

What Is Turbidity Measured in

A practical guide to what is turbidity measured in, covering the reader intent, the relationship to what is turbidity measured in, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.



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In industrial fluid management and water treatment, understanding the clarity of a liquid is as critical as monitoring its volume or pressure. Turbidity, a measure of the relative clarity of a liquid, is a fundamental parameter used to assess water quality and the efficiency of filtration processes. However, for many engineers and plant managers, the question of what is turbidity measured in often leads to a complex array of acronyms like NTU, FNU, and FAU.

Choosing the right measurement unit and corresponding sensor technology is essential for compliance with environmental regulations and for maintaining process integrity. This guide provides a technical overview of turbidity measurement units, the principles behind them, and how they relate to broader industrial instrumentation strategies, such as those found on the Main Page of professional measurement providers.

| The Principle of Turbidity Measurement

Before detailing the specific units, it is necessary to understand the physical phenomenon being measured. Turbidity is not a direct measurement of the weight or volume of suspended solids; rather, it is an optical property. It describes the expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample.

When light passes through a liquid containing suspended particles (such as silt, clay, organic matter, or microorganisms), those particles interfere with the light. The light hits the particles and scatters in various directions.

| Nephelometry

Most modern industrial turbidity meters utilize the principle of nephelometry. This technique measures the intensity of light scattered at a 90-degree angle from the incident light path. The 90-degree angle is considered the most sensitive to the presence of small particles, making it the standard for low-to-medium turbidity applications.

| Attenuation (Transmission)

In very high-turbidity environments, such as thick sludge or concentrated chemical slurries, light scattering becomes less reliable because the particles are so dense they block the light entirely. In these cases, sensors measure the attenuation—the amount of light that successfully passes through the sample to a detector located directly opposite the light source (180 degrees).

| What Is Turbidity Measured in? Understanding the Units

The units used to quantify turbidity depend largely on the light source used by the instrument and the angle at which the detector is placed. While they all aim to describe the same physical state, they are not always directly interchangeable.

| 1. NTU (Nephelometric Turbidity Units)

NTU is the most widely recognized unit in the United States and many other regions following EPA (Environmental Protection Agency) standards.

Light Source: Typically a white light (tungsten lamp) with a color temperature between 2200 and 3000 K.

Method: Measurement of light scattered at 90 degrees.

Application: Primarily used for drinking water monitoring and low-turbidity environmental water.

| 2. FNU (Formazin Nephelometric Units)

FNU is the standard unit defined by ISO 7027, the international standard for water quality.

Light Source: Near-infrared (NIR) light, usually around 860 nm.

Method: Measurement of light scattered at 90 degrees.

Application: Preferred in Europe and for industrial processes where the liquid may have a natural color. Infrared light is less affected by the color of the sample than white light, providing a more accurate reading of actual particle interference.

| 3. FTU (Formazin Turbidity Units)

FTU is a general unit based on the use of Formazin as a calibration standard. Formazin is a synthetic polymer that can be produced with highly repeatable light-scattering properties. Both NTU and FNU are technically types of FTU, but FTU itself is often used in older documentation or as a catch-all term for any turbidity measurement calibrated against Formazin.

| 4. FAU (Formazin Attenuation Units)

When measuring turbidity by light transmission (attenuation) rather than 90-degree scattering, the unit is FAU.

Method: Measurement of light at 180 degrees (straight through).

Application: Used for high-turbidity applications (typically above 40 NTU/FNU) where scattering is no longer linear due to particle density.

| 5. J TU (Jackson Turbidity Units)

JTU is a historical unit based on the Jackson Candle Turbidimeter. This method involved looking down a tube at a candle flame through a sample of water until the flame was no longer visible. While rarely used in modern automated industrial processes, it may still appear in legacy water quality reports. 1 JTU is roughly equivalent to 1 NTU, but the methods are too different for precise conversion.

| Comparison Table of Turbidity Units

Unit	Full Name	Light Source	Detection Angle	Primary Standard
NTU	Nephelometric Turbidity Units	White Light (Tungsten)	90°	EPA 180.1
FNU	Formazin Nephelometric Units	Infrared (860 nm)	90°	ISO 7027
FAU	Formazin Attenuation Units	Infrared or White	180°	ISO 7027
FTU	Formazin Turbidity Units	Variable	90°	Formazin Polymer
JTU	Jackson Turbidity Units	Candle Flame	Visual	Legacy Standard

The Relationship Between Turbidity and Level Measurement

In industrial automation, turbidity sensors are rarely used in isolation. They are frequently integrated into systems that also require precise level measurement. For example, in a wastewater clarifier, a Welk ultrasonic level sensor or radar level meter might be used to monitor the height of the water and the sludge blanket, while a turbidity sensor monitors the quality of the effluent (the treated water leaving the tank).

Understanding what is turbidity measured in allows engineers to select sensors that complement their existing level instrumentation. If a facility uses ISO-compliant level and flow systems, an FNU-based turbidity sensor is the logical choice to ensure data consistency across the plant's SCADA (Supervisory Control and Data Acquisition) system.

Selection Criteria for Industrial Turbidity Sensors

When selecting a system for turbidity measurement, engineers should evaluate the following criteria based on their specific application:

| Optical Configuration

Choose between a 90-degree (nephelometric) sensor for clean water applications and a multi-beam or backscatter sensor for high-solids environments. For processes with varying levels of solids, sensors that combine scattering and attenuation measurements provide the widest dynamic range.

| Light Source Selection

Infrared (ISO 7027): Best for colored liquids (e.g., paper pulp, chemical dyes) or if the sample contains bubbles, as NIR is less sensitive to these interferences.

White Light (EPA 180.1): Required for regulatory reporting of drinking water in specific jurisdictions. It is more sensitive to very small particles (below 1 micron).

| Installation Environment

Turbidity sensors are optical instruments, meaning they are susceptible to fouling. In industrial tanks or pipes, consider sensors with integrated cleaning mechanisms, such as wipers or ultrasonic cleaners. Furthermore, the physical placement should avoid areas of high turbulence or air entrainment, as bubbles will be read as false turbidity.

| Installation Considerations and Limitations

To ensure that the units measured (NTU/FNU) are accurate, the following installation guidelines should be followed:

1. **Avoid Air Bubbles:** Air bubbles scatter light just like solid particles. Sensors should be installed in sections of piping with constant pressure or in stilling wells within tanks to minimize aeration.
2. **Stray Light Suppression:** In open tanks or basins, ambient sunlight can interfere with optical sensors. Use light-shielded mounting hardware or sensors with modulated light sources that can filter out ambient noise.

3. Calibration Frequency: Turbidity sensors require regular calibration using Formazin standards or secondary standards (such as stabilized Formazin or polymer beads). Industrial environments with high scaling or biological growth may require monthly or even weekly calibration checks.

4. Flow Velocity: While some sensors can be submerged directly in a tank, others require a bypass line (sample cell). In a bypass setup, the flow rate must be controlled; too slow, and particles will settle; too fast, and cavitation may occur.

| FAQs: What Is Turbidity Measured in?

Q: Can I convert NTU to mg/L (Total Suspended Solids)?

A: There is no universal conversion factor. Turbidity measures light scattering, while mg/L measures mass. However, for a specific, stable process (like a consistent silt type in a river), a site-specific correlation can be developed through laboratory analysis. Generally, 1 NTU is roughly 0.5 to 1.5 mg/L for many natural water sources, but this must be verified for each application.

Q: Why does my sensor read differently than the lab sample?

A: This is often due to "stray light" or differences in the light source. If your online sensor uses infrared (FNU) and the lab uses white light (NTU), the results will differ if the water has any color. Additionally, particles may settle or flocculate in the time it takes to transport a sample to the lab.

Q: What is the maximum turbidity range for a standard nephelometric sensor?

A: Most 90-degree sensors are accurate up to 1,000 or 4,000 NTU. Beyond this point, the liquid becomes so opaque that the light cannot reach the detector, and the reading may actually drop as turbidity increases (a phenomenon known as "blinding"). For these applications, an absorption or backscatter sensor is required.

| Conclusion

Identifying what is turbidity measured in is the first step in designing a robust water quality monitoring system. Whether your application demands the precision of NTU for regulatory compliance or the color-independence of FNU for industrial process water, selecting the correct unit ensures that your data is actionable and accurate.

For comprehensive industrial measurement solutions, including radar and ultrasonic level meters that work alongside quality sensors, engineers can explore the technical resources and product options available on the Main Page. By integrating high-quality level and turbidity instrumentation, facilities can achieve superior process control, reduce waste, and ensure environmental compliance in even the most demanding industrial environments.