PRETREATMENT CORNER

WET Test Impacts on Pretreatment Programs

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Whole effluent toxicity (WET) is defined as the aggregate toxic effect of an effluent measured directly by an aquatic toxicity test. Most municipal wastewater treatment facilities with a hydraulic design capacity of 1 MGD or greater are required to conduct a series of four whole effluent toxicity (WET) tests as part of the NPDES permit renewal process. The WET test requirement also applies to POTWs with approved pretreatment programs, POTWs required to develop a pretreatment program or other facilities as required by EPA or DEP based on consideration of the following factors: (1) variability of pollutants in effluent, which are based on chemical-specific information, type of treatment facility and types of industrial contributors to the treatment facility; (2) ratio of effluent flow to receiving stream flow; (3) existing controls on point and nonpoint sources, including TMDLs; (4) receiving stream characteristics, including known or potential water quality impairment, or a water designated as an outstanding natural resource; or (5) other considerations such as history of toxic impacts or compliance problems at the POTW that may cause or contribute to adverse water quality impacts.

In Pennsylvania, most POTWs are required to conduct either acute or chronic WET testing, depending on the mixing factor of the effluent to the receiving stream. The aquatic organisms typically used include the water flea (*Ceriodaphnia dubia*), the fathead minnow (*Pimephales promelas*) and green algae (*Selenastrum capricornutum*). Each of these organisms is monitored for growth, reproduction and/or survival.

The most difficult issue POTWs may face with WET testing is when a test failure occurs and there is no obvious answer why it failed. Concurrent testing for NPDES permit parameters and other pollutants conducted on same day samples collected for WET testing may show no variations. Reviews of operator logs reveal no unusual conditions in the treatment plant. No out of the ordinary weather conditions existed on the days of sampling. Review of industrial user sampling data for the same time period appears normal. What is causing the toxicity?

Artificial toxicity may occur when sampling equipment is not routinely cleaned. Microorganisms may colonize on surfaces that are in contact with the effluent. Some of these microorganisms may produce endotoxins that are toxic to water fleas or fathead minnows. Some effluent samples may contain indigenous organisms that may attack or be confused with the test organisms. Breakdowns in the treatment process may also allow household and organic chemicals to enter the effluent discharge at toxic levels. In some cases, the toxicants or cause of toxicity can be found occurring naturally within the environment. It may be the concentration or synergistic effect that makes these factors exceed the tolerance of the test organisms.

Ion imbalance may cause toxicity. The most crucial ions are Bromide, Calcium, Chloride, Magnesium, Potassium, Sodium and Sulfate. Total dissolved solids are a good indicator of ion concentrations. If TDS concentrations are greater than 1,340 mg/L, toxicity due to ion imbalance is likely. It has also been shown that low ionic concentration, such as effluents that contain primarily well water, may also result in toxicity.

There are many variables in the test protocol that could alter final WET test results. Test acceptability criteria for each aquatic organism have been established in EPA WET guidance and must be followed to validate the final reported results. Exceedances of either the upper or lower control limit after establishment of the control chart should prompt a review of the culture and test systems, as they may cause effluent tests completed during the month(s) of the exceedances to be questioned. The quality of the dilution water used for WET testing or culturing must be sufficient to allow for satisfactory survival, growth and reproduction of the test species as demonstrated by routine reference tests and negative control performance. Concentration-response curves must be presented in the WET report by the analytical laboratory. Atypical curves may indicate anomalies with test organisms or other test protocol has occurred, with the end result being reported as a failure.

Ongoing research has demonstrated that biological interference can produce a false-positive indication of toxicity in the WET test procedure. A method is available to identify and possibly unmask a true toxic effect by comparing the concentration responses of concurrently collected untreated and UV treated water samples. The Water Environment Research Foundation (WERF) also has a few ongoing studies on WET testing and its anomalies.

If, as a pretreatment coordinator, you are investigating potential areas of toxicity, and have conducted full priority pollutant scans of the discharges from industrial contributors, the ECOTOX database, established by EPA, may be helpful. ECOTOX is found at: http://cfpub.epa.gov/ecotox/. If the toxicity cannot be determined through some basic means, DEP will most likely require that a Toxicity Reduction Evaluation/Toxicity Identification Evaluation be (TRE/TIE) be conducted, and thus the expense increases.