Turbidity Units

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Turbidity measures the scattering of light through water caused by materials in suspension or solution. The suspended and dissolved material can include clay, silt, finely divided organic and inorganic matter, soluble coloured organic compounds, and plankton and other microscopic organisms.

Turbidity is normally measured in the laboratory using a nephelometer, which is a meter that measures the intensity of light scattered at 90 degrees as a beam of light passes through a water sample. Turbidity can also be measured directly in the field using a portable device, or using a device that is fixed in the stream. The most commonly used turbidity unit is NTU, or nephelometric turbidity units. Nephelometers are calibrated using standards containing formazin which is a polymer which is similar to milk in appearance.

Historically, turbidity was measured using the Jackson candle turbidimeter. This is a visual method, where the sample is poured into a calibrated tube and the turbidity is read when the flame of a candle under the bottom of the tube disappears from view. This method is no longer in standard use as turbidities lower than 25 units can not be measured directly using this instrument. It was removed from Standard Methods for the Examination of Water and Wastewater, published by the American Public Health Association, in their 17th edition (1989). Turbidity units read from the Jackson candle turbidimeter are JTU or Jackson turbidity units. The jackson candle turbidimeter was traditionally calibrated using suspensions of kaolin (a fine clay).

According to Standard Methods for the Examination of Water and Wastewater, 40 NTU has an approximate turbidity of 40 Jackson units when measured on the candle turbidimeter; therefore, nephlometric turbidity units based on the the formazin preparation will approximate units derived from the candle turbidimeter but will not be identical to them. In other words, they are saying NTU are approximately equal to JTU, but not identical. The closeness of these readings will vary depending on the nature of the sample being measured.

An Ask A Scientist response in October 1997 quoted a conversion factor between NTU and JTU of 1 NTU = 2.5 JTU. This is incorrect, and was not given in the paper quoted as the source - Duchrow, R.M. and Everhart, W.H. (1971) Turbidity Measurement, Trans. Amer. Fish. Soc., 100, pp 682-690.

Gippel, C.J. (1994) Monitoring turbidity of stream water, Austr. J. Soil Water Cons., 7, pp 37-44 states that numerous turbidity units have been used (JTU, NTU, FTU, EBC, CNU, FAU, FNU); they are not equivalent, and they should not be confused with mass concentration, (ie they should not be confused with suspended solids measured in mg/L).

It would seem that there is some disagreement amongst scientists about the relationship between JTU and NTU. It appears that 40 NTU is approximately equal to 40 JTU, but at other turbidities, the two units are not equivalent, and may or may not approximate each other. The main reason for this is that the two measurement units refer to different instruments and different calibration materials.