

Using Risk-Based Analysis to Assess the Adequacy of Proposed Benchmarks

Individual Permit Reasonable Potential Analysis

For an individual NPDES permit, water quality based numeric effluent limitations typically are based on a reasonable potential analysis. This analysis takes into account potential dilution, variability of the effluent pollutant concentration, ratio of dissolved to total metals (translator values), and the background concentration of the pollutant and other receiving water characteristics such as pH and temperature. These site-specific variables can be plugged into a model to compare pollutant concentrations in a discharge with the physical and chemical properties of the receiving water to determine compliance with the numeric surface water quality criteria. This process, formally defined by USEPA (EPA 1991), is known as a reasonable potential determination. A positive determination of reasonable potential for an individual discharger results in an effluent limit in the permit.

General Permit Reasonable Potential Analysis

For the industrial stormwater general permit, such site specific analysis is not possible because the over one thousand facilities covered have a very wide range of stormwater discharge and receiving water characteristics. The many variables that affect the impact of stormwater on receiving water quality require permit writers to perform a generalized assessment of proposed target values to deal with uncertainty and predict the potential impact of a discharge on the environment. One method of predicting the adequacy of a target value (benchmark, action level, limit, etc) to protect water quality criteria in the receiving water is a Monte Carlo simulation.

Monte Carlo Simulation to Predict Potential Violations of Water Quality Criteria

To make a generalized assessment of proposed permit targets, and their probability to protect water quality, Ecology proposes to utilize a Monte Carlo simulation in the same fashion used in Herrera's "6415 Report" on the Industrial Stormwater Permit. Herrera's analysis used simple dilution models to evaluate the potential for exceeding numeric criteria given the following model inputs:

- Representative receiving water data for eastern and western Washington,
 - Receiving water background concentrations,
 - Translator values for estimating dissolved metals concentrations from total metals concentrations, and
 - Hardness dependant numeric criteria for metals
- Representative dilution factors (1, 2, 5, 10, 25, and 50), and
- Proposed permit targets for metals (zinc, copper, and lead).

To provide some basis for assessing uncertainty in this analysis, the Monte Carlo simulation was employed to determine the probability of exceeding the numeric criteria based on the receiving water conditions with the highest potential for occurrence. The analysis utilized an equation to predict theoretical receiving water concentrations for total zinc, total copper, and total lead at the facilities point of discharge, assuming effluent concentrations equal to the proposed benchmark and action levels. The data analysis produced summary tables to indicate the percent probability that the water quality criterion will be exceeded with effluent pollutant concentration equal to the benchmark or action level, given a range of dilution factors.

It becomes a policy issue to determine what level of risk is appropriate in a general permit scenario. For example, a benchmark with a 10% probability of violating the applicable numeric water quality criteria would probably be considered acceptable for most people; this implies that 90% of the time, the benchmark would be protective of water quality criteria.

In the 6415 Study of the ISWGP, Herrera's analysis indicated that, if an appropriate amount of dilution was available, the proposed targets in an earlier (2007) version of the draft permit would have been protective.

Ecology Proposes to Perform Analysis on New Proposal

Ecology proposes to hire Herrera to re-run the Monte Carlo simulation on the proposed targets in the draft ISWGP to determine if the concentrations are set with an acceptably low level of risk of violating water quality criteria, when an appropriate amount of dilution is available in the receiving water (e.g., a target concentration that corresponds to a <10% probability of violating WQ criteria, if at least 10:1 dilution was present). The analysis will distinguish between eastern and western Washington receiving water characteristics, which will leave open the possibility of the draft permit having different target concentrations for different sides of the Cascade Range.

Herrera's analysis is expected to begin in mid-November, and should take less than one month.

References

- EnviroVision and Herrera. 2006. Evaluation of Washington's Industrial Stormwater General Permit. Prepared for the Washington State Department of Ecology by EnviroVision and Herrera Environmental Consultants, Inc., Seattle, Washington.
- U. S. Environmental Protection Agency, Office of Water. 1991. *Technical Support Document for Water Quality-based Toxics Control*. EPA/505/2-90-001.