Fact Sheet

Reporting Biochemical Oxygen Demand Results

State of Oregon
Department of Environmental Quality

Water Quality Division
Permitting Program
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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

Summary

This document contains information on reporting Biochemical Oxygen Demand test results to DEQ.

Biochemical Oxygen Demand

BOD is an empirical measurement of the amount of biologically available organic material in water. The method consists of filling airtight bottles with varying sample dilutions seeded with bacteria, and measuring the dissolved oxygen (DO) concentration before and after a 5-day incubation period in the dark at 20º C. BOD is the difference between the initial and final DO. Details of the BOD test are in Standard Methods 5210 B.

BOD test apparatus

Quality Control Checks

Standard Methods (5210 B.6) lists four quality control checks, and the acceptance criteria for each.

a. **Minimum residual DO and minimum DO depletion:** The BOD procedure requires at least three dilutions be tested such that each are estimated to result in a DO depletion of at least 2.0 mg/L and a residual DO of at least 1.0 mg/L. At the conclusion of the test, at least one of the dilutions must meet these criteria for the test to be valid. When historical sample data are not available, the procedure recommends testing more than three sample dilutions to increase the probability that at least one will meet the depletion and residual criteria.
b. **Glucose-glutamic acid check :** Perform the GGA check to establish the test's accuracy and precision, and to measure the quality of the seed and test setup.
c. **Dilution-water quality check:** Perform this check to ensure the unseeded dilution water is of sufficient quality, and to ensure the cleanliness of incubation bottles and other materials used in the process.
d. **Seed control:** Seed controls are needed to ensure quality of the seed source, and to measure the BOD of the seed itself. For samples that are seeded, results are corrected for BOD attributable to the seed.

Data analysis and reporting

Standard Methods (5210 B.7) contains data analysis and reporting procedures.

The reported BOD is the average from all valid dilutions. If none of the dilutions result in at least 2.0 mg/L depletion, the reported BOD is a "<" value based on the least diluted sample (preferably 100%). Conversely, if none of the dilutions contain at least 1.0 mg/L residual DO at the end of the test, the reported BOD is a ">" value based on the most diluted sample.

Reporting calculated statistics

DEQ permits state that if quality control checks do not meet acceptance criteria, the results must be reported, but not used in calculations, such as monthly average and mass loading.[1] This condition does not apply to the minimum DO residual and DO depletion QC checks. Instead, the values are used in the calculations and the statistics are reported with the "<" or ">" data qualifiers as appropriate.

Example 1: None of the effluent bottles met the residual DO criteria of at least 1.0 mg/L. The least diluted sample has a BOD of >30 mg/L. The effluent flow on that day was 0.15 mgd. Three other weekly BOD tests for the month had BOD of 18, 12, and 10. All other QC checks are met.

- Maximum weekly average BOD concentration is ">30 mg/L"
- Monthly average BOD concentration is ">17.5" [(30+18+12+10)/4]
- Daily maximum mass load is ">37.5 lbs/d"

Example 2: Three effluent bottles meet the minimum DO residual and DO depletion. The BOD for each bottle is 10, 12 and 5 mg/L. The

[1] When acceptance criteria for GGA, dilution water, and/or seed control are not met, report the result as an estimated value (data qualifier "E"), and include information about the QC check that failed.
DEQ permits require the permittee to resample when possible. To allow time for a resample in the event of a QC check failure, DEQ recommends monitoring as early as possible in the monitoring period.

GGA was 161 mg/L, which fails negatively biased. All other QC checks are met.

- The BOD concentration is “E9 mg/L”. (Report the “E” on the daily data sheet only.)
- Report the GGA failure as negatively biased and include the steps taken to correct.
- Do not use the estimated value for calculating statistics, including mass calculations.
- Note that the large difference between dilutions [(5-12)/12 = 58%] indicates a potential analytical problem.

Questions?

Call your DEQ contact or one of the following regional offices:

Bend	541-388-6146
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