

Biochemical Oxygen Demand (BOD and cBOD) Checklist * REV. 11/17/23

Based on NR 149 (2021), NR 219 (2022), and Standard Methods 5210 B (2001 and 2016)

Some questions may not be applicable to every lab. If applicable, all answers must be "yes" to be in compliance.

***This checklist was created for the aid of registered laboratories. It is only an internal audit guideline; it is not meant to be comprehensive of all regulatory requirements, to dictate DNR audit format, or to include all acceptable method options. Laboratories must comply with all applicable code and method requirements whether listed on this checklist or not. Additional general NR 149 requirements are on a separate checklist.**

	Sample Storage and Handling	Y	N	Notes	Reference
1	If analysis is not started immediately (within 15 minutes of collection), are BOD samples stored at $\leq 6^{\circ}\text{C}$ (but above its freezing point) prior to analysis?				NR 219 Table F; NR 149.442 (4)(b)
2	Are samples checked for residual chlorine if the sample has been subjected to chlorination?				SM 5210 B (4)(b)(2)
3	If the sample was chlorinated, is residual chlorine checked with strips or another method that can detect down to 0.1 mg/L?				NR 149.50 (1)(m)
4	If residual chlorine is found, is the sample treated with sodium sulfite, and after treatment, is the sample rechecked for residual chlorine?				SM 5210 B (4)(b)(2)
5	Is the pH of all samples checked prior to set up?				SM 5210 B (4)(b)(1)
6	If the sample pH is not 6.0 - 8.5, is the sample pH adjusted to pH 6.5 - 7.5?				SM 5210 B (4)(b)(1)
7	If pH adjustment is done, is the amount of acid or base used limited to $\leq 0.5\%$ of the sample volume?				SM 5210 B (4)(b)(1)
8	If a pH meter is used to measure the pH (instead of pH strips), is it calibrated daily?				NR 149.44 (3)(c)
9	Are samples analyzed within the hold time of 48 hours?				NR 219 Table F

	Reagents and Standards	Y	N	Notes	Reference
10	If any reagent (e.g., nutrients, inhibitor, GGA) is prepared in the lab, is it made according to the instructions in the method?				SM 5210 B (3)
11	Is the dilution water made by adding 1 mL/L of each nutrient or by adding the appropriate size nutrient pillow?				SM 5210 B (5)(a)
12	What is the seed source? _____	NA	NA		SM 5210 B (4)(d)
13	If using a commercial seed, is it prepared as indicated by the manufacturer's preparation instructions?				SM 5210 B (4)(d) - 2016
14	Does the seed not have nitrogenous demand inhibitor (like Polyseed NX [®])?				NR 149.50 (1)(h)
15	Are reagents and standards unexpired?				NR 149.39 (3)(d)
16	Are reagents properly labeled (with chemical name, concentration, and expiration date)?				NR 149.39 (3)(a)

	Equipment	Y	N	Notes	Reference
17	When pipettes are used for samples, are they wide-bore or wide-tipped?				SM 5210 B (5)(c)(1), (5)(c)(2); NR 149.50 (1)(e)
18	Does the incubator maintain samples at $20 \pm 1^{\circ}\text{C}$ during the 5 day incubation period?				SM 5210 B (2)(b), (5)(h)

19	Is the barometer reading checked against an external source at least annually?				NR 149.44 (3)(d)(1)
20	Is the local elevation pressure used for the theoretical saturation point?				NR 149.50 (1)(L)
21	Is all maintenance for the BOD meter/probe performed as needed?				NR 149.44 (2)(a)

	Calibration and Sample Measurement	Y	N	Notes	Reference
22	Is the DO meter calibrated on each day it's used?				NR 149.50 (1)(k)
23	Is the calibration verified by comparing the meter calibration value to the theoretical saturation point?				NR 149.50 (1)(b)
24	Is the calibration performed the same each time (e.g., warm-up time, amount of water in the bottle, dab the tip or shake so no water on it, etc.)?				SM 5210 B (5)(g); SM 4500-O G, H; Manufacturer's Owner's Manual
25	Are samples warmed to 20 ± 3°C just before analysis?				SM 5210 B (5)(b)
26	Are samples properly homogenized before adding to the BOD bottles?				SM 5210 B (5)(c)
27	For sample dilutions greater than 1:100 (or 1:300 if referencing SM 5210 - 2016), is a preliminary dilution done?				SM 5210 B (5)(c)(1)
28	Is 300 mL of sample used, or are enough sample dilutions run to achieve depletion of 2 mg/L for at least one dilution?				NR 149.50 (1)(i)
29	Are sample volumes adjusted so that depletion criteria are met in at least one dilution? (<i>depletion of at least 2 mg/L DO & remainder of at least 1 mg/L DO</i>)				SM 5210 B (5)(c); NR 149.50 (1)(i)
30	Are disinfected (e.g., UV, chlorine) samples, pH adjusted samples, untreated industrial waste, and inhibited (cBOD) samples seeded?				SM 5210 B (4)(b)(1), (5)(e); NR 149.50 (1)(g)
31	For sample volumes > 201 mL, are additional nutrients (0.30 mL/300-mL bottle) added?				SM 5210 B (5)(c)(2)
32	If nitrification inhibitor is used on compliance samples, does the lab have accreditation for cBOD?				NR 149.13
33	Is the initial DO measured within 30 minutes of adding the nutrients?				SM 5210 B (5)(g)
34	Are samples with an initial DO more than a few tenths greater than the theoretical DO saturation value (based on temperature and pressure) identified and treated for supersaturation?				SM 5210 B (4)(b)(4); NR 149.50 (1)(c), (1)(d)
35	Are sample bottles water-sealed prior to incubation?				SM 5210 B (5)(f)
36	Are samples incubated for 5 days ± 6 hours?				SM 5210 B (5)(i)
37	Are only samples and seed controls that meet criteria (depletion of at least 2 mg/L DO & remainder of at least 1 mg/L DO) used in the results, or are the results qualified?				SM 5210 B (5)(c), (6)(a), (6)(d)
38	Are seed correction factors properly calculated and used to adjust results of seeded samples?				SM 5210 B (6)(a), (6)(d)
39	Are only BOD dilutions that deplete at least 2.0 mg/L DO and have a remainder of at least 1.0 mg/L averaged for the BOD result?				SM 5210 B (6)(a), (6)(d), (7)(a), (7)(b)
40	If all dilutions fail depletion or residual criteria, are the results calculated correctly?				SM 5210 B (7)

41	If sliding BODs have been observed, have steps been taken to identify the source of the toxicity?				SM 5210 B (4)(b)(3)
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	Quality Control	Y	N	Notes	Reference
42	Are the BOD bottles rotated so that the QC are not always in the same bottle?				NR 149.48 (1)(a)
43	Is a dilution water blank (method blank) run with each batch of 20 samples?				SM 5210 B (6)(c); NR 149.48 (5)(b)
44	Are dilution water blanks less than or equal to 0.2 mg/L DO?				SM 5210 B (6)(c)
45	If more than one dilution water blank is analyzed, does each one pass?				NR 149.50 (1)(f)
46	Is a GGA standard analyzed once per week (if <20 samples are analyzed in a week) or once per batch (if >20 samples are analyzed in a week)?				NR 149.48 (6)(b)
47	Is the GGA standard prepared using a concentration that yields 3 mg/L glucose and 3 mg/L glutamic acid in the GGA test bottle (typically 6.0 mL per 300 mL bottle)?				SM 5210 B (6)(b)(1)
48	Are GGA results 198 ± 30.5 mg/L (or 167.5 - 228.5 mg/L)?				SM 5210 B (5)(d), (8)(a)
49	If more than one GGA is analyzed, does each one pass?				NR 149.50 (1)(f)
50	Does the seed control regularly meet depletion and residual criteria?				SM 5210 B (6)(a), (6)(d)
51	For cBOD, is an uninhibited blank and uninhibited GGA assessed?				NR 149.50 (1)(h)

	Reporting and Qualifiers	Y	N	Notes	Reference
52	If all dilutions fail criteria, are the results reported on the eDMR with the appropriate "<" or ">" value?				NR 149.47 (1)(a); WPDES Permit
53	Is the minimum reporting limit 2 mg/L?				NR 149.48 (4)(b)
54	Is the reporting limit adjusted based on the lowest dilution reported?				NR 149.48 (4)(b)
55	Are results qualified if samples were analyzed past hold time? (<i>within 48 hours</i>)				NR 219 Table F; NR 149.47 (4)(b)
56	Are results qualified if samples were analyzed in an incubator that was out of range? (19 - 21°C)				SM 5210 B (2)(b), (5)(h); NR 149.47 (5)
57	Are results qualified if the method blank fails? (>0.2 mg/L)				SM 5210 B (6)(c); NR 149.47 (5)
58	Are results qualified if the GGA is out of range? (167.5 - 228.5 mg/L)				SM 5210 B (6)(b); NR 149.47 (5)

	Documentation and Records - Are all of the following documented or recorded, if applicable?	Y	N	Notes	Reference
59	Sample collection date and time				NR 149.45
60	Sample storage temperature				NR 149.45
61	Analyst (for set up and read out)				NR 149.45
62	Analysis dates (for set up and read out)				NR 149.45
63	Analysis times (for set up and read out)				NR 149.45
64	Unique sample IDs				NR 149.442 (1)(d); NR 149.45

65	pH meter calibration				NR 149.45
66	Sample pH and adjusted sample pH				NR 149.45
67	Residual chlorine checks and treatment				NR 149.45
68	Sample temperature just prior to dilution				NR 149.45
69	Calibration temperature				NR 149.45
70	Calibration pressure				NR 149.45
71	DO meter calibration value				NR 149.45
72	Annual barometer verification				NR 149.45
73	Lot or lab ID of all nutrients				NR 149.45
74	Lot or lab ID of GGA				NR 149.45
75	Lot or lab ID of inhibitor				NR 149.45
76	Lot or lab ID of seed source				NR 149.45
77	Seed volume				NR 149.45
78	Sample volume				NR 149.45
79	Pre-dilution volumes				NR 149.45
80	No prefilled volumes				NR 149.45
81	Incubator temperature				NR 149.45
82	Units (e.g., mL, mg/L)				NR 149.45
83	Sequence of analysis is clear				NR 149.45
84	Identification of samples that were seeded				NR 149.45
85	Identification of samples that were inhibited				NR 149.45
86	Identification of dilution that had addition of extra nutrients				NR 149.45
87	Corrections made to data were done properly (crossed out with a single line; not scribbled out or overwritten)				NR 149.39 (1)(g), NR 149.45
88	Corrective actions taken (e.g., when temperatures are out of range, analyzed past hold time, GGA or method blank failures, etc.)				NR 149.38 (3), NR 149.45
89	DO meter/probe maintenance				NR 149.45

Other Observations					

WI DNR BOD Resources					
<u>DNR Website (which includes the resources below): Laboratory Certification Wisconsin DNR</u>					
Example BOD/cBOD SOP template					
Example BOD benchesheets (includes barometer verification log and oxygen saturation table)					
Example pH benchesheet					
Example thermometer annual verification log					
Example barometer verification log					

Example daily equipment temperature measurements log
Example auto-pipette quarterly verification log
Example equipment maintenance log
Example prepared and purchased chemical tracking logs
Example general corrective action log
Lab Accreditation Program staff - contact any staff with questions or concerns, especially if there are ongoing QC issues