Assessment of data when Both Discrete and Continuous Data are Available

Delaware

Assessments of Average DO Criteria Attainment:

If sampling events occurred on at least ten different days during the assessment period for each station, attainment of the DO average criteria will be assessed using the method that follows. Stations with fewer than ten different sampling days will be considered to have insufficient data and be placed in Category 3 for this assessment cycle. Stations where monitoring has been discontinued that have data from fewer than 10 days will not be considered for further evaluation.

For purposes of DO compliance with the daily average criteria in a segment, continuous monitoring data, if available, will be averaged on a daily basis for each station. If no continuous data is available, then the field measurements (as available) will be considered to be representative of the daily average for that day. Any type of sample (continuous or field measurement) will be considered to be representative for that station at the time of collection. Once the daily average for each station (station daily average, SDA) has been determined, the SDAs for each station will be pooled and the upper confidence limit (UCL) of the nonparametric 10th percentile confidence interval will be determined using methods described in Section 3.7 of Helsel and Hirsch . That UCL will be compared to the applicable standard. If the UCL is above the applicable average criteria for all stations in a segment, the segment will be considered to be fully supporting (Category 1) for the DO average portion of ALUS. If the UCL from any station in a segment is below the applicable average, the segment will be considered not fully supportive of the aquatic life use (Category 5)

Formally stated, the following hypotheses will be tested:

H0: at the 90% Confidence level, X10 ≥ Standard

H1: at the 90% Confidence level, X10 < Standard

Where X10=Non parametric estimate of the 10th percentile of available data.

Assessments of Minimum DO Criteria Attainment:

Attainment of the minimum DO criteria will be assessed based on all available data (note that ten samples in 5 years are not needed for the comparison to the minimum). For stations for which no continuous DO monitoring data are available, two or more SDAs in five years below the applicable minimum will be sufficient evidence to show that the aquatic life use is not supported (Category 5).

For stations with continuous monitoring data, available continuous monitoring data will be pooled on an annual basis for each station. The UCL of the first percentile of the data will be calculated and compared to the minimum criteria in the same manner as the average comparison above for each year of the applicable five previous years. One or more years in which the upper confidence limit of the first percentile is below the minimum will be sufficient to determine that aquatic life use is not fully supported in the segment (Category 5). See the flow chart below for a graphical depiction of the dissolved oxygen assessment process.

Louisiana

In the event that analysis of routine ambient monitoring data for dissolved oxygen results in partial- or non-support, continuous monitoring (CM) data, where available, was used for follow-up assessment. CM data runs were approximately 48-72 hours in duration. CM data was evaluated as follows: All of the 15-minute interval dissolved oxygen observations from a CM sample run were analyzed to determine if more than 10% of the data points were below minimum criteria. Water bodies that fell below the criteria greater than 10% of the time were reported as IRC 5 (see table 3) and, therefore, are on the §303(d) list. Water bodies that fell below the criteria less than or equal to 10% of the time were placed in IRC 1, fully supported. If ambient monitoring indicated impairment and CM data was not available for analysis, the water body was placed in IRC 5 until such time as CM data can be collected during the critical season of May 1 through October 31.

New Hampshire

Continuous dataloggers in all waterbody types;: a. The preferred method of determining compliance is through the use of continuous dataloggers. b. Preferred data/conditions for assessing DO: 1)Compliance with instantaneous minimum DO concentration (mg/L) criteria shall be based on the minimum of a time series of dissolved oxygen measurements taken at the same location and a maximum of one hour apart for 24 continuous hours except as noted in 5, 6, and 7 below. High frequency datasonde measurements generally provide the most accurate and representative data. 2)Compliance with average daily DO percent saturation criteria shall be based on the time weighted average of DO measurements taken at the same location and a maximum of one hour apart for 24 continuous hours except as noted in Note 5, 6, and 7 below. 3)Time series datasets shall generally be considered complete if there are reading covering 75% of a day. 4)Lakes, Ponds, and Impoundment samples shall follow the depth and stratification considerations of Note 5 below. 5)Exceedances of the Magnitude of Exceedance (MAGEX) Threshold for DO are defined as: Class A: DO < 5.5 mg/L or < 4.5 mg/L or

Discrete sample DO assessment thresholds to approximate continuous data collection methods for Lakes, Ponds, and Impoundments shall be as below;

Use Support	DO Class A (all time periods)	DO Class B (all time periods)	DO Any Class (Cold Water Spawning Period)
FS	≥ 7 mg/L and ≥ 85% saturation	≥ 6 mg/L and ≥ 85% saturation	≥ 9 mg/L and ≥ 85% saturation
Insufficient Information	≥ 6 mg/L but < 7 mg/L and/or ≥ 75% saturation but < 85% saturation	≥ 5 mg/L but < 6 mg/L and/or ≥ 75% saturation but < 85% saturation	≥ 9 mg/L but < 8 mg/L and/or ≥ 75% saturation but < 85% saturation
NS	< 6 mg/L or < 75% saturation	< 5 mg/L or < 75% saturation	< 8 mg/L or < 75% saturation

Rivers and Streams considerations for assessing DO with discrete (a.k.a. instantaneous or grab) samples: a. If preferred data is not available (see Note 4), rivers and streams may be assessed for compliance with the instantaneous minimum DO concentration (mg/L) criterion as well as the MAGEX threshold based on grab sample taken between 05:00 and 08:00. Exceedences shall be per Note 3 and MAGEXs per Note 4.b.d. b. If preferred data is not available (see Note 4), rivers and streams may be assessed for compliance with the 75% average daily saturation DO criterion based on a grab samples as shown below as an approximation of continuous data collection methods, provided that samples are taken within the specified times shown below (Source: NHDES, 2003g)

New Mexico

2.1.3 … Because of the limitations of grab data and the increasing availability of sonde and thermograph data, assessments using sonde and thermograph data are preferred. … Starting with the 2010 listing cycle, the temperature protocol covers all temperature assessment scenarios, including procedures for both instantaneous grab and thermograph data for all types of aquatic life uses in either lotic (e.g., streams or rivers) or lentic (e.g., lake or reservoir) water bodies (see Appendix B). … Based on the success of the thermographbased assessment protocol, additional large dataset assessment protocols were developed to address parameters with known diurnal fluxes, namely dissolved oxygen and pH (Appendices E and F, respectively). Starting with the 2012 listing cycle, these protocols cover all assessment scenarios, including procedures for both instantaneous grab and sonde data for all types of aquatic life uses in either lotic (e.g., streams or rivers) or lentic (e.g., lake or reservoir) water bodies.

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•Instantaneous (grab) DO data			
A) Rivers or streams	**A)** Not assessable (cannot determine Fully Supporting with grab data only)	**A)** DO criteria excursions* in ≥ 10% of measurements, or 2 or more measurements if 10 or fewer data points are available.	**A)** DO listings based on grab data will be noted as Category 5C (need sonde data to confirm).
B) Lakes or reservoirs	**B)** No DO criteria excursions^	**B)** 1 or more DO criteria excursions^	**B)** See 20.6.4.14.C(3) NMAC for additional information regarding lake sampling^.
•Continuously recorded DO data (≥72 hours, ≤one hour frequency interval)	DO criteria excursion(s)* for less than four consecutive hours.	DO criteria excursions* for four or more consecutive hours.	If an AU is determined to be impaired for both excessive nutrients and DO following respective assessment protocols, the AU will be listed for the causal variable (nutrients) rather than the response variable (DO).

NOTES:

^ Lakes are typically sampled once in the spring and fall, and twice in the summer. DO measurements taken at intervals are averaged for the epilimnion, or in the absence of an epilimnion, for the upper one-third of the water column of the lake to determine attainment of DO criteria.

* Listing based on data points when concurrently-measured percent saturation was greater than or equal to 90% will be further examined to determine the site-specific reason for the high percent saturation.

Virginia

For dissolved oxygen, the instantaneous minimum standard is used to assess exceedences unless continuous monitoring data are available to assess the daily average. See Section 5.12 for assessment methodology for continuous monitoring. Dissolved oxygen in the Chesapeake Bay and its tributaries is assessed according to the method outlined in Section 5.3.

5.12 Continuous Monitoring Assessment Methodology

…Although these are significant benefits of continuous monitoring, the large datasets generated by such monitoring can be a challenge for assessment. It is considered appropriate to apply a 10.5% rule to grab sample datasets, which tend to be relatively small, but applying that rule to a continuous monitoring dataset, which can contain as many as tens of thousands of observations, could result in a water being assessed as attaining the standard for a parameter that it may be actually impaired for. Thus, using continuous monitoring data for listing and delisting waters requires caution and thoughtfulness. The following rules were crafted with this in mind:

Rule 1

A continuous monitoring dataset that is eligible for assessment must cover at least thirty 24-hour periods (with the exception of data being assessed for maximum temperature violations, which must cover at least fifteen 24-hour periods). This allows for an informative characterization of a water during the critical period (May to September) when violations of conventional field parameters are most expected.

Rule 2

The continuous monitoring dataset will have undergone rigorous and standardized QA/QC screening before analysis. Every 24-hour period with at least 75% of its observations deemed as valid should be assessed and counted as a single sample. Grab samples must be collected during the run that a continuous monitor is deployed.

Rule 3

Daily averages are the mean of all valid observations (including grab samples from the same station) collected during a 24-hour period. A violating DO daily average is defined as a mean calculated from all valid data collected during a 24-hour period that is below the appropriate daily average criterion for a given water. To count two violating daily means as separate violations, they must not be contained within the same four-day interval. This is consistent with 4-day experimental tests conducted by USEPA during the development of chronic DO criteria.

Rule 4

A 24-hour period violates minimum and maximum criteria when > 10.5% of its observations violate the criteria. Any two such days, even if consecutive, would count as two separate violations. Water temperature should be evaluated for violating increases as described in Section 9VAC25-260-60 of the Water Quality Standards. The “natural temperature” for a site should be determined upstream from a point-source discharge prior to assessment. Violations recorded during the continuous monitoring run should be combined with grab samples within the assessment data window. A 10.5% rule should then be applied to the combined data set.

Rule 5

For water temperature standards specifying a maximum hourly change (9VAC25-260-70), a 10.5% rule should be applied to the total number of monitored hours where data meet QA/QC

(including hours of the first and last days of deployment.) An additional continuous monitoring dataset, collected during a subsequent year, during the same month(s) as the listing dataset, must be used to delist it.
Rule 6
If a continuous monitoring dataset is used to list a water on the 303(d) Impaired Waters List, then an additional continuous monitoring dataset, collected during a subsequent year, during the same month(s) as the listing dataset, must be used to delist it. A water that was previously listed using grab samples may be delisted using continuous monitoring data collected for at least 30 days, during a subsequent year and during the same month(s) when violations were previously found.

Washington
Assessment Information and Specific Data Requirements
The assessment of dissolved oxygen data are based on either continuous monitoring data or single sample event (grab sample) data. Continuous monitoring is preferred, as it provides a better representation of the waterbody condition throughout the day since ambient dissolved oxygen concentrations typically exhibit a diurnal cycle. Continuous monitoring can better determine the lowest daily dissolved oxygen concentration in a water body. However, until improved technology leads to easy and cost effective continuous dissolved oxygen measurements, Ecology recognizes that most dissolved oxygen monitoring is performed as single sample events. Data sample values collected infrequently or less frequently than one sample value per hour will be considered "single sample data." Data sets that include at least one sample value per hour will be considered continuous monitoring.

When continuous monitoring data (sampling intervals of 30 minutes or less) are available, Ecology will assess the seven-day average of daily maximum (7-DADMax) temperature measurements.

Wisconsin
Minimum DO Data: 3 days of continuous measurements (no less than 1 sample per hour) in July or August collected from each of 2 separate calendar years.

Temperature Data: 10 discrete daily values[25] or days of continuous temperature data collected within a given calendar month to assess against acute and sub-lethal criteria, respectively.