

Improved Turbidity Monitoring

By Douglas C. Osburn, OAWU Circuit Rider

As I was reading through some of the magazines from other rural water organizations I found an article from the HACH Company on turbidity. It was the first in a series of three and soon to be four. I was impressed with the straightforward approach and I called HACH for permission to reprint the article in our magazine. I hope you enjoy it as much as I did.

[This is the first in a series of articles prepared to help operators implement an accurate, low-level turbidity monitoring program they can use to ratchet up filtration effectiveness and reduce the health risks of finished water.]

Improved Turbidity Monitoring Leads to Enhanced Operation, Water Quality

By Mike Sadar, Application Scientist II,
Hach Company

Casually, turbidity is often referred to as the cloudiness, or clarity, of water. Scientifically, turbidity is the interaction between light and suspended particles such as silt, clay, algae and other microorganisms, and organic matter in the water. It's important to remember that turbidity is not a measure of the quantity of suspended solids in your sample but, instead, an aggregate measure of the combined scattering effect from the suspended particles on an incident light source.

A surrogate, but revealing, measurement

Even though it is not a direct measure of particulates in water, turbidity might be the most informative single water quality measurement – from treatment start to finish.

Suspended particles absorb and re-radiate, or scatter, light in a manner dictated by their size, shape, and composition. Therefore, sensitive turbidity measurement can reflect a change in type of particles present, change in particle concentration, or change in relative particle size distribution in the sample. Process operators armed with the sensitive readings made by today's

advanced turbidity instrumentation have real-time assessment of particle content changes in influent, during filtration, and during backwash. They can make process decisions not possible with less-convenient, alternative methodologies such as gravimetric total suspended solids (TSS) testing.

Instrument design is critical

Most modern turbidimeters apply 90-degree, or nephelometric, detection – a technique considered very sensitive to particle scatter over a wide range of particle sizes. (See Figure 1.) Alternative measurements made by general-purpose photometers measure the absorbance or transmittance of the incident light and yield measurements far different than – and not directly comparable to – those made by nephelometers.

Even various nephelometric instruments utilize a wide array of light sources with different wavelengths that interact with the suspended materials in different ways. Instruments that meet USEPA Method 180.1 design requirements are more sensitive to small particles than instruments meeting the ISO 7027 (International Organization for Standardization) design standard. However, the longer-wavelength instruments are less sensitive to the interference caused by dissolved color in samples, making them very useful in process control. (See Figure 2.) Depending on your source water, you might use both kinds of instruments to squeeze the most out of your filtration system and realize the highest-quality product efficiently. (For more information comparing the low-level performance of different instrument designs, request Hach Company technical booklet #7063.)

Next: Even with today's advanced electronic instrumentation, practical guides for operator technique and proper instrument installation and maintenance help assure accurate turbidity monitoring.

Hach turbidity application expert in Oregon, Jack Firkins, is ready to answer turbidity monitoring questions you might have after reading this article. Contact him toll-free 800-227-4224, ext. 2115.

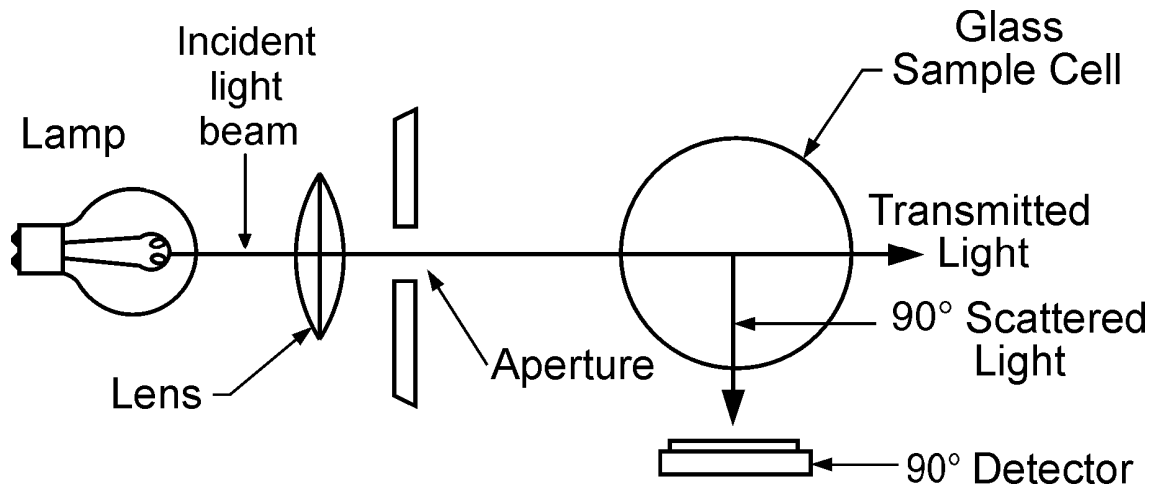


Figure 1: Nephelometers, or nephelometric turbidimeters, measure the light scattered at an angle of 90° from the incident light beam. Readings are in Nephelometric Turbidity Units, or NTU, and cannot be compared directly to Formazin Attenuation Units (FAU) readings made with instruments applying absorption or transmission optical designs.

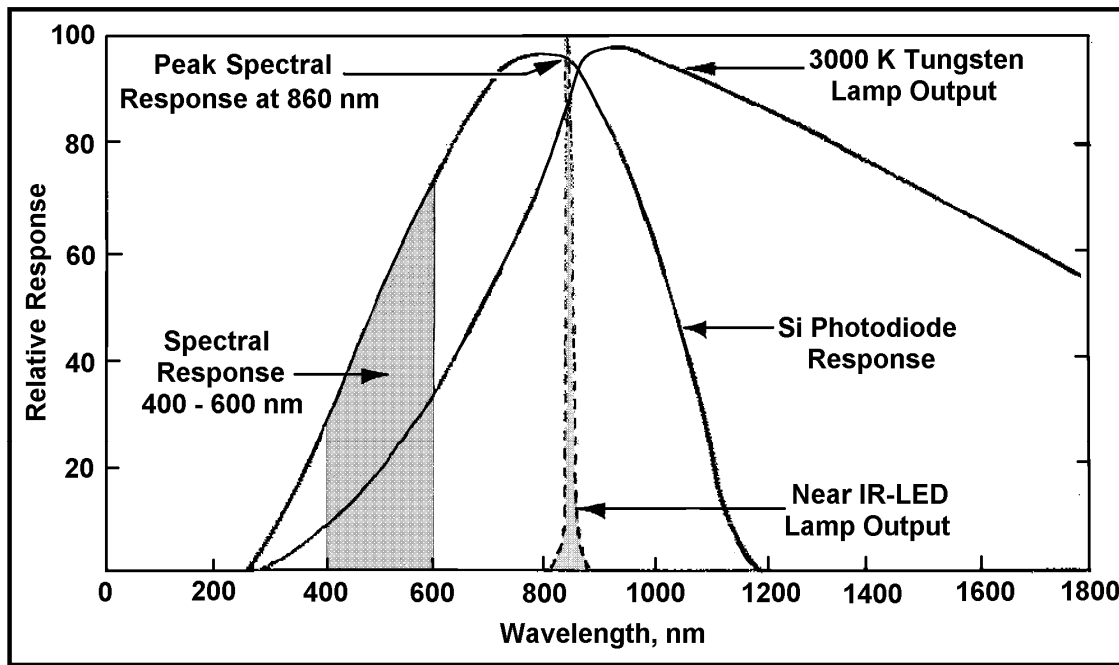


Figure 2: A typical USEPA Method 180.1-compliant nephelometer incorporates a tungsten lamp light source and silicon photodiode detector for peak spectral response from 400 to 600 nm. ISO 7027-compliant instruments offer peak spectral response at 860 nm. While the latter optical design is less sensitive to smaller particles, research has shown the longer-wavelength nephelometer minimizes interference caused by the presence of dissolved, light-absorbing substances such as colored organic material. This minimized interference occurs primarily at turbidity levels higher than 1.0 NTU.



Very low turbidity measurements are the result of accurate turbidity monitoring and tight treatment process control. They indicate the removal of organic materials that can reduce the effectiveness of disinfection, as well as particulates that can support the growth of harmful organisms.