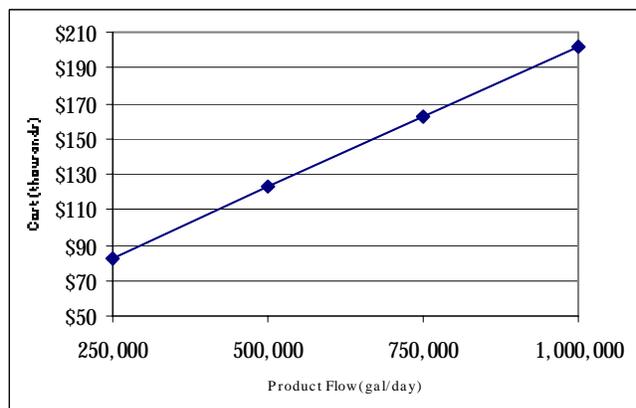
Disadvantages -

- ! Costly initial investment.

BAT Equipment Cost*



BAT Annual O&M Cost*



*Refer to Cost Assumptions Fact Sheet. Does not include general sitework, building, external pumps/piping, pretreatment, or off-site sludge disposal.