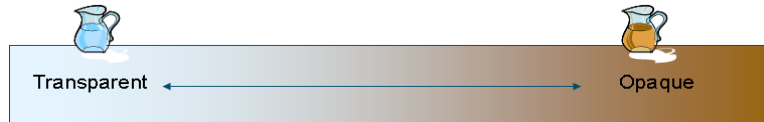


Turbidity FAQ's

1. What is Turbidity?

Answer: Turbidity is the cloudy appearance of water caused by the presence of suspended and colloidal matter. According to ISO 7027, the definition of turbidity is the reduction of transparency of a liquid caused by the presence of undissolved matter



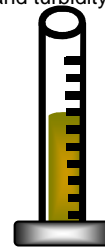
2. How Can Turbidity be measured?

Answer: There are a few ways to measure turbidity.

- Secchi disk
 - This is a disk with black and white markings, about 12 to 15 inches in diameter that is dropped down in a pond, lake, or river with a rope. The user watches the disk submerge to a depth until he/she can no longer see white color on the disk.
- Turbidity tube
 - This is a graduated cylinder that has a secchi disk on the bottom. It is used similarly as the secchi disk, except the water is captured in the cylinder instead of submersing the disk.
- Continuous on-line measurement:
 - This method uses white light 90 degrees or infrared to measure a constantly flowing sample.



Drawing of Secchi disk (above) and turbidity tube (below)



3. When do I use a Secchi disk or Turbidity tube versus a continuous on-line measurement?

Answer:

- The Secchi disk and Turbidity tube are an inexpensive way to take grab-sample measurements. They are time consuming, and requires someone to take grab samples on a frequent basis. If problems are not found in a timely manner, government fines can be costly for ongoing problems for drinking water applications.
- Continuous on-line measurements are used to insure immediate reaction can take place with changes in turbidity, avoiding problems and heavy government fines. This is required if the grab sampling method is continuously problematic and problems cannot be contained.

4. What are the units of measure for Turbidity?

Answer: According to EPA 180.1, section 1, Note 1: NTU's are considered comparable to the previously reported Formazin Turbidity Units (FTU) and Jackson Turbidity Units (JTU).

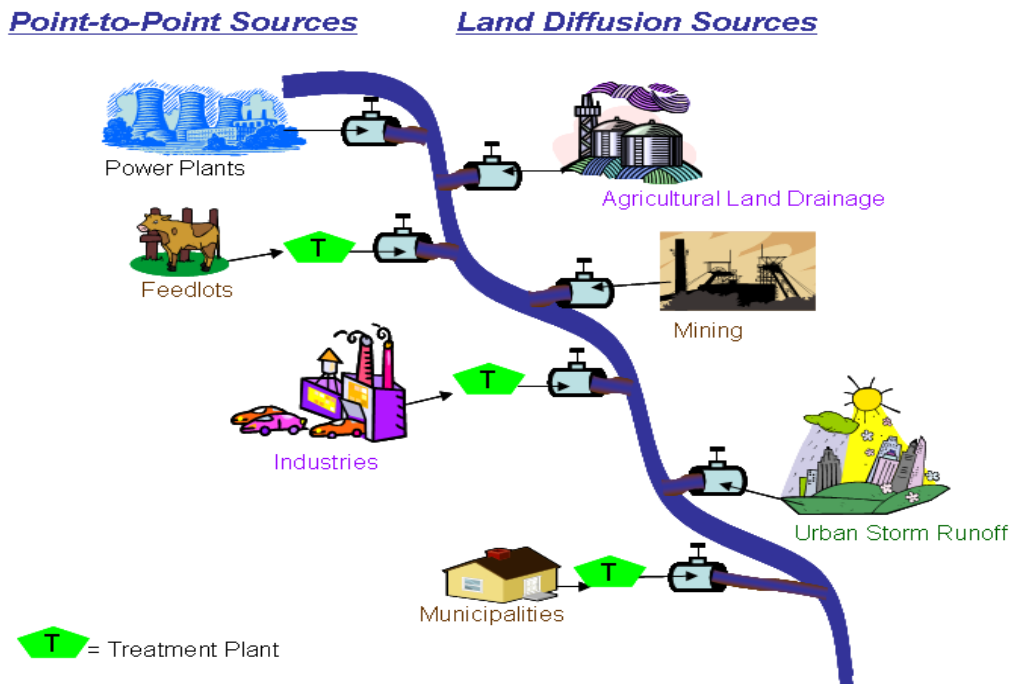
5. What does NTU mean?

Answer: NTU is an abbreviation for Nephelometric Turbidity Units. The term *Nephelometric* refers to the way the instrument estimates how light is scattered by suspended particulate material in the water.

6. What causes turbidity?

Answer: There are many causes of turbidity. In natural bodies of water, causes of turbidity include phytoplankton, shoreline particulates, clays and silts, stirred up bottom sediments, organic debris from streams and/or wastewater discharges, dredging operations, floods, abundance of bottom-feeding fish. Outside sources of water contamination include:

- Power Plants: Heated water
- Feedlots: Organics, solids, nutrients, microorganisms
- Industries: Organics, chemicals, color, foam, salts, toxins, heated water
- Municipalities: Domestic and industrial wastes; microorganisms, color and foam, nitrogen, phosphorus
- Agricultural Land Drainage: Soil from erosion, fertilizers, pesticides, organics, microorganisms
- Mining: Suspended solids, acid mine drainage
- Urban Storm Runoff: Industrial dust, dirt, and litter

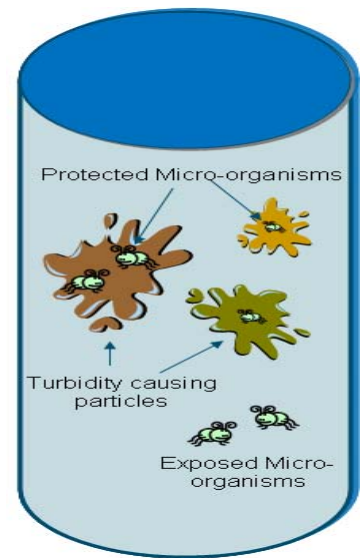


7. What are the affects of too much turbidity in fresh water sources:

- Damage to aquatic animals
 - Reduce light, reduced food growth
 - Reduced photosynthesis lowers release of oxygen into the water.
- Simply aesthetics - people don't like the look of dirty water.
- Adds to the costs to the treatment of surface water supplies used for drinking water since the turbidity must be virtually eliminated for effective disinfection
- Particulates also provide attachment sites for heavy metals such as cadmium, mercury and lead, and many toxic organic contaminants such as PCBs, PAHs and many pesticides.

8. Why is measuring turbidity important?

- a. The particles that cause turbidity provide “shelter” for microbes thus reducing exposure to disinfectants. If not removed, they can promote re-growth of pathogens in the water distribution system. This leads to waterborne disease outbreaks.
- b. Waterborne disease outbreaks are caused by viruses, bacteria, or protozoa. *Giardia* and *Cryptosporidium* are responsible for the majority of waterborne outbreaks.
- c. Drinking water systems using surface water must provide adequate treatment to remove and/or inactivate *Giardia* and *Cryptosporidium*. Turbidity is a useful predictor of parasite removal efficiency and maximizes public health protection.



9. What does the EPA say about how to control turbidity?*

Answer: The EPA (Environmental Protection Agency) states conventional surface drinking water plants are required to measure turbidity at the combined effluent and each individual filter.

10. Does the EPA require the type of measuring apparatus used to measure turbidity? *

Answer: Yes, EPA Method 180.1 states turbidity should be measured using a White Light at 90 Degrees.

11. What are the EPA Turbidity measurement requirements for drinking water plants?*

Answer:

- Combined Filter Effluent: Less than or equal to 0.3 NTU in at least 95% of the readings
- Individual Filter Effluent: Less than 0.5 NTU

12. What are examples of municipal drinking water treatment plant turbidity measuring points?*

Answer:

- The influent of a surface drinking water plant to determine coagulant requirements of the raw water.
- Before and after reverse osmosis systems to determine the efficiency of the membrane and filter performance. It also determines when a filter will require a backwash. After the filter media is no longer efficient, it may allow larger particles to pass.

13. How often should the turbidity system be calibrated?*

Answer: The EPA recommends that on-line turbidity systems be calibrated at least once every three months if they are used for EPA reporting. Otherwise, the system should be calibrated whenever it is determined by the application requirements.

14. Do you provide EPA approved calibration solutions?*

Answer: Yes, the EPA approved solutions available are Amco polymer standard and Formazin solution.

15. Do the calibration standards used for the Signet 4150 turbidimeter need to be mixed?*

Answer: When using the Amco polymer standard kit, there is no mixing required.

16. How much calibration and cleaning liquid is required to calibrate the Signet 4150 turbidimeter?*

Answer: Only a small amount of liquid calibration solution is required. There is no cleaning involved during calibration because the measuring cell remains connected to the system even during calibration.

17. How much downtime is required to calibrate the Signet 4150 turbidimeter?*

Answer: None. The system continues to stay connected to the process liquid during calibration of the unit. Once calibration is completed, the system is immediately put back into service.

18. What components are required to set up the Signet 4150 Turbidimeter?

Answer: Two things are required. A 4.75 mm (3/16”) ID, 8 mm (5/16”) OD flexible tubing is required for the water supply connections. A power cord is also required. All other installation components are included.



The following Frequently Asked Questions and answers are extracted from the EPA Interim Enhanced Surface Water Treatment Rule, Frequently Asked Questions, Office of Water (4606).*

Section 1.3 Turbidity Standards (Combined Filter Effluent)

For further information, see the following rule sections:

Citation	Part Title
§141.73(a)(3)	Filtration
§141.173(a), (b)	Filtration

Q: *In terms of compliance with the combined filter effluent turbidity levels, does 0.3 NTU really mean 0.349 NTU and does 1 NTU really mean 1.49 NTU?**

A: Yes, due to rounding of significant figures.

Q: *A system may substitute continuous turbidity monitoring for grab sample monitoring every four hours. Which results of the continuous monitoring would the system report?**

A: The system is required to record results every four hours. Each month, the system must report the total number of filtered water turbidity measurements recorded, the number and percentage of the recorded measurements taken which are less than or equal to 0.3 NTU, and the date and value of recorded measurements greater than 1 NTU.

Section 1.4 Individual Filter Provisions

For further information, see the following rule sections:

Citation	Part Title
§141.174(a), (b)	Filtration Sampling Requirements
§141.175(a), (b)	Reporting and Recordkeeping Requirements
§142.16(g)(1)	Special Primacy Requirements

Q: *As a system brings filters on line, at different times, do they need separate timers on each filter or can they take all readings on the quarter hour (i.e. 3:00, 3:15, 3:30, etc.)?**

A: Taking all readings on the quarter hour would meet the intent of the rule.

Q: *Is particle counting an adequate substitute for continuous turbidity monitoring?**

A: No. Particle counting may not be used as a substitute for continuous turbidity monitoring. However, EPA encourages the use of particle counters for optimization of process control.

Q: *Some package plants and/or filters are constructed so that it is not possible to install the continuous turbidimeters on each filter bed and perform this monitoring. How do you resolve this issue?**

A: Individual filter monitoring is a requirement of the rule for all Subpart H systems serving 10,000 or more persons that use conventional or direct filtration. This is to ensure public health protection for the maximum number of people. Configurations which do not allow for such plumbing, such as a Greenleaf Filter Plant or certain automatic backwash filters, can be considered one filter and can monitor the combined effluent from the unit every 15 minutes to determine compliance with the individual filter requirements. Systems which believe that they fall under this category should consult with the state. However, it is likely that some of these plants/filters are plumbed such that they can install turbidimeters on individual filters, and therefore should.

Q: *What if a plant exceeds a turbidity trigger for an individual filter while performing filter to waste? Does this need to be reported? Is it a violation?**

A: The turbidity requirements apply only to water that will become part of the combined filter effluent of the plant. Filtered wastewater turbidity does not need to be measured or reported and should not have violations associated with it.

Q: *Does each filter need its own turbidimeter or can several filters be connected to one turbidimeter?**

A: The rule doesn't preclude the use of a single turbidimeter to measure and record the turbidity of multiple filters. A state would have to find that this would be an appropriate methodology for measuring and recording compliance with the individual filter reporting and recordkeeping requirements.

Q: *When a system exceeds the rule-established individual filter turbidity trigger levels in two consecutive measurements taken 15 minutes apart, certain corrective actions are required to be completed within designated time frames. When does the clock start running on those time limits?**

A: The time for completing the necessary corrective actions begins immediately after the second of the two measurements that exceed the "trigger" level.

Q: *How should a system deal with spiked turbidimeter readings for hours (sometimes as many as 12 hours) after the turbidimeter (not the filter it is monitoring) has been cleaned?**

A: EPA believes that the duration of these kinds of spiked readings should normally be a matter of minutes, not hours. A turbidimeter returning inaccurate readings for more than a few minutes should be overhauled or replaced. In the event that inaccurate spikes lasted for a longer period of time, the system would have the option of measuring and recording turbidity at 15 minute intervals using a bench top turbidimeter until the on-line unit returned to normal.

Q: *If a turbidity exceedence is caused by a failure of the turbidimeter, does it still have to be reported?**

A: High turbidity readings that are caused by cleaning and purging a turbidimeter, etc. and that are not indicative of finished water quality do not have to be reported as treatment technique violations and do not trigger the corrective actions of §141.175(b)(1) - (4). However, the system must keep a written record of the readings, the cause of the turbidimeter failure, and why the readings have been deemed inaccurate. When possible, bench top measurements should be made to provide confirmation of the system's reasons for deleting and/or replacing measurements.

*Georg Fischer Signet LLC is providing this information for information only. Please check the EPA website for most current information on Turbidity measurements, regulations, and information. Visit www.epa.gov for more information.