Water Regulations and Sampling

The primary government agency charged with protection of human health and the environment in the U.S. is the Environmental Protection Agency (EPA). The EPA protects human health and the natural environment through regulation of air, water, and land. The regulations comply with seven principle statutes:

- Toxic Substances Control Act (TSCA)
- Resource Conservation and Recovery Act (RCRA)
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- Clean Air Act (CAA)
- Clean Water Act (CWA)
- Safe Drinking Water Act (SDWA)
- Emergency Planning and Community Right to Know Act (EPCRA)

The Clean Water Act eliminates and prohibits the discharge of pollutants into surface waters and is the primary federal law in the United States governing water pollution. The goal of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 U.S.C §1251(a)). In order to achieve this goal the CWA focuses on eliminating releases of water containing high amounts of toxic substances that contributes to water pollution. Under the CWA, water bodies that are polluted are referred to as "impaired." The "impairment" label is based on the intended use of the water body and is determined by Total Maximum Daily Loads (TMDL), which sets the limit on the maximum amount of pollution that a water body can receive. The water bodies that are designated for recreation purposes (water skiing and swimming) have a different set of water quality standards, TMDL, than a water body designated as a drinking water source. The principal body of law currently in effect is based on the Federal Water Pollution Control Amendments of 1972, which expanded and strengthened earlier legislation. Major amendments were enacted in the Clean Water Act of 1977 and the Water Quality Act of 1987. For more information regarding how New Mexico manages the CWA, please visit the Surface Water Quality Bureau web site at http://www.nmenv.state.nm.us/swqb/.

While the CWA protects water bodies, the Safe Drinking Water Act (SDWA) protects human health from contaminants in drinking water. The EPA sets the national standard for the quality of drinking water and oversees state and local water suppliers. The standards consist of a list of 87 constituents that are monitored in drinking water supplies, and water systems are obligated to treat its water source to meet the standards. The Maximum Concentration Limit (MCL) is the term used to define drinking water standards. The constituents typically present in the drinking water cannot exceed the stated MCL as defined by the SDWA. The SDWA applies to all public water utilities in the United States. There are currently more than 461,000 public water systems in the U.S.

There are many constituents which water is regulated and tested, under both the CWA and SDWA. Facilities permitted under the National Pollutant Discharge Elimination System (NPDES) in the U.S. are required to implement sampling programs to demonstrate and document their compliance with environmental regulations, including the CWA and SDWA. The 2009 New Mexico Envirothon Aquatics section will discuss three field measurement methods applicable to the CWA and SDWA and their purposes; turbidity, pH, and electrical conductance. For more information about the NPDES program please visit http://cfpub.epa.gov/npdes/.

Turbidity measures the scattering effect that suspended solids have on light: the higher the intensity of scattered light, the higher the turbidity. Primary contributors to turbidity include clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton, and microscopic organisms. In surface water, the clarity of a natural body of water is used routinely as an indicator of the condition and productivity of the aqueous system. In ground water, turbidity is commonly measured during well development and purging to indicate the extent to which particulates occur. Turbidity measurements reported for regulatory purposes require a true nephelometric measurement using turbidimeter instruments that meet U.S. Environmental Protection Agency specifications. Turbidity is measured in nephelometric turbidity units (NTU). Suspended matter or impurities that interfere with the clarity of the water cause turbidity. Potential impurities may include silt, clay, inorganic and organic matter, and soluble colored organic compounds. There are many concerns with turbidity and how it can impact the biodiversity of an aquatic ecosystem. An example of adverse impacts of high turbidity is the transport and availability of contaminants within suspended clay particles, such as fecal coliform bacteria.

Figure 1. Turbidimeter and accessories (from www.hach.com).

The typical means of expressing hydrogen ion concentration is as pH, which is defined as the negative logarithm of the hydrogen-ion concentration (pH = $-\log_{10} [H^+]$). The concentration range suitable for the existence of most biological life is quite narrow and critical usually falling within the range of pH 6-pH 9. A lower pH indicates a more acidic solution (increased H^+ concentration) while higher pH indicates a more basic solution (increased OH^- concentration). pH is unit-less and can be measured by multiple means including a pH meter and pH indicators.

Figure 2. pH meter with screen and instrument panel (from www.hach.com).

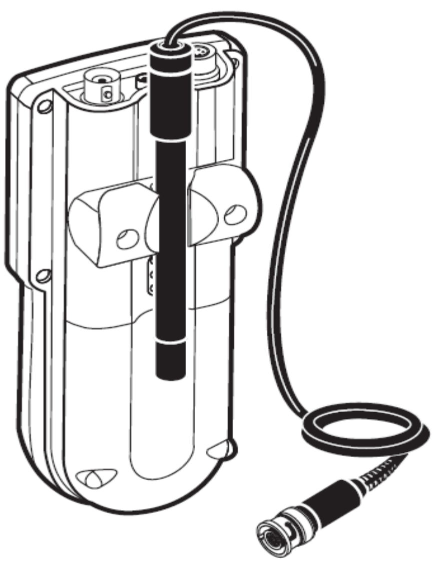

Figure 3. Back view of pH meter with electrode (from www.hach.com).

Electrical Conductance (EC) is a measure of the capacity of water (or other media such as soils) to conduct an electrical current. Electrical conductance of water is a function of the types and quantities of dissolved substances in water, but there is no universal linear relation between total dissolved substances and conductivity. EC sources include the underlying or surrounding geology, wastewater (point source pollution), septic system wastewater or leach-field water (nonpoint source), and other human activities including runoff from urban and agricultural areas. There are also several factors, which can impact EC which including watershed size and drainage characteristics. In SI units, EC is expressed as millisiemens per meter and in microomhos per centimeter in U.S. customary units.

Figure 4. Front view of Conductivity meter (from www.hach.com).

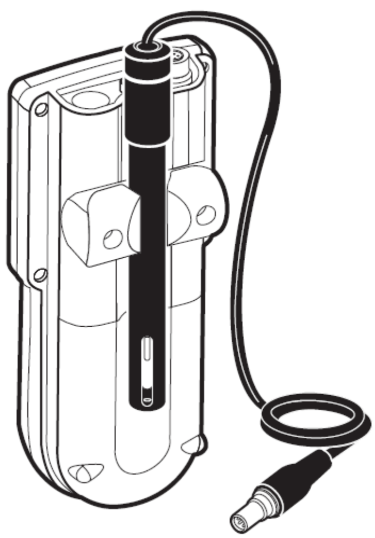

Figure 5. Back view of EC meter with electrode and cable (from www.hach.com).