

NC Wastewater Operator Certification

Biological Wastewater Needs-to-Know

Introduction for BOTH Grade 1 & 2

This document represents the minimum training standards required for an individual to qualify to take the NC Biological Wastewater Operator Grade 1 and 2 examinations.

The NTKs were approved by the Water Pollution Control System Operators Certification Commission (WPCSOCC) of the NC Operator Certification Program in the NC Department of Environmental Quality (NCDEQ).

All agencies and individuals conducting schools, courses, or classes for the purposes of meeting operator's training requirement for certification are required to follow this course standard and the Needs-To-Know (NTK) for each specific grade level to develop their curriculum and teaching outlines. We encourage each of the agencies and individuals teaching these courses to add to the standards, as you believe necessary to increase the learning of the operators.

Course Summary

Minimum Required Teaching Time:

Each Certification school provider will provide the minimum instruction of hours and can increase the training time as needed.

Course	Minimum Required Time
Grade 1	34 hours
Grade 2	38 hours
Grade 1 & 2 Combines Course	59 hours

Course Description:

This course is designed to provide the individual with general knowledge of the operation of wastewater treatment systems. The course will provide the individual with knowledge of the laws and regulations related to wastewater treatment systems operation, and equipment usually employed in such plants and the ability to describe the general maintenance requirements for

such plants. This course is designed to assist the individual in preparation for the North Carolina Water Pollution Control System Operators Certification Commission certification examination.

Reference Texts: (updated May 2026)

Many editions and other versions are available at online booksellers, NC One Water, . Originally this NTK used the Sacramento Manuals as a reference. The Water Environment Federation (WEF) also produces manuals that can be used as a reference. It is not required to purchase these reference texts. You may wish to talk to your instructor during class to determine if they will be useful study tools for you.

Grade 1:

- Available at Sacramento State Water program: <https://www.owp.csus.edu/> Operation of Wastewater Treatment Plants, Volume 1, 8th edition
- Previous versions of this Sacramento Manual include: Small Wastewater System Operation & Maintenance - Vol. 1
- Similar manual available at Water Environment Federation (WEF): Wastewater Treatment Fundamentals 1.
<https://www.wef.org/publications/publications/books/wastewater-treatment-fundamentals>

Grade 2:

- Available at Sacramento State Water program: <https://www.owp.csus.edu/> Operation of Wastewater Treatment Plants, Volume 2, 8th edition
- Previous versions of this Sacramento Manual include: Small Wastewater System Operation & Maintenance - Vol. 2
- Similar manual available at Water Environment Federation (WEF): Wastewater Treatment Fundamentals 2.
<https://www.wef.org/publications/publications/books/wastewater-treatment-fundamentals>

Grade 1 Minimum Required Hours per Certification School

Needs-To-Know Topic	Minimum Hours Required
A. Introduction to Wastewater	2.5
B. Wastewater Collection Systems	0.5
C. Grease Traps / Grease Interceptors	0.5
D. Pumps	1.0
E. Septic Tank / Sand Filters Systems	3.0
F. Preliminary Treatment	1.0
G. Wastewater Lagoons and Ponds	3.0
H. Constructed Wetlands	1.0
I. Introduction to Activated Sludge	3.0
J. Disinfection	1.5
K. Sampling & L Lab procedures	3.0
L. Lab procedures	(included above)
M. Required Technical Knowledge (math)	6.0
N. Applied Electricity	1.0
O. Instrumentation & Controls	1.0
P. Health & Safety	3.0
Q. Laws & Regulations	3.0
Total Time:	34.0

Grade 2 Minimum Required Hours per Certification School

Needs-To-Know Topic	Minimum Hours Required
A. Mechanical & Maintenance Operations	1.0
B. Preliminary Treatment	1.0
C. Sedimentation & Flotation	2.0
D. Attached Growth Systems	2.0
E. Activated Sludge	3.0
F. Sludge Digestion	3.0
G. Solids Handling & Disposal	2.0
H. Advanced Treatment	3.0
I. Disinfection	1.0
J. Instrumentation & Controls	2.0
K. Laboratory Procedures	3.0
L. Sampling	1.0
M. Laws & Regulations	3.0
N. Public Relations	0.5
O. Required Technical Knowledge (Math)	5.0
P. Industrial Pretreatment	0.5
Q. Biology	2.0
R. Health & Safety	3.0
Total Time:	38.0

Grade 1 & 2 Combined Course

Grade 1+2 Combined Minimum Required Hours per Certification School	
Needs-To-Know Topic	Minimum Hours Required
Introduction to Wastewater	2.5
Wastewater Collection Systems	2.0
Grease Traps / Grease Interceptors	0.5
Pumps	1.0
Preliminary Treatment	2.5
Wastewater Lagoons & Ponds	3.0
Constructed Wetlands	1.0
Septic Tank / Sand Filters Systems	3.0
Disinfection	2.5
Instrumentation & Controls	3.0
Applied Electricity	1.0
Introduction to Activated Sludge	3.0
Mechanical & Maintenance Operations	1.0
Sedimentation & Flotation	2.0
Attached Growth Systems	2.0
Activated Sludge	3.0
Sludge Digestion	2.0
Solids Handling & Disposal	2.0
Advanced Treatment	3.0
Laboratory Procedures	3.0
Laws & Regulations	3.0

Public Relations	0.5
Required Technical Knowledge (Math)	6.0
Industrial Pretreatment	1.0
Biology	2.0
Health & Safety	3.0
Total Time:	58.5

NC Water Pollution Control System Operator Certification Commission

Biological Wastewater Treatment Systems

Grade 2

Needs to Know

- 2019 –

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GRADE 2: NEEDS-TO-KNOW

A. Preliminary Treatment

1. Explain the operation of a comminutor.
2. Describe aerated grit removal units and their advantages and disadvantages.
3. Given the appropriate data, be able to calculate the velocity in a grit chamber.
4. Describe the control of velocity in a grit chamber through use of the following techniques:
 - A. Proportional weir (suro);
 - B. Parabolic weir;
 - C. Rectangular weir;
 - D. Parshall flume.
5. What is a typical velocity in a long channel grit chamber?
6. Explain the purpose of grit washing.
7. Describe the purpose and operation of a cyclone separator.
8. What are the typical amounts of grit removed from a wastewater influent?

B. Sedimentation and Flotation

1. Given drawings or diagrams, identify and describe the functions of the following components of clarifiers:
 - A. Circular clarifiers:
 - 1) Influent line
 - 2) Stilling well
 - 3) Skimmers
 - 4) Scum trough
 - 5) Scrapers
 - 6) Sump
 - 7) Sludge Withdrawal Pipe
 - 8) Drive unit
 - 9) Effluent trough
 - 10) Vacuum sludge removal equipment
 - B. Rectangular clarifiers:
 - 1) Influent line
 - 2) Target baffle
 - 3) Flights
 - 4) Scum trough
 - 5) Sump
 - 6) Sludge withdrawal pipe;
 - 7) Drive unit
 - 8) Effluent trough
 - 9) Chains
 - 10) Skimmers

2. Identify the importance of the following factors in the operation of sedimentation basins:
 - A. Sludge density
 - B. Frequency of sludge removal
 - C. Short circuiting
3. Describe typical design requirements for clarifier detention times and removal efficiencies.
4. In a conventional wastewater treatment plant receiving only domestic wastewater, what is the approximate reduction in suspended solids and BOD through a primary clarifier?
5. What is usually done with the sludge and scum collected in a primary clarifier?
6. What types of equipment overload devices should be employed in connection with sedimentation basins?
7. Explain things to look for in identifying mechanical malfunctions of clarifiers.
8. What are some of the factors that must be considered in operating primary and secondary clarifiers in order to obtain best results?
9. Describe the effects of wind and temperature on settling basins and settleability.
10. Why is a secondary clarifier needed after a trickling filter or an aeration basin?
11. Describe the effects of influent flow variations on the efficiency of sedimentation.
12. Describe the effects of a clarifier malfunction on other treatment units.
13. Define and be able to calculate the surface loading rates and weir overflow rates for clarifiers.
14. What are the recommended weir overflow rates for primary clarifiers?
15. What are the recommended weir overflow rates for secondary clarifiers?
16. What are the effects of the recirculation of return sludge from final settling tanks to aeration tanks on detention time, surface settling rate and weir overflow rate for final settling tanks?
17. What is the effect of returning secondary sludge to be settled again in the primary clarifier?

C. Biology

1. Explain the nitrogen cycle.
2. What is nitrification and under what conditions will it occur?
3. What is denitrification and under what conditions will it occur?
4. Differentiate between the following types of organisms and describe their significance in wastewater treatment:
 - A. Algae

- 1) Blue-green
- 2) Green
- B. Rotifers
- C. Nematodes
- D. Psychoda larvae
- E. Stalked ciliates
- F. Free-swimming ciliates
- G. Flagellates
- H. Filamentous
- I. Amoeboid
- J. Worms
- K. Tardigrades

D. Attached Growth Systems

Trickling Filters and Rotating Biological Contactors-RBCs

1. What is an attached growth system?
 - A. Trickling Filter
 - B. Rotating Biological Contactors (RBCs)
2. Describe how to stop a rotating distributor on a trickling filter.
3. Why should the flow be shut off before attempting to work on the filter?
4. Describe needs and methods used in cleaning and flushing the orifices in trickling filter distributor arms.
5. Describe the purpose of trickling filter underdrains.
6. Explain the differences between various types of distribution systems on trickling filters.
7. Describe the characteristics of different types of trickling filter media.
8. Explain the importance of ventilation in trickling filters and how proper ventilation is assured in their design and operation.
9. Draw a flow schematic for a typical standard rate trickling filter plant.
10. Given diagrams or drawings of trickling filters, identify all of the following major components and describe the purpose of each.
 - A. Dosing siphons
 - B. Different types of distribution device
 - C. Central column sealing devices
 - D. Bearing and bearing lubrication facilities
 - E. Influent pipe
 - F. Distributor base
 - G. Distributor arm
 - H. Stay rods

- I. Turnbuckles
 - J. Arm dump gates
 - K. Fixed nozzles
 - L. Splash plates
 - M. Ventilation ports
 - N. Tile underdrains
 - O. Media
11. Explain which tests would be run on a RBC and explain why it is necessary to run these tests on a RBC.
 12. How is oxygen supplied to the biological growth on the RBC media?
 13. Explain why the tanks holding the wastewater that the media drum rotates in are contoured to the general shape of the media drum.
 14. What are some of the reasons that RBC media drums are covered?
 15. What is the appearance of the biomass during normal operation? What is the appearance of the biomass during an organically overloaded condition?
 16. If the RBC unit experiences loss of electrical power for an extended period (more than 4 hours) what actions should be taken?

E. Activated Sludge

1. Explain the purpose of the following in diffused air aeration systems:
 - A. Blowers
 - B. Valves
 - C. Piping
 - D. Air flow meters
 - E. Air filters
 - F. Diffusers and diffuser systems
 - G. Provision for balancing and adjusting air flows
 - H. Lubrication
 - I. Air compressors
 - J. Turbines;
 - K. Pressure-relief valves
 - L. Timers
2. Identify factors that determine air requirements in an activated sludge aeration basin.
3. What happens to the air requirements in an activated sludge aeration basin when there is an increase or a decrease in the amount of mixed liquor suspended solids?
4. Describe and differentiate between diffused air and mechanical aeration systems.
5. Identify typical return sludge flow rates, expressed as percent of influent flow.
6. Explain typical causes and corrective actions for shock loads, pH changes, septic loads and irregular flow in aeration basin influents.
7. Identify the analyses that would be of greatest significance in evaluating conditions in the

activated sludge aeration basin.

8. Identify the purpose and importance of the following parameters in the operation of activated sludge systems.
 - A. 30-minute settleability
 - B. Dissolved oxygen (DO)
 - C. Mixed liquor suspended solids (MLSS)
 - D. Mixed liquor volatile suspended solids (MLVSS)
 - E. pH
 - F. Temperature
 - G. Nitrogen content
 - H. Phosphorus content
 - I. MCRT
 - J. F/M (food to microorganism) ratio
 - K. Sludge Volume Index (SVI)
 - L. Oxygen uptake rate
9. Identify the minimum dissolved oxygen (DO) required for an activated sludge process.
10. Identify proper safety procedures in connection with activated sludge.
11. Describe when and how excess activated sludge is wasted and the impact of inappropriate wasting.
12. Identify the following typical operational problems in activated sludge plants including causes, types of laboratory tests needed to confirm the problem and test results that would be associated with these problems. Also, explain reasonable steps for correcting each of the problems.
 - A. Sludge bulking
 - B. Rising sludge
 - C. Ash on top of clarifier
 - D. Over aeration
 - E. Filamentous growths
 - F. Toxic substances
 - G. Pin floc
 - H. Straggler floc
13. Explain how variations in flow rates cause problems in activated sludge plants.

14. Explain and differentiate between the following types of activated sludge processes.
 - A. Extended aeration
 - B. Conventional activated sludge
 - C. High-rate activated sludge
 - D. Describe the operation of a Sequential Batch Reactor (SBR) activated sludge system
 - E. Fixed/Film/Suspended Growth Systems
 - F. Kraus process
 - G. Step aeration
 - H. Complete mix
 - I. Modified aeration high rate activated sludge
 - J. Contact stabilization
15. What are nitrification and denitrification and how do they impact the operation of an activated sludge plant.
16. What effect might heavy metals or insecticides have on an activated sludge plant?
17. Why is food to microorganism (F/M) ratio based on mixed liquor volatile suspended solids instead of mixed liquor suspended solids?
18. Given appropriate data, be able to solve problems involving the following for activated sludge plants:
 - A. SVI
 - B. Mean cell residence time (MCRT)
 - C. Sludge wasting rates
 - D. Organic loading
 - E. F/M (food to microorganism)

F. Disinfection

Chlorination, Dechlorination and UV Disinfection

1. Identify and describe the function and basic components of hypochlorinators.
2. Describe procedures for the detection and correction of chlorine leaks.
3. How do you determine the proper feed rates of dechlorinating agents?
4. Explain the reactions which occur when chlorine is added to wastewater.
5. What are chloramines?
6. What chemicals are used for the dechlorination of chlorinated effluents?
7. Identify various uses for chlorine in wastewater treatment operations other than disinfection.
8. List the most commonly used methods of dechlorination.
9. In what way does the UV system disinfect the wastewater?
10. Why are ultraviolet systems considered a safer method of disinfection?

11. What is the most common method of generation of ultraviolet light?
12. What are the most common methods of exposing the wastewater to the UV light/radiation?
13. What are the safety concerns with the operation of an UV Disinfection System?
14. What can affect the efficiency of the UV system?
15. What are the most common maintenance tasks associated with UV systems?
16. What method is used for cleaning the quartz sleeves?
17. What method is used to dispose of burned out UV lamps?
18. Define ultraviolet light/radiation?
19. Identify and briefly describe the following factors which affect the disinfection efficiency when using chlorine:
 - A. Combined, total or free chlorine residuals
 - B. Contact time
 - C. Temperature
 - D. pH
 - E. Presence and types of organic matter
 - F. Number of pathogens
 - G. Reducing agents
 - H. Maintenance of contact basin
 - I. Maintenance of chlorine diffusers

G. Advanced Treatment Systems

1. What are the forms of nitrogen found in wastewater and why is it necessary to treat them?
2. What are the effects of nitrogen and phosphorus in the receiving waters?
3. Why is it sometimes necessary to remove phosphorous from municipal wastewaters?
4. How is phosphorous removed by conventional secondary (biological) wastewater treatment facilities?
5. Where in the treatment plant flow could chemical precipitants be added?
6. How is nitrogen removed or altered by conventional secondary or biological treatment?
7. What is a typical flow application rate in gallons per minute per square foot (gpm/ft²) for tertiary filters?
8. Define and describe a gravity mixed-media filter.
9. Describe the operation and maintenance strategy for a mixed-media filter and membrane filtration.
10. Describe common operational problems occurring with a gravity mixed-media filter.

11. List the advantages and disadvantages of deep-bed versus traveling-bridge tertiary filters.
12. Define coagulation and flocculation and describe how each relates to wastewater treatment.
13. Describe how the following chemicals are commonly used in wastewater treatment:
 - A. Aluminum Sulfate (dry and liquid);
 - B. Ferric chloride;
 - C. Lime;
 - D. Polymeric Flocculants (dry and liquid).
14. Describe why the use of metering equipment is important for a chemical feed system.
15. Define the steps for selecting a chemical feeder. What considerations must be made when a chemical feeder is selected?
16. Describe how to determine chemical dosage.
17. Describe the procedure for performing a jar test.
18. Define and describe a microscreen and an operational strategy for it.
19. What is filtration?

H. Solids Handling & Disposal

1. What is the difference in performance between sand and asphalt sludge drying beds?
2. Explain the purpose and advantage of sludge thickening or direct dewatering of the sludge before digestion.
3. Name some uses for dried sludge. What precautions should be observed in using dried sludge?
4. Describe the values of sludge as a soil conditioner and fertilizer.

I. Sludge Digestion

General:

1. Describe the sludge that is generated by wastewater treatment.
2. What is the purpose and objective of sludge digestion?
3. Explain the basic differences between aerobic and anaerobic digesters.
4. What is the proper disposal method for the supernatant from sludge digestion?
5. Why are digesters mixed?
 - A. Anaerobic
 - B. Aerobic

6. What maintenance steps are necessary for sludge pumps and pipelines?
7. Describe the purpose of supernatant withdrawal devices.
8. What causes coning in a digester?
9. Why are the following materials undesirable in an anaerobic digester?
 - A. Grit
 - B. Toxic materials
 - C. Grease
 - D. Plastic products
 - E. Industrial by products

Aerobic:

1. Define aerobic digestion.
2. Describe the safety measures associated with aerobic digesters.
3. Identify and explain the purpose of each of the following aerobic sludge digestion components:
 - A. Mixing:
 - 1) Mechanical
 - 2) Diffused air
 - B. Piping:
 - 3) Withdrawal
 - 4) Recirculation
 - 5) Addition
 - C. Supernatant withdrawal
4. What is the proper level of dissolved oxygen that should be maintained in an aerobic digester and why?
5. How many days are typically required for complete digestion?
6. Explain how aerobic digester foaming can be controlled.
7. List and explain some of the factors that determine the size and number of aerobic sludge digestion tanks?
8. What is the volatile content of properly digested aerobic sludge?
9. What is the normal percentage reduction of solids in an aerobic digester?

J. Mechanical & Maintenance Operations

1. Explain (define) each of the following:
 - A. Suction head (lift)
 - B. Friction head
 - C. Discharge head
 - D. Total pump capacity
 - E. Total dynamic head
 - F. Water horsepower
 - G. Brake horsepower
 - H. Motor horsepower
2. Explain the concept of pump and motor efficiencies. (The actual value is usually specified by the manufacturer.)
3. Describe how each of the following affect the capacity of a centrifugal pump:
 - A. Size of the suction and discharge ports
 - B. Speed
 - C. Total dynamic head
 - D. Wear on the impeller
4. Describe how each of the following affect shaft couplings:
 - A. Pump cycling
 - B. Shaft misalignment
 - C. Worn bearings
 - D. Lubrication
5. Describe how each of the following affect the performance of a centrifugal pump:
 - A. Temperature and viscosity of the liquid pumped
 - B. Specific gravity of the liquid pumped
6. Describe procedures which should be employed for inventory control in a wastewater treatment plant.
7. Explain the importance of the following factors in corrosion of waste collection and treatment systems:
 - A. Oxygen
 - B. Acidity
 - C. Carbon dioxide (CO₂)
 - D. pH
 - E. Temperature
 - F. Bacteria
 - G. Gaseous substances
 - H. Humidity
 - I. Galvanic action

K. Instrumentation & Controls

1. Why is an audible and visual alarm important with lift stations and other instrumentation systems?
2. What is telemetry and how would it be used in various wastewater systems.
3. Describe the following types of instruments and outline their applications in wastewater treatment plants:
 - A. Flow measurement and control
 - B. Pressure measurement and control
 - C. Temperature measurement and control
 - D. pH measurement and control
 - E. Chlorine measurement and control
 - F. Water level measurement and control
 - G. DO measurement and control
 - H. Turbidity meter
 - I. Intensity meter
 - J. Transmittance measurement
4. Distinguish between indicators, recorders and totalizers and indicate the purpose of each.
5. If a flow meter is not within 10% of the correct reading, what items should be checked as potential causes of the error?
6. What maintenance is required for water-level float controls?
7. What is the significance of the submergence in a Parshall flume?

L. Sampling

1. What is the purpose of sampling?
2. What are the differences between a grab and composite sample?
3. What are the objectives of routine process control and compliance sampling?
4. What field parameters are typically measured in the effluent and receiving waters?
5. Describe circumstances when grab and composite samples may be desirable.
6. Describe techniques and precautions necessary to collect representative samples of wastewater.
7. Explain the importance of the following in sampling:
 - A. Cleanliness of containers and measuring devices
 - B. Accuracy of records (labels, locations, time, data, type sample, weather, other information)
 - C. Refrigeration of samples

- D. Chemical preservation of samples
 - E. Chain-of-custody
8. Why is it necessary to note the physical characteristics of the sample and sample site?
 9. Why should the receiving waters be sampled above and below the discharge point?
 10. Identify locations in a treatment system where it would be appropriate to make various solids determinations.
 11. Describe how to solve problems to determine the volume that should be collected at each time interval to form a composite sample that is flow proportional.
 12. Define the following types of samples:
 - A. Grab
 - B. Flow proportional composite samples
 - C. Continuous composite samples
 - D. Timed composite samples
 13. What are the objectives of pre-plant and in-plant investigative monitoring and how do they determine the monitoring procedures that are to be implemented?
 14. Describe the factors which must be considered in establishing sampling frequency.
 15. List the different types of sample containers and the samples that have to be collected in each type.

M. Laboratory Procedures

1. Describe proper techniques for washing glassware and the importance of such.
2. Why should acid be added to water rather than the reverse?
3. Why should you always use a rubber bulb or other mechanical means to pipette wastewater and chemical solutions?
4. Describe the most common test for fecal coliform bacteria.
5. Distinguish between the total coliform and fecal coliform tests.
6. Name a specific chemical commonly used in a wastewater treatment plant laboratory which must be stored in each type of container and why each type of container is important.
 - A. Dark
 - B. Plastic
 - C. Glass
 - D. Vented containers
7. Define each of the following analyses and explain the significance of each analysis in wastewater treatment:
 - A. Chemical oxygen demand (COD)
 - B. Settleability, 30-minute
 - C. Oil and Grease
 - D. Percent moisture
 - E. Oxygen uptake rate
 - F. Biochemical oxygen demand (BOD)
 - G. TSS
 - H. Fecal coliform bacteria
 - I. Nitrogen
 - 1) Ammonia (NH₃)
 - 2) Total Kjeldahl (TKN)
 - 3) Nitrite (NO₂)
 - 4) Nitrate (NO₃)
 - 5) Phosphorus
 - J. Effluent
8. Discuss the procedures for performing an activated sludge settleability test.
9. Given appropriate laboratory data, explain how to calculate the BOD of a sample.
10. What is a standard solution and why? How is it used?
11. Describe the proper labeling of standard solutions and outline precautions for proper handling of these solutions.
12. Why should approved methods be used when performing wastewater analyses? Where are approved methods found?
13. What are interferences and how do they affect analytical results?

N. Required Technical Knowledge

1. Describe how to read and interpret pump curves, graphs, charts, data trend curves, tables and nomographs.
2. Given appropriate data, be able to calculate each of the following:
 - A. Sludge wasting rates
 - B. Surface settling rate
 - C. Weir overflow rate
 - D. Trickling filter hydraulic and organic loadings
 - E. Sludge age
 - F. MCRT
 - G. BOD (unseeded)
 - H. Horsepower (water)
 - I. Percent settleable solids
 - J. Sludge volume index (SVI)
 - K. Recirculation rates
 - L. Velocity and flows
 - M. Aeration basin volume and radius/diameter from given detention time and plant flow
 - N. F/M

O. Industrial Pretreatment

1. What is meant by the term Industrial Pretreatment?
2. What is the purpose of pretreatment of industrial wastes before disposal into a municipal system?
3. What is meant by SIC number?
4. What is meant by shock load and what constitutes a shock load?
5. What constituents may be in industrial wastes which might interfere with biological treatment?
6. What is meant by industrial wastewater?
7. Why is knowledge of industrial wastes important in the operation of municipal treatment systems?
8. Identify the characteristics of industrial wastewater, which may be especially important and/or harmful in municipal treatment plants.
9. Identify some of the potential effects of industrial wastewaters on streams which are different from effects of domestic wastewater effluent.

10. Identify some of the major problems, which may be encountered in the operation of municipal plants as the result of industrial wastewater discharges.

P. Laws & Regulations

REFERENCE: *North Carolina Administrative Code: Chapter 8
Water Pollution Control System Operators Certification Commission*

Certification Rules:

1. Identify the North Carolina governmental agency which has principal responsibility for water pollution control activities state-wide.

The Division of Water Resources (DWR) in the Department of Environmental Quality (DEQ)

2. Identify the federal agency which has primary responsibility for establishing policy and regulations concerning water pollution control nation-wide.

The United States Environmental Protection Agency (US EPA)

3. Describe the functions of the Water Pollution Control System Operators Certification Commission.

The Commission has two functions:

- A. Classification of water pollution control systems
- B. Certification of water pollution control system operators

4. Describe the current State regulatory procedure with respect to water pollution violations and identify penalties which can be imposed for those violations.

A civil penalty of not more than \$25,000 per day per violation may be assessed for any NPDES permit limit violation, or water quality standard violation, against the permit holder, or the operator, of a water pollution control system. In addition, a civil penalty, not to exceed \$10,000 per day per violation, may be levied for continuous water quality violations against the permit holder, or the operator, of a water pollution control system.

5. Describe the five basic NPDES monitoring parameters and state the significance of each in the regulatory control of wastewater:

- A. Flow - The basic unit of daily volume discharge
- B. BOD - The best indicator of wastewater strength
- C. Suspended solids - Readily determined measure of treatment efficiency
- D. pH - Critical factor in protecting aquatic life
- E. Fecal coliform - Indicator organism for determining pollution problems

6. Under what circumstances may a certified operator's certification be revoked, suspended, or a letter of reprimand be issued to the operator?

- A. The operator has practiced fraud or deception in the performance of his or her duties as a certified operator.
- B. Reasonable care, judgment, or the application of the operator's knowledge or ability were not used during the performance of his or her duties as a certified operator.

- C. The operator is incompetent or unable to properly perform his or her duties as a certified operator.
 - D. Failure to apply their knowledge or ability in the performance of their duties.
 - E. Intentionally supplying false information in order to obtain or maintain certification.
 - F. Cheating on a certification examination.
7. Distinguish between voluntary compliance and compulsory compliance.
- Compulsory compliance is mandated by conditions of the user's permit. Voluntary compliance is an agreement between users and regulatory agencies usually of a temporary nature.
8. What is the minimum frequency required for the calibration of flow meters and what is the acceptable percentage of correct reading?
- Annual calibration is required with a deviation of plus or minus 10%.
9. What is Public Law 92-500?
- PL 92-500 is the Federal Water Pollution Control Act (1970). It is now the Clean Water Act. The ultimate goal is to maintain water qualities such that all waters are fishable and swimmable.
10. Be familiar with the permit requirements for land application of sludge.
11. Be familiar with the laboratory certification requirements.
12. Be familiar with the industrial pretreatment program requirements.
13. What are the Code of Federal Regulations (CFR) 503 regulations?
14. What are the requirements for reporting a spill?
15. Understand all sections of NPDES permit.

Field Parameters Lab Rules:

1. What are the purposes of the Laboratory Certification rules?
 - A. To assure that consistent and method compliant data is being reported to North Carolina regulatory agencies.
 - B. To set certification criteria for laboratories performing any tests, analyses, measurements or monitoring required under G.S. 143 Article 21.
 - C. Establish fees for certification program support.
2. What are the ways to assure that technicians performing field parameter testing are performing the analysis properly?

By a thorough review of bench sheets used by the facility by both internal and external data reviewers. When all information regarding the test parameters have been properly listed it, provides assurance that all of the method requirements have been achieved and performed properly. A copy of each approved analytical method is required to be kept on site.
3. What 6 analytical parameters (field tests) are covered by field parameter certification?

- A. Specific Conductance (Conductivity)
- B. Dissolved Oxygen
- C. pH
- D. Settleable Residue
- E. Total Residual Chlorine
- F. Temperature

4. What is the NCLC program, and what does it do?

The North Carolina Laboratory Certification program is the group responsible for compliance and enforcement of laboratory certification regulations.

5. What is involved in proficiency testing, and how often must this type of performance evaluation be performed once the laboratory is certified?

Proficiency testing consist of obtaining a blind sample of “unknown” value for each of the parameters for which you are certified, these “unknown” samples are obtained from an accredited provider that supplies the actual value of the “unknown” sample to the NCLC program and the client. North Carolina uses the NIST (National Institute of Standards and Technology) vendors. The certified laboratory then performs analysis of the sample and reports the value to the NCLC program where it will be reviewed for accuracy. Each facility must analyze one passing performance evaluation sample per year for each method for which certification is obtained.

6. Which 2 of the 6 analytical parameters that are covered by field parameter certification do not have performance evaluation (PE) samples of “unknown” value that can be used for annual proficiency testing?

Dissolved Oxygen and Temperature blind samples are not available; performance evaluation results are currently not required for these.

7. How long must the data for each analysis from a field parameter sample be kept and what information is required for each sample analyzed?

Pertinent data for each analysis must be maintained for 5 years. Required information is

- Date and time sample collected
- Date and time of analysis
- Sample site
- Collector’s and analyst’s name
- Meter calibration record(s)
- True value and % recovery of all standards or buffers analyzed
- All data must be labeled with the proper units of measure

8. What is a bench sheet and what needs to be included on it?

A bench sheet is a printed sheet with spaces provided for information relative to the analysis being performed, it must contain

- Date and time sample collected
- Date and time of analysis

- Sample site
 - Collector's and analyst's name
 - Meter calibration record(s)
 - True value and % recovery of all standards or buffers analyzed
 - All data must be labeled with the proper units of measure
9. For each instrument used for field parameter readings, how are calibrations documented?
- A record of instrument calibration where applicable, must be filed in an orderly manner so as to be readily available for inspection upon request. It is recommended that calibration information is included on the same bench sheet as the daily data. Each facility must maintain a record of instrument calibration each analysis day. In cases such as residual chlorine and pH, where a calibration check standard is analyzed, the facility must document both the reading of the check standard as well as the applicable acceptance range.
10. What are some of the actions that can result in a laboratory being decertified?
- A. Failing to maintain the facilities, records, personnel, equipment or a quality control program.
 - B. Submitting inaccurate data or information
 - C. Failing to pay required fees by due date.
 - D. Failing to discontinue supplying data for clients or programs when a decertification is in effect.
 - E. Failing to provide a split sample to the state when requested.
 - F. Failing to use approved methods.
 - G. Failing to report changes in laboratory supervisor or equipment changes within 30 days.
 - H. Failing to report analysis of required annual performance evaluation by due date.
 - I. Failing to allow an inspection by an authorized representative.
 - J. Failing to supply analytical data requested by state laboratory.

Records & Reports:

1. Explain the value of records as a tool in operating and planning wastewater treatment facilities.
2. State the purpose of NPDES Permit monthly monitoring reports.
3. Explain NPDES reporting procedures, including frequency of data collection, report preparation, report submission, responsibility for accuracy, and timeliness.
4. Identify the agency to which the NPDES reports should be submitted.
5. What monitoring reports are required by the State?
6. State the type of records and reports which must be kept at the wastewater treatment plant and how long they must be kept there.
7. Given appropriate forms and data, prepare a monthly report to the State.

8. Identify reasons for maintaining the following records at a treatment plant and state what information must be included in each type of record:
- A. The plant log book
 - B. Wastewater flows (maximum, minimum, average)
 - C. Wastewater temperature
 - D. Weather conditions
 - E. Plant units in operation
 - F. Plant units out of service and reasons why
 - G. Laboratory analytical results (see sampling laboratory procedures)
 - H. Work in progress
 - I. Work completed
 - J. Important communications received and sent
 - K. Breakdowns
 - L. Personnel absences
 - M. Accidents
 - N. Visitors
 - O. Miscellaneous
 - P. Sludge disposal records.

Q. Public Relations

1. Explain the need for maintaining good public relations as part of ensuring public support.
2. Explain the importance of maintaining good public relations with each of the following groups:
 - A. Regulatory agencies
 - B. City councils
 - C. Civic groups
 - D. Industries
 - E. Environmental groups
 - F. Governing agencies
 - G. Local Health Department.
3. Explain the role of each of the following as factors influencing public relations:
 - A. Attitude
 - B. Manner
 - C. Appearance
 - D. Conduct
 - E. Spirit
 - F. Quality and quantity of work
 - G. Responsibility

- H. Knowledge of work and responsibility
 - I. Morale and pride
 - J. Confidence
 - K. Interest
 - L. Honesty.
4. Explain the importance of having a designated spokesperson to deal with the press.
 5. Explain the role of the following in maintaining good public relations:
 - A. Good housekeeping
 - B. Odor control
 - C. Insect control
 - D. Information booklets, pamphlets, brochures, etc.
 - E. Handling complaints
 - F. Plant tours.
 6. Explain what should and should not be included in news releases.
 7. Explain the role of the following in ensuring good public relations:
 - A. News releases
 - B. Photographs
 - C. Advertisements
 - D. Bulletins and newsletters
 - E. Activities reports
 - F. Plant information booklets, pamphlets, brochures, etc.
 - G. Operating reports and records.

R. Health & Safety

1. Explain the need for safety in wastewater treatment plants.
2. Describe the hazards of infection and explain how to minimize them.
3. Explain reasons for the following basic rules of good personal hygiene in wastewater treatment plants as listed below:
 - A. Keep hands and fingers away from eyes, ears, nose and mouth.
 - B. Wear rubber gloves.
 - C. Wash hands before eating and smoking.
 - D. Do not store personal clothes with work clothes.
 - E. Give cuts and scratches first aid immediately.
 - F. Take a shower after work.
 - G. Receive inoculations for typhoid fever, tetanus, etc.
 - H. Provide waterless hand cleaners at various locations throughout the plant.
4. Explain why each of the following precautions is important:
 - A. Do not lift more than can be handled comfortably.
 - B. Establish a solid footing and good balance before lifting.
 - C. Get as close to the load as possible when lifting or carrying.

- D. Keep the back straight, gripping the object firmly, and using the legs to provide lift.
 - E. Never carry a load that is too large to see over or around.
5. Describe hazards commonly encountered with respect to falling and explain methods for minimizing them.
 6. Describe special hazards existing in treatment plants with respect to drowning and explain how to minimize them.
 7. Explain the importance of color selection in painting piping and other equipment in the treatment plant.
 8. Why should NO SMOKING areas, exits and evacuation routes be clearly identified?
 9. Why is it especially important for wastewater treatment plant operators to have knowledge of first aid?
 10. Describe the basic good housekeeping measures listed below, explain the reason for each and describe why they encourage safety.
 - A. Have a routine cleaning program
 - B. Keep floors dry or provide platforms
 - C. Remove trash and loose debris
 - D. Repair loose boards, holes, splinters and protruding nails
 - E. Keep walkways free of oil, grease and sludge
 - F. Keep combustible wastes in metal air-tight containers and remove from the plant daily
 - G. Regular painting
 - H. Grass mowed and trimmed
 - I. Prompt cleanup of spills
 - J. Clean windows
 - K. Use of kick-plates on catwalks and raised surfaces
 11. What types of security measures should be enforced regarding the following and why?
 - A. Fencing
 - B. Limited access
 - C. Supervision of visitors
 12. Identify electrocution hazards in wastewater treatment plants and explain how to minimize them.
 13. Identify and describe hazards and appropriate safety precautions in wastewater treatment plants and collection systems with respect to:
 - A. Gases
 - B. Poisonous substances
 - C. Suffocation
 - D. Explosions
 - E. Confined spaces
 - F. Blood-borne pathogens
 14. Describe the physiological effects of harmful gases to the respiratory system, nerves, blood, etc.
 15. Describe why the following procedures are necessary when harmful gases exist in work areas:

- A. Purging to remove toxic or flammable gases.
 - B. Use of self-contained air packs in the event of a chlorine leak.
16. What percent oxygen concentration is necessary in air to sustain life?
 17. Define 'confined space' and the permit required for confined space.
 18. Describe how to test for an oxygen deficiency and toxic gas.
 19. Explain why the following conditions cause oxygen deficiency in wastewater treatment plants and collection systems:
 - A. Poor ventilation.
 - B. Displacement of air by another gas.
 - C. Absorption, consumption or biochemical depletion of air by decomposition of organic matter in sewers, manholes and covered tanks.
 20. Describe procedures that should be followed if an oxygen deficiency exists.
 21. Explain the difference between a gas mask and self-contained breathing apparatus.
 22. Identify hazardous locations in small, simple wastewater treatment plants with respect to encouraging noxious gases and oxygen deficiency.
 23. Identify types of protective clothing which should be available in wastewater treatment plants and describe conditions under which each type of protective clothing should be worn.
 24. What are the three ingredients necessary for a fire?
 25. Why is noise considered a safety hazard?
 26. Explain the importance of proper lighting as a safety measure.
 27. What action must be taken when electrical equipment is repaired or installed in a wastewater treatment plant and in collection systems?
 28. Explain the need for fire proofing chemical storage facilities.
 29. Describe routine testing and maintenance procedures that should be followed to ensure proper operation of safety equipment and measures.
 30. Describe the importance and typical locations for installation of guard rails, warning signs and other protective equipment in wastewater treatment plants.
 31. What agency administers the OSHA program in North Carolina?
 32. Describe the reason for each of the following precautions when working in below-ground structures:
 - A. Placing warning devices, barricades or guard rails around manholes.
 - B. Placing trucks and equipment between working area and traffic.
 - C. Removing manhole covers with hoists or hooks.
 - D. Prohibiting smoking in any underground structure.
 - E. Testing for oxygen deficiency and dangerous gases.
 - F. Requiring each worker entering a manhole to wear a harness and lifeline.
 - G. Stationing two men at the entrance to a manhole while a third worker is in the manhole.
 - H. Ventilating and purging the underground structure with fresh air.
 - I. Using non sparking tools, shoes with rubber soles, and safety lights.
 - J. Permitting no open flames in or near the structure.

33. What emergency phone numbers should always be kept posted in a conspicuous place?
34. What are the employer's responsibilities for providing necessary safety equipment? How and why should employees be informed that it is for their benefit?
35. Describe the safety requirements needed with respect to belts, coupling guards, electrical disconnects and lockout procedures.
36. Identify the poisonous snakes and insects (water moccasins, black widow and brown recluse spiders, fire ants, wasps, etc.) that may be encountered in and around a wastewater treatment plant and describe the first aid actions that will be needed in the event of a bite or sting.
37. Describe how to organize and implement a good safety training program. What are some of the main issues that should be addressed?
38. Identify where you can obtain training films and other training aids in order to carry out safety training programs.
39. What is the Occupational Health and Safety Act (OHSA) and what is involved in complying with it in wastewater treatment plants?
40. Explain the importance of informing plant employees about safety laws and describe methods for encouraging compliance with them.
41. Describe the requirements of the "Right to Know" regulations.
42. What is an oxygen enriched and oxygen deficient atmosphere?