Water Pollution Control System Operator Certification Commission Training Course Standards

The

North Carolina

Biological Wastewater

Treatment Systems Operator's

Grade Three and Four Course

Revised: July 8, 2005

INTRODUCTION

This document represents the minimum training standards required for an individual to qualify to take North Carolina's biological certification examination. The Water Pollution Control System Operators Certification Commission (WPCSOCC) and the Technical Assistance and Certification Unit of the North Carolina Department of Environment and Natural Resources (NCDENR) approved this document.

All agencies and individuals conducting schools, courses, or classes for the purpose of meeting operator's training requirement for certification are required to follow the Course Standards and the *Needs-To-Know* for each specific grade level in developing 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 experience of the operators.

ACKNOWLEDGMENTS

Special thanks to the following wastewater professionals who devoted many hours to making revisions to the Biological Wastewater Operators Course Standards and Needs to Know documents. They represent over twenty years of wastewater experience and expertise. We also appreciate the organizations that these individuals represent. They have demonstrated their commitment to quality training for the biological wastewater operators of North Carolina. These organizations allowed their employees time away from their work so that this project might be completed. In many cases they paid the expense for travel and lodging. Again to each of you we say, “Thank you”.

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Water Pollution Control System Operator Certification Commission Approved Training Course Standards Wastewater Treatment Systems Operators Course Summary

TIME REQUIRED: Each agency providing training may increase the time for training as necessary above the minimum times listed below.

Grade III	Time: 35 hours
Grade IV	Time: 39 hours
Grade III and IV Combined Course	Time: 56 hours

COURSE DESCRIPTION: This course is designed to provide the individual with a 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 equipment. This course is designed to assist the individual in preparation for the North Carolina Water Pollution Control System Operators Certification Commission Examination.

INSTRUCTORS: Should possess an academic and/or professional background acceptable to the approved sponsoring agency.

TEXTS: **Operation of Wastewater Treatment Plants, volume I and II** and **Advanced Waste Treatment.** Available from the Office of Water Programs, California State University, Sacramento, 6000 J Street, Sacramento, California 95819-6025. Telephone: 916-278-6142 Email address: wateroffice@csus.edu

PowerPoint Class Outline. Available from the North Carolina Department of Environment and Natural Resources, Water Quality Section, Technical Assistance and Certification Unit, 1618 Mail Service Center, Raleigh, NC 27699-1618. Instructors must present the topics as presented in the materials approved by the Water Pollution Control System Operators Certification Commission.

***Needs-To-Know Manual*.** Available on the North Carolina Department of Environment and Natural Resources, Water Quality Section, Technical Assistance and Certification Unit Web-site: h2o.enr.state.nc.us/tacu/manuals.

COURSE EVALUATIONS: Students will complete a course evaluation form provided by the school/agency conducting the course. The school/agency conducting the course is required to send a copy of all completed evaluation forms to the Technical Assistance and Certification Unit within 15 days of course completion.

CLASS ROSTERS: The instructor will keep Class rosters. One copy of the roster will be sent to the Technical Assistance and Certification Unit within 15 days of course completion. All students **must attend at least 80%** of the course in order to receive credit for completion.

Grade Three: Wastewater Treatment Systems Operator's Course Time Requirement by Topic

Needs-To-Know Topic	Minimum Time Required
Attached Growth	1.0 hours
Activated Sludge	3.0 hours
Disinfection (Chlorination, Dechlorination, and UV Disinfection)	1.0 hours
Anaerobic Sludge Digestion	3.0 hours
Sludge Conditioning	3.0 hours
Sludge Disposal	2.0 hours
Sampling	1.0 hours
Laboratory Procedures	3.0 hours
Public Relations	1.0 hours
Personnel	1.0 hours
Industrial Pretreatment	1.0 hours
Biology	2.0 hours
Pumps and Hydraulics	3.0 hours
Health and Safety	3.0 hours
Laws and Regulations	3.0 hours
Wastewater Plant Security	1.0 hours
Mathematics Conversion Factors	3.0 hours
Total Time	**35.0 hours**

Grade Four: Wastewater Treatment Systems Operator's Course Time Requirement by Topic

Needs-To-Know Topic	Minimum Time Required
Pumps and Hydraulics	3.0 hours
Activated Sludge	6.0 hours
Biological Nutrient Removal	3.0 hours
Anaerobic Sludge Digestion	3.0 hours
Disinfection (Chlorination, Dechlorination, and UV Disinfection)	2.0 hours
Reclaimed Water / Reuse	1.0 hours
Solids Handling and Disposal	2.0 hours
Composting	1.0 hours
Odor Control	1.0 hours
Laboratory Procedures	3.0 hours
Personnel	1.0 hours
Public Relations	1.0 hours
Budget and Finance	1.0 hours
Health and Safety	3.0 hours
Industrial Pretreatment	1.0 hours
Laws and Regulations	3.0 hours
Wastewater Plant Security	1.0 hours
Mathematics Conversion Factors	3.0 hours
Total Time	**39 hours**

Grade Three and Four: Wastewater Treatment Systems Operator's Course Time Requirement by Topic

Needs-To-Know Topic	Minimum Time Required
Pumps and Hydraulics	3.0 hours
Attached Growth	1.0 hours
Activated Sludge	6.0 hours
Anaerobic Sludge Digestion	4.0 hours
Biological Nutrient Removal	3.0 hours
Disinfection: Chlorination, Dechlorination & UV Disinfection	3.0 hours
Sludge Conditioning	3.0 hours
Sludge Disposal	2.0 hours
Reclaimed Water / Reuse	1.0 hours
Composting	1.0 hours
Odor Control	1.0 hours
Solid Handling and Disposal	3.0 hours
Biology	2.0 hours
Sampling	2.0 hours
Laboratory Procedures	3.0 hours
Industrial Pretreatment	1.0 hours
Budget and Finance	1.0 hours
Public Relations	1.0 hours
Personnel	1.0 hours
Health and Safety	3.0 hours
Laws and Regulations	4.0 hours
Wastewater Plant Security	1.0 hours
Mathematics Conversion Factors	6.0 hours
Total Time	**56.0 hours**

WW NTK GRADE 3

Biology

1. Define and distinguish between autotrophic and heterotrophic organisms and give examples of each.

2. Define ultimate oxygen demand (UOD), nitrogenous oxygen demand (NOD) and carbonaceous biochemical oxygen demand (CBOD) as the terms are used in N.C. regulatory practice.

3. Describe the differences between aerobic respiration, anaerobic respiration, and fermentation. Give examples of each in wastewater processes and streams.

4. Describe the receiving stream oxygen sag curve downstream from a discharge point.

5. Explain the effect of temperature on oxygen sag, considering both physical and biological impacts.

6. Explain the effects of light on oxygen sag.

7. Describe the effects of flow and turbulence on the oxygen sag curve.

8. Describe the changes in nitrogen formations below a wastewater discharge.

9. Differentiate between the following types of organisms and describe their significance in wastewater treatment:

   A) Bacteria
      (1) Nitrosomonas;
      (2) Nitrobacter;
      (3) Thiobacillus;
      (4) Zooglea ramigera;
      (5) Methane formers.

   B) Protozoa
      (1) Paramecium;
      (2) Vorticella.

Attached Growth

1. Explain the biological actions taking place in trickling filters.

2. Describe the advantages and disadvantages of trickling filters as compared with activated sludge.

3. Describe series vs. parallel operation of trickling filters, including advantages and disadvantages.

4. Describe the use and operation of the trickling filter as a treatment process prior to the activated sludge process.

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 which 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. Mean Cell Resident Time (MCRT);
   J. Food to Microorganism ratio (F/M);
   K. Sludge Volume Index (SVI);
   L. Oxygen uptake rate (OUR).

9. Identify the minimum dissolved oxygen (DO) required for an activated sludge process.

10. Identify proper safety procedures used in connection with the activated sludge process.

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 which 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. Describe and differentiate between the following types of activated sludge processes.

    A. Extended aeration;
    B. Conventional activated sludge;
    C. High-rate activated sludge;
    D. Sequential Batch Reactor (SBR) activated sludge system;
    E. Fixed/Film/Suspended Growth Systems.

15. What is nitrification and denitrification and how do they impact the operation of an activated sludge plant?

16. What effect might heavy metals have on an activated sludge plant?

17. What effect might insecticides have on an activated sludge plant?

18. Why are food to microorganism (F/M) ratios based on mixed liquor volatile suspended solids instead of mixed liquor suspended solids?

19. 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. Food to Microorganism ratio (F/M).

20. Differentiate between fixed-platform and floating types of mechanical aerators and give advantages and disadvantages of each.

21. What are side streams and what impact do they have on the activated sludge system?

22. How can the oxygen transfer of mechanical aerators be adjusted?

Disinfection

1. What is breakpoint chlorination?

2. What happens to chloramines at the breakpoint?

3. What are the effects of chloramines on receiving waters?

4. How does ultraviolet light provide disinfection?

5. Name some advantages and disadvantages of using chlorination and ultraviolet light for the disinfection of wastewater.

6. What are the feed methods and chemicals used for dechlorination?

Anaerobic Sludge Digestion

1. Given diagrams or drawings, identify the following components in a gas collection and piping system and indicate the purpose of each:

   A. Condensate removal;
   B. Pressure control and pressure indicating devices (manometers);
   C. Backflow prevention equipment;
   D. Backflame prevention;
   E. Gas meters;
   F. Waste gas burner.

2. Give typical sludge production figures for primary, trickling filter and activated sludge plants.

3. Differentiate between orifice and displacement type gas meters.

4. What fuels are most commonly used to heat sludge digesters? What alternative fuels can be used on a standby basis?

5. What gas production quantities are commonly encountered from an anaerobic digester in terms of cubic feet of gas produced per pound of volatile matter destroyed?

6. Identify and explain the purpose of each of the following sludge digestion components:

   A. Digester cover:
      1) Fixed;
      2) Floating;

B. Heating:
    1) External;
    2) Steam;
    3) Draft tube;
    4) Coils;

C. Mixing:
    1) Mechanical;
    2) Gas;

D. Piping:
    1) Withdrawal;
    2) Recirculation;
    3) Addition;

E. Supernatant withdrawal.

7. Describe maintenance steps necessary for the following gas collection systems:

    A. Condensate traps;
    B. Flame arrestor;
    C. Check valves;
    D. Pressure regulating valves;
    E. Manometers;
    F. Tank covers;
    G. Relief valves (vacuum and pressure);
    H. Waste gas flares;
    I. Gas meters;
    J. Manual plug valves.

8. Describe the methods for the collection and storage of digester gas. Describe the uses of digester gas.

9. Identify and describe the purpose of each component in a digester heating system.

10. Describe maintenance steps necessary for the following digester heating system components:

    A. Fire box;
    B. Heat exchange tubes;
    C. Gas system;
    D. Temperature control system.

11. What is the purpose of the cover position indicator?

12. Differentiate between single-stage and two-stage anaerobic digestion.

13. In two-stage digestion, what is the principal accomplishment in the first stage?

14. In two-stage digestion, what is the principal accomplishment in the second stage?

15. In two-stage digestion, where should mixing be practiced? Why?

16. In a two-stage digestion system, why should gas production be minimized in the second stage?

17. Why should a secondary digester be kept quiescent?

18. Differentiate between conventional and high-rate sludge digestion.

19. What are the advantages of operating in the mesophilic range as compared to the thermophilic and psychrophilic ranges?

20. What are the advantages of a floating cover digester as compared to a fixed-cover digester?

21. What special precautions should be taken in the operation of digesters with fixed covers?

22. What are common symptoms of an imbalance in an anaerobic digester?

23. What are three situations (causes) which may lead to such an imbalance?

24. How do you prevent and correct the imbalance in a digester for each of the above causes?

25. Identify normal operating ranges for an anaerobic sludge digester for the following parameters:

    A. pH;
    B. Alkalinity;
    C. Volatile acids;
    D. Gas production;
    E. Temperature.

26. Describe digester problems that will be noted by examining each of the following:

    A. Gas production;
    B. Gas composition;
    C. Volatile acids.

27. Identify and explain the types of data needed to operate the following sludge digestion processes:

    A. Raw sludge;
    B. Digesting sludge;
    C. Digested sludge;
    D. Digester gas production;
    E. Digester gas composition;
    F. Supernatant;
    G. Temperature;

H. pH;
I. Volatile acids;
J. Alkalinity.

28. Describe the proper procedures and equipment necessary for collecting the data listed in question 27 and be able to:

    A. perform necessary calculations in connection with the collection, manipulation and interpretation of the data and;
    B. make and explain operational decisions based on each type of data.

29. Why is the volatile acid/alkalinity ratio useful in digester operation? What should be done to prevent an increase in the volatile acid/alkalinity ratio?

30. Describe the importance of the following in two-stage sludge digestion:

    A. Addition of lime;
    B. Scum control.

31. Describe maintenance requirements for the components of anaerobic digesters.

32. Describe maintenance procedures necessary for the following digester mixing systems:

    A. Pump mixing systems;
    B. Gas mixing systems;
    C. Compressors;
    D. Timers;
    E. Internal mixers.

Sludge Conditioning

1. Describe each of the following devices used for sludge dewatering:

    A. Vacuum filter;
    B. Belt filter press;
    C. Centrifuge;
    D. Drying beds;
    E. Vacuum-assisted drying beds.

2. What is the elutriation of digested sludge?

3. Describe the purpose, method of use, and discharge solids concentration of each of the following sludge thickening and conditioning units:

    A. Gravity thickeners;
    B. Decanting;
    C. Dissolved air flotation units;
    D. Centrifugation;

E. Chemical coagulants (identify types);
F. Thermal conditioning;
G. Elutriation.

4. Identify advantages and disadvantages of sand beds, vacuum filters, centrifuges, presses and other systems.

5. Identify the type of dewatering performance typically expected in vacuum filter installations.

6. What are typical loading rates for sludge vacuum filters?

7. Describe the need for chemical treatment in vacuum filtration of sludge.

8. What type of dewatering performance is typically expected in a sludge centrifuge installation?

9. What type of chemical treatment is normally employed in centrifuging sludge?

10. Describe maintenance steps necessary for the following sludge centrifuge components:

    A. Sludge feed pumps;
    B. Chemical feed systems;
    C. Wearing parts in the centrifuge;
    D. Centrate discharge pump;
    E. Sludge cake conveyor;
    F. Centrifuge drive (electrical and mechanical);
    G. Filtrate pumps;
    H. Vacuum pumps.

11. What is the importance of conditioning before sludge dewatering?

12. Describe the advantages and disadvantages of heat drying and incineration of sludge.

Sludge Disposal

1. Identify the analyses which would be of greatest significance for evaluating characteristics of raw sludge.

2. Identify the analyses which would be of greatest significance in evaluating characteristics of digested sludge.

3. Identify advantages and disadvantages of the following methods for sludge disposal:

    A. Incineration, multiple hearth;
    B. Burying (landfill);
    C. Land application/irrigation;
    D. Lagooning, without prior dewatering;
    E. Use as a fertilizer;
    F. Composting.

Sampling

1. What are the objectives of pre-plant and in-plant investigative monitoring?

2. How do these objectives determine the monitoring procedures that are to be implemented?

3. Describe factors that must be considered in establishing sampling frequency.

4. Know the types of sampling containers used for each lab analysis and the reasons for each type of container.

Laboratory Procedures

1. Identify and describe the proper procedures for the operation of:

   A. Analytical balances;
   B. Muffle furnaces;
   C. Drying ovens.

2. Draw an oxygen demand curve showing typical carbonaceous BOD and nitrogenous BOD.

3. Explain how to determine the BOD dilutions needed for wastes of unknown strength.

4. Why is the COD test better than the BOD test for plant control?

5. How will nitrification inhibitor affect a BOD test?

6. Differentiate between multiple tube and membrane filter procedures. Why are the results often different?

7. Describe proper techniques for ensuring the sterility of glassware used in microbiological analyses.

8. Describe each of the following analyses and explain its significance:

   A. Chlorine residual: total (combined) and free;
   B. Turbidity;
   C. Ammonia nitrogen;
   D. Heavy metals.

9. Identify and describe the use for each of the following items of laboratory equipment:

   A. Beaker;
   B. Graduated cylinder;
   C. Pipette;
   D. Burette, clamp and support;
   E. Flask;
   F. BOD bottle;
   G. Funnel;

H. Test tube;
I. Imhoff cone and support;
J. Bunsen burner;
K. Crucible;
L. Volumetric and serological pipettes;
M. Erlenmeyer and volumetric flasks;
N. Boiling flasks;
O. Kjeldahl flasks;
P. Separatory funnels;
Q. Condensers;
R. Petri dishes;
S. Dessicator;
T. Tongs, clamps, forceps;
U. Concentric ring tripod;
V. Fume hood;
W. Gooch crucible, evaporating dish;
X. Wash bottle;
Y. Magnetic stirrer;
Z. Membrane filter and funnel assembly;
AA. Glass fiber disc and funnel assembly;
BB. Analytical balance;
CC. Automatic burette
DD. Spectrophotometer.

10. Describe proper procedures for ensuring adequate cleanliness of glassware for use in analyses.

11. Identify State agencies with the capability and equipment for making radiation measurements.

12. Describe the importance of the following in caring for balances:

    A. Balance being level;
    B. Supported on a solid surface;
    C. Use of clean weights and handling procedures;
    D. Careful cleaning of balance
    E. Calibration.

13. Describe the types of records that should be maintained of daily laboratory procedures, data and equipment?

14. What are trend charts and why should they be maintained?

15. What is quality control and why is it important?

16. What are duplicate samples and why are they important?

17. What are spiked samples and why are they important?

18. Why should someone other than the analyst prepare spiked and duplicate samples?

19. Explain the following aspects of the procedure for determining BOD:

    A. Characteristics of the dilution water;
    B. Reason for use of special dilution water;
    C. Justification for each constituent in the dilution water;
    D. Dilution of the sample for the analyses;
    E. Cleaning of BOD bottles;
    F. Pretreatment of sample;
    G. Dilution techniques;
    H. Sample incubation procedures;
    I. Analysis of dissolved oxygen content;
    J. Calculation of BOD;
    K. Interpretation of results;
    L. Maximum and minimum depletion;
    M. Glucose/glutamic acid;
    N. Seeded vs. unseeded;
    O. Seed correction
    P. Nitrification inhibitor.

20. Why should duplicate samples be analyzed for quality control?

21. Identify laboratory manuals for wastewater analyses and procedures.

22. Describe how to set up and conduct jar tests.

Pumps and Hydraulics

1. Given appropriate data, determine elevation heads at different points in a system.

2. Given appropriate data, calculate pressure heads at different points in a system.

3. As flow through a pipeline increases, what happens to the head?

4. Outline advantages and disadvantages of variable speed pump systems.

5. Describe typical applications for, as well as giving the advantages and disadvantages of each of the following pump drives:

    A. 110 volt (V) versus. 440 volt (V) alternating current (AC) electric motors;
    B. Alternating current (AC) versus direct current (DC) electric motors;
    C. Internal combustion engines.

Industrial Pretreatment

1. When are municipal sewer use ordinances needed? Who should have one and why?
2. Describe typical rules and regulations for wastewater discharges into municipal systems.
3. Why do municipal sewer use ordinances prohibit certain types or qualities of wastewater?
4. Identify typical prohibitions that may be placed by municipalities on industrial wastewaters.
5. What are surcharges for industrial wastewaters?
6. Why are surcharges for industrial wastewater desirable?
7. Describe the importance of maintaining proper working relationships with industry personnel.
8. Describe the role of pretreatment or industrial user permits as part of a good working relationship with industry.
9. When is combined treatment of municipal and industrial waste desirable?
10. Why do industrial wastes require different analyses than domestic wastewater?
11. Explain the current pretreatment regulations for industrial dischargers (i.e. categorical regulations and local limits requirements).

Health and 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 hepatitis, 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
    C. Proper detection equipment.

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 noise is 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 is the Occupational Health and Safety Act (OHSA) and what is involved in complying with it in wastewater treatment plants?

32. What agency administers the OSHA program in North Carolina?

33. 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.

34. What emergency phone numbers should always be kept posted in a conspicuous place?

35. What are the employer's responsibilities for providing necessary safety equipment? How and why should employees be informed that it is for their benefit?

36. Describe the safety requirements needed with respect to belts, coupling guards, electrical disconnects and lockout procedures.

37. 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.

38. Describe how to organize and implement a good safety-training program. What are some of the main issues that should be addressed?

39. Identify where you can obtain training films and other training aids in order to carry out safety training programs.

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?

Personnel

1. Discuss the importance of each of the following aspects of personnel supervision and be able to describe a practical procedure for each one:

   A. Selection and placement of new employees;
   B. Job classification and recognition of various levels of responsibilities;
   C. Maintaining effective communications between employer and employee;
   D. Recognition of meritorious service;
   E. Promotions;
   F. General work rules;
   G. Discipline;
   H. Keeping personnel records and time sheets.

2. What are performance standards and explain their importance.

3. Explain why periodic performance appraisal of an employee is important.

4. Explain why discussions with employees regarding periodic performance appraisals are important.

5. Explain the importance of each of the following roles for which the employer is responsible and explain steps which are appropriate in carrying out that responsibilities:

   A. Have a well managed system of employment;
   B. Proper recognition of the individual;
   C. Proper handling of grievances and complaints;
   D. Providing encouragement for the employees;
   E. Providing needed equipment and supplies;
   F. Using practical psychology in dealing with employees.

6. Explain how the following employee needs and concerns can affect their performance:

   A. Retirement plans;
   B. Educational plans;
   C. Insurance benefits;
   D. Fringe benefits;
   E. Salaries;
   F. Personal satisfaction.

7. Describe considerations regarding personnel promotions.

8. Explain steps which should be taken to encourage special training through home study and participation in correspondence and technical schools.

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.

   A. Explain the role of the following in maintaining good public relations:
   B. Good housekeeping;
   C. Odor control;
   D. Insect control;
   E. Information booklets, pamphlets, brochures, etc.;
   F. Handling complaints;
   G. Plant tours.

5. Explain what should and should not be included in news releases.

6. 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.

Laws and Regulations

Certification Rules:

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

   The Division of Water Quality (DWQ) in the Department of Environment and Natural Resources (DENR) is the agency.

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:
   1. Classification of water pollution control systems;
   2. 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.

9. 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.

10. 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%.

11. 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.

12. Be familiar with the permit requirements for land application of sludge.

13. Be familiar with the laboratory certification requirements.

14. Be familiar with the industrial pretreatment program requirements.

15. What are the Code of Federal Regulations (CFR) 503 regulations?

16. What are the requirements for reporting a spill?

17. Understand all sections of NPDES permit.

Field Parameters Lab Rules:

18. 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.

19. What are the ways to assure that technicians performing field parameter testing are performing the analysis properly?

Data reviewers provide both an internal and external thorough review of bench sheets used by the facility. 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.

20. 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.

21. 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.

22. 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.

23. 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.

24. 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…

    A. Date and time sample collected;
    B. Date and time of analysis;
    C. Sample site;
    D. Collector's and analyst's name;
    E. Meter calibration record(s);
    F. True value and % recovery of all standards or buffers analyzed;

G. All data must be labeled with the proper units of measure.

25. 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:

A. Date and time sample collected;
B. Date and time of analysis;
C. Sample site;
D. Collector's and analyst's name;
E. Meter calibration record(s);
F. True value and % recovery of all standards or buffers analyzed;
G. All data must be labeled with the proper units of measure.

26. 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.

27. 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 and Reports:

28. Explain the value of records as a tool in operating and planning wastewater treatment facilities.

29. State the purpose of NPDES Permit monthly monitoring reports.

30. Explain NPDES reporting procedures, including frequency of data collection, report preparation, report submission, responsibility for accuracy, and timeliness.

31. Identify the agency to which the NPDES reports should be submitted.

32. What monitoring reports are required by the State?

33. State the type of records and reports which must be kept at the wastewater treatment plant and how long they must be kept there.

34. Given appropriate forms and data, prepare a monthly report to the State.

35. 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.

Air Quality:

36. What is the Title V air permit program?

Title V permit program comes from the Clean Air Act (CAA) of 1990; the goal of the permit program is to ensure compliance and more thorough air pollution control. The permit issued under this program details all aspects of the source's yearly air emissions activities. Also known as the Operating Permit Program.

37. How is the Title V Permit Program similar to the NPDES Program?

The Title V program requires states to develop and implement the program and the EPA to provide assistance in the development and implementation of the programs.

38. Where can the regulations for the implementation of the State Operating Permits Program be found?

In the Title 40 Code of Federal Regulations (CFR) Part 70, this details the minimum

requirements that must be met by the State Operating Permit Programs.

39. What are some of the regulated air pollutants emitted from a wastewater treatment plant?

    Total Suspended Particulates (TSP), Particulate Matter up to 10 microns (PM10), Carbon Monoxide, Nitrogen Oxides

40. What are the criteria for determining if your wastewater treatment plant requires an Operating Permit?

    In order for a facility to be required to have an operating permit, the facility has to have the potential to emit at least 100 tons per year of any **criteria air pollutant**, or 10 tons per year of any single **hazardous (toxic) air pollutant**, or 25 tons per year of all **hazardous (toxic) air pollutants** combined.

41. What are criteria air pollutants?

    There are 7 criteria air pollutants:
    A. Sulfur dioxide;
    B. Total suspended particulates;
    C. Particulate matter less than 10 microns (PM10);
    D. Carbon monoxide;
    E. Nitrogen oxides;
    F. Volatile organic compounds (VOC's);
    G. Lead and lead compounds.

    These pollutants are found in relatively large quantities in the lower atmosphere particularly in populated and urban areas.

42. What are hazardous or toxic air pollutants?

    There are currently 188 listed hazardous (toxic) air pollutants; these are compounds that are known or suspected to cause cancers or other serious health effects.

43. List some of the activities at a WWTP, which <u>do not</u> require an Operating Permit?

    A. Laboratory activities for water or wastewater analyses;
    B. Storage tanks for fuel oils, kerosene, diesel fuel, natural or LP gas;
    C. Wastewater treatment processes for which there are no applicable requirements;
    D. Non-self propelled non road engines, except generators;
    E. Sewer gas stacks or vents to prevent sewer gases escaping through plumbing traps.

44. What are the most common activities at a WWTP that would require an Operating Permit?

    Emergency and peak shaving generators and lime silos

45. What is the determining factor regarding generators that make an Operating Permit necessary?

    The size of the generator, run time of the generator and the electrical energy produced

46. Which major piece of equipment at a WWTP always requires an Operating Permit?

Sludge Incinerators

Wastewater Plant Security

Restrict Access to System:

1. Why are hardwired surveillance systems better than wireless systems?

   Hardwired surveillance systems provide more security than wireless systems. This is true because the hardwired surveillance systems signal are transmitted directly to the receiver and wireless systems are transmitted over the airway. When the signal is transmitted over the airway it is susceptible to a cyber-attack (computer hacking).

2. What types of protection will a closed circuit television (CCTV) provide wastewater plants?

   Closed circuit TV (CCTV) installed around the perimeter of a wastewater plant help in providing detection and deterrence of unauthorized persons entering the facility.

3. What types of protection will adequate lighting around wastewater treatment plant perimeter provide?

   Adequate lighting around a wastewater treatment plant's perimeter fencing may result in deterrence and detection.

4. From a security perspective, what is the best practice for the delivery of chemicals and other such supplies?

   Chemical deliveries should be performed in the presence of wastewater system personnel. Verify the credentials of all delivery drivers. Match all delivered goods with manifest and purchase order.

5. What should facility owners do before allowing vendor or contractor personnel unescorted access to a wastewater facility?

   Before allowing vendor or contractor personnel unescorted access to a wastewater facility, the wastewater facility owner may want to adopt a security policy that requires vendors to have an employee screening process.

6. How can concrete "Jersey" barriers be used to provide security?

   Concrete security "Jersey" barriers are a means of preventing accidental or intentional vehicle intrusion into a facility. Concrete security "Jersey" barriers are the best physical counter measure to guard against intentional vehicle intrusion at the wastewater treatment plant. Install concrete "Jersey" barrier to protect critical components.

7. What critical components of a public awareness program?

   Uniforms, identification cards for personnel, system logos on wastewater system vehicles and other critical components of the facility.

Implement System's Communication System:

8. What is a way to identify resources, personnel, and equipment that might be needed to respond to an emergency?

   One way to identify resources, personnel, and equipment that might be needed to respond to an emergency is to enter into a mutual aid agreement with local public safety personnel.

9. What are some actions to take to avoid confusion and conflict that might arise during an emergency response?

   Define the type of assistance to be provided in writing in the mutual aid agreement and identify the chain of command that activates the agreement.

10. What is the most effective way to disseminate information to the public in the event of an emergency?

    Designate one spokesperson for the system.

11. How should customers and the public be notified of health hazards caused by the disruption of the wastewater treatment facility?

    By the fastest means available

Implement Security Procedures for Personnel:

12. What is the advantage of developing a Security Awareness Program?

    An advantage of a security awareness program is that it involves the employees in the security program in a positive manner.

13. What is the most significant limitation of an employee security screening process?

    The most significant limitation of an employee security screening program is that historical data will not necessarily reveal issues that may lead to dishonest behaviors.

14. What is the most significant disadvantage of a vendor or contractor employee security screening process?

    The most significant disadvantage of a vendor or contractor employee security

screening process is that it may cause increased costs from vendors due to the need to implement additional controls.

Protect Sensitive Information About the Wastewater Facility:

15. Why should passwords on computers used at wastewater facilities be frequently changed?

    To prevent the possibility of intrusion into the system by unauthorized personnel, it is recommended that passwords be change at a minimum of every 90 days.

16. What is one measure that can be taken to prevent the lost of data records if there is an intrusion into the SCADA system?

    Intrusion into the SCADA system may result in damage or loss to the operating system, data records, set-point information and the SCADA software. Wastewater facilities should consider backing up critical applications and databases to an offsite facility.

17. What is the most effective way to secure computers used for SCADA systems from cyber-attacks (computer hackers)?

    In order to most effectively secure computers used for SCADA systems from cyber-attacks (computer hackers) at wastewater facilities is for the computer not to be connected to the Internet.

18. Describe protection of sensitive documents that may be found in wastewater facilities vehicles.

    Often wastewater facilities contain schematics, maps, and other sensitive documents. To protect these sensitive documents before parking the vehicle at the end of the day any critical information should be removed.

19. Describe how to manage critical computer data.

    In case your computer is damaged or suffers from a hacker attack, it is a good idea to regularly copy critical data on backup tapes or disks and store them at a secure off-site location.

20. What is a vulnerability assessment?

    A vulnerability assessment is a systematic process for evaluating the susceptibility of critical facilities to potential threats. It also identifies corrective actions that can reduce or mitigate the risk of serious consequences associated with these threats?

Emergency Response Plan:

21. What is an emergency response plan?

    An emergency response plan is a document describing the actions that a wastewater facility would enact during disasters or other unexpected incidents. Portions of the emergency response plan tied to the vulnerability assessment for wastewater facilities should be distributed to only those with a "need to know". Preparing emergency response plans for wastewater systems is the responsibility of local officials. An emergency response plan for a wastewater facility should be specific for the facility.

22. How often should an emergency response plan be reviewed and updated?

    Annually

23. At a minimum, how often should contact lists on emergency response plans be verified?

    Quarterly

24. Identify the four phases of emergency management that should be addressed in emergency response plans.

    Preparedness;
    Response;
    Recovery;
    Mitigation.

Mathematics

Definitions and Conversion Factors

1. **Arithmetic Mean** - The sum of the values divided by the number of values or, simply, the average.

2. **Circumference of a circle** - The length of the external boundary of a circle.

3. **Chlorine Dosage** - The amount of chlorine added to wastewater.

4. **Chlorine Demand** - The difference between the amount of chlorine added to wastewater and the amount of residual chlorine remaining after a given contact time. Chlorine demand may change with dosage, time, temperature, pH, nature and the amount of impurities in wastewater.

Chlorine Demand = Chlorine Dosage - Chlorine Residual

5. **Chlorine Residual** - The quantity of chlorine in excess of the chlorine demand, expressed in mg/l. The residual must remain for a sufficient contact time, usually 30 minutes, to insure the killing of pathogens.

6. **Detention Time** - The time required to fill a tank at a given flow or the theoretical time required for a given flow of wastewater to pass through a tank.

7. **Diameter of a circle** - The distance from one side of a circle to the other, passing through the center.

8. **Geometric Mean** - For any set of values, it is the *n*th root of the product of the individual values where *n* is equal to the number of individual values. It is equivalent to the antilog of the arithmetic means of the logarithms of the individual values and is used in averaging results from the fecal coliform analysis because an extreme value has a lesser influence on the final result.

9. **Hydraulic Loading** - This is the number of gallons of wastewater applied per day per square foot (or per acre) of filter surface. The hydraulic loading for a standard rate trickling filter is usually between 25 to 100 gal/day/sq. ft. and for a high rate trickling filter the hydraulic loading may be between 100 to 1000 gal/day/ft^2.

10. **Milligram per liter (mg/l)** - One-thousandth of a gram in one liter of solution.
    e.g. : 1 mg/l = 0.001 gram in 1 liter

11. **Trickling Filter Organic Loading** - This is the number of pounds of BOD per day per 1000 cubic feet of filter medium. Pounds per acre-foot or per cubic yard of filter medium are also occasionally used. The organic loading for a standard rate trickling filter is 5 to 25 pounds of BOD per day per one thousand cubic feet of media. The organic loading for a high rate trickling filter is usually between 25 to 300 pounds of BOD per day per one thousand cubic feet of filter media.

12. **Population Equivalent** - A means of expressing the strength of organic material in wastewater. In a domestic wastewater system, microorganisms use up about 0.2 pounds of BOD per day for each person using the system (as measured by the standard BOD test).

13. **Part per million (ppm)** - This term is used interchangeably for milligram per liter (mg/l) with the explanation for that interchangability being as follows:

$$\frac{1 \text{ milligram}}{1 \text{ liter}}$$

$$= \frac{1 \text{ milligram}}{1{,}000 \text{ milliliters}}$$

$$= \frac{1 \text{ milligram}}{1{,}000 \text{ milliliters x } 1000 \text{ milligrams per millilite}}$$

$$= \frac{1 \text{ milligram}}{1{,}000{,}000 \text{ milligrams}}$$

$$= \frac{1 \text{ part}}{1 \text{ million parts}}$$

= 1 part per million or 1 ppm

14. **Radius of a circle** - One-half of the diameter or the distance from the center of the circle to a side of the circle.

15. **Sludge Age** - Average time in days a particle of suspended solids remains under aeration in the activated sludge process.

16. **Sludge Volume Index (SVI)** - This is a calculation used to indicate the settling ability of activated sludge (aerated solids) in the secondary clarifier. The calculation is a measure of the volume of sludge compared with its weight.

17. **Surface Settling Rate** - This term is expressed in terms of gpd/sq. ft. of tank surface area. The suggested surface settling rate varies from 300-1200 gallons per day per square foot of surface area.

18. **Velocity** - The time rate of motion in a given direction or, simply, the speed.

19. **Volume** - The capacity of a container or the amount it can hold.

20. **Weir Diameter** - Circular clarifiers have a circular weir within the outside edge of the clarifier. All of the water leaving the clarifier flows over this weir. The diameter is the length of the line from one edge of a weir to the opposite edge and passing through the center of the circle formed by the weir.

21. **Weir Overflow Rate** - Wastewater leaves the clarifier by flowing over some type of weir arrangement. The number of linear feet of weir in relation to the flow is important to prevent short circuits or high velocity near the weir which might pull settling solids into the

effluent. The weir overflow rate is the number of gallons of wastewater that flow over one linear foot of weir per day. Most designers recommend 10,000 to 20,000 gallons per day per linear foot of weir.

22. **Total Suspended Solids (TSS), mg/l** $= \frac{\text{dry solids in grams x 1000 mg/g x 1000 ml/l}}{\text{sample volume in mls}}$

or $= \frac{\text{weight of solids in mg x 1000 mls/l}}{\text{sample volume in mls}}$

23. **Total Solids (TS), mg/l =** $\frac{\text{A - B x 1000}}{\text{sample volume in mL}}$

where A = weight of dish + dried residue in milligrams
B = weight of dish in milligrams

24. **Volatile Solids (VS), mg/L =** $\frac{\text{(A - B) x 1000}}{\text{sample volume in mL}}$

where A = weight of residue + dish before ignition in milligrams
B = weight of residue + dish after ignition in milligrams

25. Percent (%) Volatile Solids = $\frac{\text{(A - C) x 100}}{\text{A-B}}$

where A = weight of dish + dried residue in milligrams
B = weight of dish in milligrams
C = weight of residue + dish after ignition in milligrams

26. **F/M (food to microorganism) ratio** $= \frac{\text{BOD (or COD) in mg/l x MGD x 8.34}}{\text{MLVSS in mg/l x aeration basin vol. in MG x 8.34}}$

27. **Brake horsepower (Brake HP)** $= \frac{\text{flow in gpm x total head in ft}}{\text{3960 x pump efficiency}}$

28. **Motor horsepower (Motor HP)** $= \frac{\text{gpm x total head in ft}}{\text{3960 x pump efficiency x motor efficiency}}$

29. **Loss of Alkalinity due to Nitrification, mg/l** = 7.2 mg/l of alkalinity is consumed per mg/l of NH_3 converted to NO_3. (*Please note that some literature sources use 7.1 or 7.14 mg/l as the conversion factor.)

30. **Pump electrical costs per year**

= hp x 0.746 kW/hp x # of hrs pump operates per day x cost ($) per kW/hr x 365 day/yr.

31. **Watts** = volts x amps = $\frac{\text{voltage}}{\text{ohms}}$

32. **BOD_5, mg/l (seeded)** = $\frac{[(DO_1 - DO_5) - (\text{seed correction})] \times 300 \text{ mL}}{\text{mL of sample volume}}$

Where:

seed correction = $\frac{\text{5 day depletion of seed sample}}{\text{mL seed}}$

DO_1 = Initial DO, in mg/L
DO_5 = DO after 5 days, in mg/L

33. **Percent (%) Reduction of Volatile Solids in a digester** = $\frac{\%\text{ In} - \%\text{ Out}}{\%\text{ In} - (\frac{\%\text{ In} \times \%\text{ Out}}{100})} \times 100$

34. Dry solids to a digester, lbs/day = sludge in gpd x 8.34 lbs/gal x $\frac{\%\text{ Total solids}}{100}$

35. **Volatile Solids to a digester, lbs/day**

= sludge in gpd x 8.34 lbs/gal x $\frac{\%\text{ Total Solids}}{100}$ x $\frac{\%\text{ Vol. Solids}}{100}$

36. **Volatile Solids Destroyed in a digester, lbs/day/ft^3**

= $\frac{\text{Volume of sludge in gal/day x \% solids x \% volatile x \% reduction x 8.34}}{\text{Digester volume in } ft^3}$

37. **Return Activated Sludge (RAS) Rate calculated using Settleability**

MGD = Secondary influent flow, MGD x Return Sludge Rate Ratio

where the **Return Sludge Rate Ratio** = $\frac{\text{30 min settled sludge volume in ml/l}}{\text{clear liquid volume in ml/l}}$

or = $\frac{\text{30 min settled sludge volume in ml/l}}{\text{1000 ml/l – 30 minute settled sludge volume in ml/l}}$

38. **Volume/Concentration conversion**

= mls x normality = mls x normality
or mls x concentration = mls x concentration

39. **Total waste activated sludge (WAS) in MGD**

= current rate in MGD + additional rate in MGD

GRADE 4 NEEDS-TO-KNOW

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 which 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. Mean Cell Resident Time (MCRT);
   J. Food to Microorganism ratio (F/M);

K. Sludge Volume Index (SVI);
L. Oxygen uptake rate (OUR).

9. Identify the minimum dissolved oxygen (DO) required for an activated sludge process.

10. Identify proper safety procedures in connection with the 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 which 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. Describe and differentiate between the following types of activated sludge processes.

    A. Extended aeration;
    B. Conventional activated sludge;
    C. High-rate activated sludge;
    D. Sequential Batch Reactor (SBR) activated sludge system;
    E. Fixed/Film/Suspended Growth Systems.

15. What is 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 are food to microorganism (F/M) ratios 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. Sludge Volume Index (SVI);
    B. Mean cell residence time (MCRT);
    C. Sludge wasting rates;
    D. Organic loading;
    E. Food to Microorganism ratio (F/M).

19. What is the approximate range of efficiency of coarse and fine air diffusion aeration devices used in activated sludge plants?

20. Be familiar with schematics for the following design variations, describe the characteristics of each and give advantages and disadvantages:

    A. Conventional activated sludge;
    B. Contact stabilization;
    C. Extended aeration;
    D. Kraus process;
    E. Step-Feed aeration;
    F. Complete mix;
    G. Modified aeration/high rate activated sludge;
    H. Tapered aeration;
    I. Oxidation ditch;
    J. Sequential Batch Reactor (SBR);
    K. Bardenpho/ A^2O;
    L. Pure Oxygen.

21. How would the addition of alum affect an activated sludge system?

22. Differentiate between fixed-platform and floating types of mechanical aerators and give advantages and disadvantages of each.

23. What are side streams and what impact do they have on the activated sludge system?

24. How can the oxygen transfer of mechanical aerators be adjusted?

Biological Nutrient Removal

1. Why is it important to control the discharge of nitrogen and phosphorous?

2. What are the two means of removing phosphorous?

3. Know the differences and purposes of aerobic, anoxic and anaerobic zones in a biological nutrient removal treatment system.

4. What is Luxury Uptake?

5. Know the chemicals that can be used for phosphorous removal.

6. How is nitrification/denitrification accomplished?

7. What are the end products of denitrification?

8. What is the impact on alkalinity and dissolved oxygen in a plant that accomplishes denitrification?

Disinfection (Chlorination, Dechlorination, and UV

1. 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.

2. What is the significance of chlorinated organics in water?

3. What are the basic configurations of UV systems?

4. What factors can affect the life and efficiency of the UV lamp?

Reclaimed Water/Reuse

1. What is reclaimed water?

2. What is the nationally recognized color for Reclaimed water?

3. What is the maximum hold time for bulk reclaimed water once it leaves the plant site?

4. What is the buffer requirement, for reclaimed water; from private or public water supply?

5. What is the buffer requirement, for reclaimed water, from waters classified as WS, B, SA, ORW, HQW, or SB?

Anaerobic Sludge Digestion

1. Identify the following components in a gas collection and piping system and indicate the purpose of each:

   A. Condensate removal;
   B. Pressure control and pressure indicating devices (manometers);
   C. Backflow prevention equipment;
   D. Backflame prevention;
   E. Gas meters;
   F. Waste gas burner.

2. What fuels are most commonly used to heat sludge digesters? What alternative fuels can be used on a standby basis?

3. What gas productions quantities are commonly encountered from an anaerobic digester in terms of cubic feet of gas produced per pound of volatile matter destroyed?

4. Identify and explain the purpose of each of the following sludge digestion components:

   A. Digester cover:
      1) Fixed;
      2) Floating;
   B. Heating:
      1) External;
      2) Steam;
      3) Draft tube;
      4) Coils;
   C. Mixing:
      1) Mechanical;
      2) Gas;
   D. Piping:
      1) Withdrawal;
      2) Recirculation;
      3) Addition;
   E. Supernatant withdrawal.

5. Describe maintenance steps necessary for the following gas collection systems:

   A. Condensate traps;
   B. Flame arrestor;
   C. Check valves;
   D. Pressure regulating valves;
   E. Manometers;
   F. Tank covers;
   G. Relief valves (vacuum and pressure);
   H. Waste gas flares;
   I. Gas meters;
   K. Manual plug valves.

6. Describe the methods for collecting and storing of digester gas. Describe the uses of digester gas.

7. Identify and describe the purpose of each component in a digester heating system.

8. What is the purpose of the cover position indicator?

9. Differentiate between single-stage and two-stage anaerobic digestion.

10. In two-stage digestion, what is the principal accomplishment in the first stage?

11. In two-stage digestion, what is the principal accomplishment in the second stage?

12. In two-stage digestion, where should mixing be practiced? Why?

13. Why is gas production lower in the second stage?

14. When should a digester be kept quiescent?

15. Differentiate between conventional and high-rate sludge digestion.

16. What are advantages of operating in the mesophilic range as compared to the thermophilic and psychrophilic ranges?

17. What are the advantages of a floating cover digester as compared to a fixed-cover digester?

18. What special precautions should be taken in the operation of digesters with fixed covers?

19. Identify normal operating ranges for an anaerobic sludge digester for the following parameters:

    A. pH;
    B. Alkalinity;
    C. Volatile acids;
    D. Gas production;
    E. Temperature.

20. Describe digester problems and corrective actions of the following:

    A. Abnormal gas production;
    B. Gas composition;
    C. Volatile acids.

21. Identify and explain the types of data needed to operate the following sludge digestion processes:

    A. Raw sludge;
    B. Digesting sludge;

C. Digested sludge;
D. Digester gas production;
E. Digester gas composition;
F. Supernatant;
G. Temperature;
H. pH;
I. Volatile acids;
J. Alkalinity.

22. Describe the operations for the following digester mixing systems:

A. Pump mixing systems;
B. Gas mixing systems;
C. Compressors;
D. Timers;
E. Internal mixers.

Solids Handling and Disposal

1. Describe and understand the operation and purpose of mechanical dryers and incinerators.

2. What are the factors that affect mechanical drying?

3. Discuss the need for scrubbers on mechanical dryers and incinerators.

4. Identify and understand the various options available for achieving Class A and Class B biosolids.

5. Describe the advantages and disadvantages of heat drying and incineration of sludge.

Composting

1. What are the general categories of composting processes?

2. Define “Composting”?

3. What are factors that affect the composting process?

4. What is the optimum moisture range for windrow composting?

5. What is “balling”?

6. What is the desired temperature range for a compost pile?

7. What is the typical time required for composting secondary sludge?

Pumps and Hydraulics

1. Given a pump manufacturer's pump curve for a given impeller size and speed, determine the following:

   A) Pump capacity;
   B) Head, expressed in feet;
   C) Pump efficiency;
   D) Brake horsepower.

2. Given a set of characteristic (performance) curves for a centrifugal pump, use those curves to determine performance under various operating conditions such as head, discharge etc.

3. Describe how to select (specify) a given pump type, power, and drive for any given application.

4. Given appropriate data, system-head curves and pump characteristic curves, determine pumping efficiency and power requirements.

5. Describe how to solve problems to determine power requirements and efficiency for pumping systems.

6. Explain how to solve flow problems by using head loss tables, graphs, or nomographs.

7. What is the hydraulic profile?

8. How can the hydraulic profile in the wastewater treatment plant be adjusted?

9. Why would the hydraulic profile in the wastewater treatment plant need to be adjusted?

Odor Control

1. What are examples of organic gases that give off offensive odors?
2. What are two inorganic gases that give off offensive odors?
3. At what level can hydrogen sulfide be detected by humans?
4. What is an *Odor Panel*?
5. What are possible solutions for controlling or eliminating odors?
6. How is Oxygen Reduction Potential (ORP) associated with odor control?
7. What are common methods of treating odors contained in the air?
8. What is the difference between Adsorption and Absorption?
9. What is “caustic impregnated” carbon?
10. What is Activated Carbon?

Laboratory Procedures

1. Define each of the following analyses, explain its significance in plant operations and be able to interpret the lab results:

   A. Sludge volume index (SVI);
   B. Volatile acids;
   C. Nitrogen Compounds;
   D. Phosphorus Compounds;
   E. Organic Compounds;
   F. Total Organic Carbon (TOC);
   G. Alkalinity;
   H. Cyanide;
   I. Metals;
   J. Mercury (Clean Sampling Techniques);
   K. Chronic toxicity tests;
   L. Oxygen Demands;
   M. Oil and Grease;
   N. Solids;
   O. Temperature;
   P. pH;
   Q. Fecal Coliform;
   R. Other analyses as related to NPDES permits.

2. Describe methods of analyses for chlorine measurement.

3. Describe proper procedures for performing titrations.

4. Discuss the operation and QA/QC involved in the use of spectrophotometric methods.

5. What is a quality control chart and why is it used?

6. What are specific (selective) ion probes and for which analyses are they used?

7. What factors contribute to the coliform count in streams and rivers other than the discharge of wastewater effluent?

8. How do you determine the difference between animal and human contamination?

9. What are fecal streptococci and what is their significance in the analysis of wastewater?

10. Compare and contrast the information obtained from the following tests:

    A. Biochemical oxygen demand (BOD);
    B. Chemical oxygen demand (COD);
    C. Total organic carbon (TOC).

Health and 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
    C. Detection equipment.

17. What percent oxygen concentration is necessary in air to sustain life?

18. Define 'confined space' and the permit required for confined space.

19. Describe how to test for an oxygen deficiency and toxic gas.

20. 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?

Industrial Pretreatment

1. What is meant by the synergistic effect of certain industrial wastes?

2. Describe the importance of an effective sewer use ordinance.

3. Explain the reason for developing an enforcement response plan where the authority for the plan is based in the sewer use ordinance.

4. Identify some regulatory methods being used for controlling industrial wastewater discharges into municipal treatment facilities.

5. Why would a survey of industrial wastewater sources be conducted?

6. Describe problems involved in sampling and evaluating industrial wastes.

7. Describe the characteristics and the purpose of metering and sampling manholes.

8. Identify radioactive health hazards in wastewater treatment plants and sewers.

9. Why is it good to know about the biological treatability of a waste before it is discharged to a plant?

10. Identify the most significant characteristics of wastewater from the following industries:

    A. Textile industries;
    B. Metal finishing industries;
    C. Laundries;
    D. Breweries;
    E. Paper industries;
    F. Meat processing plants;
    G. Chemical industries;
    H. Fertilizer industries;
    I. Petroleum industries;
    J. Food processing industries;
    K. Dairy industries;
    L. Printing industries;
    M. Mining industries.

Laws and Regulations

Certification Rules:

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

   The Division of Water Quality (DWQ) in the Department of Environment and Natural Resources (DENR).

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:
   1. Classification of water pollution control systems;
   2. 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 reprimanded?

   The Water Pollution Control Systems Operator Certification Commission may revoke the certificate of any certified operator when it is found that:

   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; or
   c) the operator is incompetent or unable to properly perform his or her duties;
   d) the operator fails to use reasonable care and judgment in the performance of their

duties;
e) the operator intentionally supplied false information in order to obtain, or maintain certification;
f) the operator cheated on a certification exam.

8. 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.

9. What is the frequency for flow meter calibration and what is the acceptable range of deviation?

   The minimum required frequency of calibration is once per year. The acceptable deviation is plus or minus 10%.

10. 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.

11. Be familiar with the permit requirements for land application of sludge.

12. Be familiar with the laboratory certification requirements.

13. Be familiar with the industrial pretreatment program requirements.

14. What are the Code of Federal Regulations (CFR) 503 regulations?

15. What are the requirements for reporting a spill?

16. Understand all sections of an NPDES permit.

Field Parameters Lab Rules:

17. 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.

18. What are the ways to assure that technicians performing field parameter testing are performing the analysis properly?

    Conduct 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.

19. 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.

20. 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.

21. 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.

22. 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.

23. 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.

24. 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…

A. Date and time sample collected;
B. Date and time of analysis;
C. Sample site;
D. Collector's and analyst's name;
E. Meter calibration record(s);
F. True value and % recovery of all standards or buffers analyzed;
G. All data must be labeled with the proper units of measure.

25. 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.

26. 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 and Reports:

27. Explain the value of records as a tool in operating and planning wastewater treatment facilities.

28. State the purpose of NPDES Permit monthly monitoring reports.

29. Explain NPDES reporting procedures, including frequency of data collection, report preparation, report submission, responsibility for accuracy, and timeliness.

30. Identify the agency to which the NPDES reports should be submitted.

31. What monitoring reports are required by the State?

32. State the type of records and reports which must be kept at the wastewater treatment plant and how long they must be kept there.

33. Given appropriate forms and data, prepare a monthly report to the State.

34. 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.

Air Quality:

35. What is the Title V air permit program?

Title V permit program comes from the Clean Air Act (CAA) of 1990; the goal of the permit program is to ensure compliance and more thorough air pollution control. The permit issued under this program details all aspects of the source's yearly air emissions activities. Also known as the Operating Permit Program.

36. How is the Title V Permit Program similar to the NPDES Program?

    The Title V program requires states to develop and implement the program and the EPA to provide assistance in the development and implementation of the programs.

37. Where can the regulations for the implementation of the State Operating Permits Program be found?

    In the Title 40 Code of Federal Regulations (CFR) Part 70, this details the minimum requirements that must be met by the State Operating Permit Programs.

38. What are some of the regulated air pollutants emitted from a wastewater treatment plant?

Total Suspended Particulates (TSP), Particulate Matter up to 10 microns (PM10), Carbon Monoxide, Nitrogen Oxides

39. What are the criteria for determining if your wastewater treatment plant requires an Operating Permit?

    If the facility has the potential to emit at least 100 tons per year of any **criteria air pollutant**, or 10 tons per year of any single **hazardous (toxic) air pollutant**, or 25 tons per year of all **hazardous (toxic) air pollutants** combined.

40. What are criteria air pollutants?

    There are 7 criteria air pollutants,
    - Sulfur dioxide;
    - Total suspended particulates;
    - Particulate matter less than 10 microns (PM10);
    - Carbon monoxide;
    - Nitrogen oxides;
    - Volatile organic compounds (VOC's);
    - Lead and lead compounds.

    These pollutants are found in relatively large quantities in the lower atmosphere particularly in populated and urban areas.

41. What are hazardous or toxic air pollutants?

    There are currently 188 listed hazardous (toxic) air pollutants; these are compounds that are known or suspected to cause cancers or other serious health effects.

42. List some of the activities at a WWTP, which <u>do not</u> require an Operating Permit?

    A. Laboratory activities for water or wastewater analyses;
    B. Storage tanks for fuel oils, kerosene, diesel fuel, natural or LP gas;
    C. Wastewater treatment processes for which there are no applicable requirements;
    D. Non-self propelled non road engines, except generators;
    E. Sewer gas stacks or vents to prevent sewer gases escaping through plumbing traps.

43. What are the most common activities at a WWTP that would require an Operating Permit?

    Emergency and peak shaving generators and lime silos

44. What is the determining factor regarding generators that make an Operating Permit necessary?

    The size of the generator, run time of the generator and the electrical energy produced

45. What major piece of equipment at some WWTP's always requires an Operating Permit?

    Sludge and Sewage Sludge Incinerators

Personnel

1. Discuss the importance of each of the following aspects of personnel supervision and be able to describe a practical procedure for each one:

   A. Selection and placement of new employees;
   B. Job classification and recognition of various levels of responsibilities;
   C. Maintaining effective communications between employer and employee;
   D. Recognition of meritorious service;
   E. Promotions;
   F. General work rules;
   G. Discipline;
   H. Keeping personnel records and time sheets.

2. What are performance standards and explain their importance.

3. Explain why periodic performance appraisal of an employee is important.

4. Explain why discussions with employees regarding periodic performance appraisals are important.

5. Explain the importance of each of the following roles for which the employer is responsible and explain steps which are appropriate in carrying out that responsibilities:

   A. Have a well managed system of employment;
   B. Proper recognition of the individual;
   C. Proper handling of grievances and complaints;
   D. Providing encouragement for the employees;
   E. Providing needed equipment and supplies;
   F. Using practical psychology in dealing with employees.

6. Explain how the following employee needs and concerns can affect their performance:

   A. Retirement plans;
   B. Educational plans;
   C. Insurance benefits;
   D. Fringe benefits;
   E. Salaries;
   F. Personal satisfaction.

7. Describe considerations regarding personnel promotions.

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:

   A. Explain the role of the following in maintaining good public relations;
   B. Good housekeeping;
   C. Odor control;
   D. Insect control;
   E. Information booklets, pamphlets, brochures, etc.;
   F. Handling complaints;
   G. Plant tours.

5. Explain what should and should not be included in news releases.

6. 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.

Budget And Finance

1. Explain the purpose of specifications in contracts for purchasing materials.

2. Explain the process of obtaining bids on equipment purchases.

3. Identify factors which are significant in determining the cost of operating a wastewater treatment plant.

4. Describe how to organize and prepare annual operating and maintenance budgets.

5. Describe how to develop estimates for the following annual needs:

   A. Capital improvements and expansions;
   B. Spare parts and major replacements;
   C. Operating and laboratory personnel.

6. Explain the importance of each of the following factors in financing the operation of a wastewater treatment plant:

   A. Revenues;
   B. Improvements;
   C. Expenditures;
   D. Service charges;
   E. User rates.

7. What are municipal revenues and assessments?

8. Describe methods for establishing yearly maintenance and operating cost and periodic changes in those costs.

9. Describe methods of calculating costs for treating industrial wastewaters.

10. List several important considerations in purchasing materials for wastewater treatment operations. Why are some of these required by State law?

Wastewater Plant Security

Restrict Access to System:

1. Why are hardwired surveillance systems better than wireless systems?

   Hardwired surveillance systems provide more security than wireless systems. This is true because the hardwired surveillance systems signal are transmitted directly to the receiver and wireless systems are transmitted over the airway. When the signal is transmitted over the airway it is susceptible to a cyber-attack (computer hacking).

2. What types of protection will a closed Circuit Television (CCTV) provide wastewater plants?

   Closed circuit TV (CCTV) installed around the perimeter of a wastewater plant help in providing detection and deterrence of unauthorized persons entering the facility.

3. What types of protection will adequate lighting around wastewater treatment plant perimeter provide?

   Adequate lighting around a wastewater treatment plant's perimeter fencing may result in deterrence and detection.

4. From a security perspective, what is the best practice for wastewater treatment plants?

   Vegetation around the perimeter of a wastewater plant should not obstruct the view of critical components.

5. From a security perspective, what is the best practice for the delivery of chemicals and other such supplies?

   Chemical deliveries should be performed in the presence of wastewater system personnel. Verify the credentials of all delivery drivers. Match all delivered goods with manifest and purchase order.

6. Before allowing vendor or contractor personnel unescorted access to a wastewater facility, facility owners should?

   Before allowing vendor or contractor personnel unescorted access to a wastewater facility, the wastewater facility owner may want to adopt a security policy that requires vendors to have an employee screening process.

7. How can concrete "Jersey" barriers be used to provide security?

   Concrete security "Jersey" barriers are a means of preventing accidental or intentional vehicle intrusion into a facility. Concrete security "Jersey" barriers are the best physical counter measure to guard against intentional vehicle intrusion at the wastewater treatment plant. Install concrete "Jersey" barrier to protect critical components.

8. What are some critical components of a public awareness program?

Uniforms, identification cards for personnel, and system logos on wastewater system vehicles and critical components.

Implement System's Communication System:

9. What is a way to identify resources, personnel, and equipment that might be needed to respond to an emergency?

   One way to identify resources, personnel, and equipment that might be needed to respond to an emergency is to enter into a mutual aid agreement.

10. What are some actions to take to avoid confusion and conflict that might arise during an emergency response?

    Define the type of assistance to be provided in writing in the mutual aid agreement and identify the chain of command that activates the agreement.

11. What is the most effective way to disseminate information to the public in the event of an emergency?

    Designate one spokesperson for the system.

12. From a security perspective, what is not considered a component of an effective community outreach program?

    Public facility tours stressing the importance of critical infrastructure is not a component of an effective community outreach.

13. How should customers and the public be notified of health hazards caused by the disruption wastewater treatment?

    By the fastest means available

Implement Security Procedures for Personnel:

14. Security awareness program

    An advantage of a security awareness program is that it involves the employees in the security program in a positive manner.

15. What is the most significant limitation of an employee security screening process?

    The most significant limitation of an employee security screening program is that historical data will not necessary reveal issues that may lead to dishonest behaviors.

16. What is the most significant disadvantage of a vendor or contractor employee security

screening process?

The most significant disadvantage of a vendor or contractor employee security screening process is that it may cause increased costs from vendors due to the need to implement additional controls.

Protect Sensitive Information About the Wastewater Facility:

17. How often should passwords on computers used at wastewater facilities be changed?

    At a minimum, passwords on computers used at wastewater facilities should be changed every 90 days.

18. What is one measure that can be taken to prevent the lost of data records if there is an intrusion into the SCADA system?

    Intrusion into the SCADA system may result in damage or loss to the operating system, data records, set-point information and the SCADA software. Wastewater facilities should consider backing up critical applications and databases to an offsite facility.

19. What is the most effective way to secure computers used for SCADA systems from cyber-attacks (computer hackers)?

    In order to most effectively secure computers used for SCADA systems from cyber-attacks (computer hackers) at wastewater facilities is for the computer not to be connected to the Internet.

20. Describe protection of sensitive documents that may be found in wastewater facilities vehicles.

    Often wastewater facilities contain schematics, maps, and other sensitive documents. To protect these sensitive documents before parking the vehicle at the end of the day any critical information should be removed.

21. Describe how to manage critical computer data.

    In case your computer is damaged or suffers from a hacker attack, it is a good idea to regularly copy critical data on backup tapes or disks and store them at a secure off-site location.

22. What is a vulnerability assessment?

    A vulnerability assessment is a systematic process for evaluating the susceptibility of critical facilities to potential threats and identifying corrective actions that can reduce of mitigate the risk o f serious consequences associated with these threats?

Emergency Response Plan:

23. What is an emergency response plan?

An emergency response plan is a document describing the actions that a wastewater facility would enact during disasters or other unexpected incidents. Portions of the emergency response plan tied to the vulnerability assessment for wastewater facilities should be distributed to only those with a “need to know”. Preparing emergency response plans for wastewater systems is the responsibility of local officials. An emergency response plan for a wastewater facility should be specific for the facility.

24. How often should an emergency response plan be reviewed and updated?

    Annually

25. At a minimum, how often should contact lists on emergency response plans be verified?

    Quarterly

26. Identify the four phases of emergency management that should be addressed in emergency response plans.

    Preparedness, response, recovery, and mitigation

Mathematics

Definitions and Conversion Factors

1. **Arithmetic Mean** - The sum of the values divided by the number of values or, simply, the average.

2. **Circumference of a circle** - The length of the external boundary of a circle.

3. **Chlorine Dosage** - The amount of chlorine added to wastewater.

4. **Chlorine Demand** - The difference between the amount of chlorine added to wastewater and the amount of residual chlorine remaining after a given contact time. Chlorine demand may change with dosage, time, temperature, pH, nature and the amount of impurities in wastewater.

Chlorine Demand = Chlorine Dosage - Chlorine Residual

5. **Chlorine Residual** - The quantity of chlorine in excess of the chlorine demand, expressed in mg/l. The residual must remain for a sufficient contact time, usually 30 minutes, to insure the killing of pathogens.

6. **Detention Time** - The time required to fill a tank at a given flow or the theoretical time required for a given flow of wastewater to pass through a tank.

7. **Diameter of a circle** - The distance from one side of a circle to the other, passing through the center.

8. **Geometric Mean** - For any set of values, it is the *n*th root of the product of the individual values where *n* is equal to the number of individual values. It is equivalent to the antilog of the arithmetic means of the logarithms of the individual values and is used in averaging results from the fecal coliform analysis because an extreme value has a lesser influence on the final result.

9. **Hydraulic Loading** - This is the number of gallons of wastewater applied per day per square foot (or per acre) of filter surface. The hydraulic loading for a standard rate trickling filter is usually between 25 to 100 gal/day/sq. ft. and for a high rate trickling filter the hydraulic loading may be between 100 to 1000 gal/day/ft^2.

10. **Milligram per liter (mg/l)** - One-thousandth of a gram in one liter of solution.
    e.g. : 1 mg/l = 0.001 gram in 1 liter

11. **Trickling Filter Organic Loading** - This is the number of pounds of BOD per day per 1000 cubic feet of filter medium. Pounds per acre-foot or per cubic yard of filter medium are also occasionally used. The organic loading for a standard rate trickling filter is 5 to 25 pounds of BOD per day per one thousand cubic feet of media. The organic loading for a high rate trickling filter is usually between 25 to 300 pounds of BOD per day per one thousand cubic feet of filter media.

12. **Population Equivalent** - A means of expressing the strength of organic material in wastewater. In a domestic wastewater system, microorganisms use up about 0.2 pounds of BOD per day for each person using the system (as measured by the standard BOD

test).

13. **Part per million (ppm)** - This term is used interchangeably for milligram per liter (mg/l) with the explanation for that interchangeability being as follows:

$$\frac{1 \text{ milligram}}{1 \text{ liter}}$$

$$= \frac{1 \text{ milligram}}{1{,}000 \text{ milliliters}}$$

$$= \frac{1 \text{ milligram}}{1{,}000 \text{ milliliters} \times 1000 \text{ milligrams per millilite}}$$

$$= \frac{1 \text{ milligram}}{1{,}000{,}000 \text{ milligrams}}$$

$$= \frac{1 \text{ part}}{1 \text{ million parts}}$$

= 1 part per million or 1 ppm

14. **Radius of a circle** - One-half of the diameter or the distance from the center of the circle to a side of the circle.

15. **Sludge Age** - Average time in days a particle of suspended solids remains under aeration in the activated sludge process.

16. **Sludge Volume Index (SVI)** - This is a calculation used to indicate the settling ability of activated sludge (aerated solids) in the secondary clarifier. The calculation is a measure of the volume of sludge compared with its weight.

17. **Surface Settling Rate** - This term is expressed in terms of gpd/sq. ft. of tank surface area. The suggested surface settling rate varies from 300-1200 gallons per day per square foot of surface area.

18. **Velocity** - The time rate of motion in a given direction or, simply, the speed.

19. **Volume** - The capacity of a container or the amount it can hold.

20. **Weir Diameter** - Circular clarifiers have a circular weir within the outside edge of the clarifier. All of the water leaving the clarifier flows over this weir. The diameter is the length of the line from one edge of a weir to the opposite edge and passing through the center of the circle formed by the weir.

21. **Weir Overflow Rate** - Wastewater leaves the clarifier by flowing over some type of weir arrangement. The number of linear feet of weir in relation to the flow is important to prevent short circuits or high velocity near the weir which might pull settling solids into the effluent. The weir overflow rate is the number of gallons of wastewater that flow over one linear foot of weir per day. Most designers recommend 10,000 to 20,000 gallons per day

per linear foot of weir.

22. **Total Suspended Solids (TSS), mg/l** $= \frac{\text{dry solids in grams x 1000 mg/g x 1000 ml/l}}{\text{sample volume in mls}}$

or $= \frac{\text{weight of solids in mg x 1000 mls/l}}{\text{sample volume in mls}}$

23. **Total Solids (TS), mg/l =** $\frac{\text{A - B x 1000}}{\text{sample volume in mL}}$

where A = weight of dish + dried residue in milligrams
B = weight of dish in milligrams

24. **Volatile Solids (VS), mg/L =** $\frac{\text{(A - B) x 1000}}{\text{sample volume in mL}}$

where A = weight of residue + dish before ignition in milligrams
B = weight of residue + dish after ignition in milligrams

25. Percent (%) Volatile Solids = $\frac{\text{(A - C) x 100}}{\text{A-B}}$

where A = weight of dish + dried residue in milligrams
B = weight of dish in milligrams
C = weight of residue + dish after ignition in milligrams

26. **F/M (food to microorganism) ratio** $= \frac{\text{BOD (or COD) in mg/l x MGD x 8.34}}{\text{MLVSS in mg/l x aeration basin vol. in MG x 8.34}}$

27. **Brake horsepower (Brake HP)** $= \frac{\text{flow in gpm x total head in ft}}{\text{3960 x pump efficiency}}$

28. **Motor horsepower (Motor HP)** $= \frac{\text{gpm x total head in ft}}{\text{3960 x pump efficiency x motor efficiency}}$

29. **Loss of Alkalinity due to Nitrification, mg/l** = 7.2 mg/l of alkalinity is consumed per mg/l of NH_3 converted to NO_3. (*Please note that some literature sources use 7.1 or 7.14 mg/l as the conversion factor.)

30. **Pump electrical costs per year**

= hp x 0.746 kW/hp x # of hrs pump operates per day x cost ($) per kW/hr x 365 day/yr.

31. **Watts** = volts x amps = $\frac{\text{voltage}}{\text{ohms}}$

32. **BOD_5, mg/l (seeded)** = $\frac{[(DO_1 - DO_5) - (\text{seed correction})] \times 300 \text{ mL}}{\text{mL of sample volume}}$

Where:

seed correction = $\frac{\text{5 day depletion of seed sample}}{\text{mL seed}}$

DO_1 = Initial DO, in mg/L
DO_5 = DO after 5 days, in mg/L

33. Percent (%) Reduction of Volatile Solids in a digester = $\frac{\%\text{ In} - \%\text{ Out}}{\%\text{ In} - (\frac{\%\text{ In} \times \%\text{ Out}}{100})} \times 100$

34. Dry solids to a digester, lbs/day = sludge in gpd x 8.34 lbs/gal x $\frac{\%\text{ Total solids}}{100}$

35. **Volatile Solids to a digester, lbs/day**

= sludge in gpd x 8.34 lbs/gal x $\frac{\%\text{ Total Solids}}{100}$ x $\frac{\%\text{ Vol. Solids}}{100}$

36. **Volatile Solids Destroyed in a digester, lbs/day/ft^3**

= $\frac{\text{Volume of sludge in gal/day x \% solids x \% volatile x \% reduction x 8.34}}{\text{Digester volume in } ft^3}$

37. **Return Activated Sludge (RAS) Rate calculated using Settleability**

MGD = Secondary influent flow, MGD x Return Sludge Rate Ratio

where the **Return Sludge Rate Ratio** = $\frac{\text{30 min settled sludge volume in ml/l}}{\text{clear liquid volume in ml/l}}$

or = $\frac{\text{30 min settled sludge volume in ml/l}}{\text{1000 ml/l – 30 minute settled sludge volume in ml/l}}$

38. **Volume/Concentration conversion**

= mls x normality = mls x normality
or mls x concentration = mls x concentration

39. **Total waste activated sludge (WAS) in MGD**

= current rate in MGD + additional rate in MGD

Appendix 1: Wastewater Rules

North Carolina Administrative Code

Title 15A

Department of Environment and Natural Resources

Division of Water Quality

Subchapter 8G
Section .0100 through
Section .1100

WATER POLLUTION CONTROL SYSTEM OPERATORS RULES

Last Amended on December 1, 2006

Water Pollution Control System Operators
Certification Commission

Raleigh, North Carolina

SUBCHAPTER 8G - AUTHORITY: ORGANIZATION: STRUCTURE: DEFINITIONS

SECTION .0100 - GENERAL PURPOSE AND DEFINITIONS

15A NCAC 08G .0101 PURPOSE

The purpose of these Rules is to:

(1) protect the public health of the citizens of the State; and
(2) conserve, protect, and maintain the quality of the water resources of the State as assigned by the North Carolina Environmental Management Commission; and
(3) protect the public investment in water pollution control systems; and
(4) provide for the classification of water pollution control systems; and
(5) establish the procedures for the examination and certification of operators of water pollution control systems.

History Note: *Authority G.S. 90A-35;*
Eff. April 1, 1999.

15A NCAC 08G .0102 DEFINITIONS

(a) "Activated sludge" means a biological wastewater treatment process in which predominantly biodegradable pollutants in wastewater are absorbed, or adsorbed, by living aerobic organisms and bacteria in an aerated suspension which is separated from the treated wastewater gravimetrically.
(b) "Actual experience" means the time working as a water pollution control system operator or operator in responsible charge. An operator is an individual whose principal job responsibility is the actual physical operation of process equipment and systems at a water pollution control system. Primary job responsibilities such as laboratory testing, facility and equipment maintenance, administrative support, or direct or indirect supervision do not qualify as actual experience.
(c) "Approved training" means any training, required in order to be eligible for an examination or to meet continuing education requirements as established in accordance with 15A NCAC 08G .0400 and 15A NCAC 08G .0701. The standards for approved training shall be developed by a committee consisting of representatives for training sponsors, DWQ staff, instructors and certified operators. The standards must be approved by the Commission and shall be known as "Water Pollution Control System Operator Certification Commission Training Course Standards" or "Needs to Know". These standards can be found at http://h20.enr.state.nc.us/tacu.
(d) "Back-up ORC" means Back-up Operator in Responsible Charge and refers to the operator who is designated to act as surrogate for the Operator in Responsible Charge (ORC) when the ORC is absent from his or her professional duties as set forth in G.S. 90A-44.
(e) "Basic sciences" means courses in agronomy, biology, botany, chemistry, engineering, environmental health and sciences, geology, math, physics, soil science, and zoology offered by an accredited college or university.
(f) "Chemical process" means a water pollution control system process consisting exclusively of the addition of chemicals to treat wastewaters.
(g) "Collection system" means a continuous connection of pipelines, conduits, pumping stations and other related constructions or devices used to conduct wastewater to a water pollution control system.
(h) "Commission" means the Water Pollution Control System Operators Certification Commission created by G.S. 143B-300.
(i) "Contact Hour" means one hour of Commission approved operator instruction in accordance with 15A NCAC 08G .0701.
(j) "Contract operations firm" means any commercial water pollution control system operations firm which contracts with the owner of a water pollution control system to provide operational services for the system pursuant to G.S. 90A-45(a).
(k) "Contract operator" means any certified water pollution control system operator who contracts with the owner of a water pollution control system to provide operational and other services for the system pursuant to G.S. 90A-45(a).
(l) "Electrodialysis system" means a system utilizing a selective separation of dissolved solids process that is based on electrical charge and diffusion through a semipermeable membrane.
(m) "Fixed growth" means a biological wastewater treatment system in which the wastewater is treated by contact with a biological growth that is affixed to support media and includes systems such as trickling filters, rotating biological contactors, and biological tower treatment systems.
(n) "GED" means general educational development in reference to a high school diploma equivalency.
(o) "Nutrient Reduction" means the reduction of total nitrogen or total phosphorous by an activated sludge or fixed growth process.
(p) "Operator in Training (OIT)" means the certificate issued with Commission approval to an individual prior to the completion of the experience requirements for that level of certification.

(q) "Operator in Responsible Charge (ORC)" means the individual designated by a person, firm, or corporation (municipal or private) owning or having control of a water pollution control system as the operator of record of the water pollution control system and who has primary responsibility for the operation of such system as defined in G.S. 90A-46.
(r) "Owner" means the person, firm, or corporation (municipal or private) owning or having control of a water pollution control system as described in G.S. 90A-44.
(s) "Passing score" means earning 70 percent of the available points on an examination administered by the Commission.
(t) "Permanent certificate" means the certificate of competency issued by the Commission to an individual as the result of the individual obtaining a passing score on an examination administered by the Commission, or a certificate issued by reciprocity agreement by the Commission, and is subject to the provisions of G.S. 90A-40(a).
(u) "Physical/Chemical system" means any water pollution control system which utilizes a physical or a chemical process or both.
(v) "Physical process" means any water pollution control system process consisting of electrodialysis, adsorption, absorption, air stripping, gravimetric sedimentation, flotation or filtration as the means of treatment.
(w) "Reciprocity certificate" means a certificate issued of the appropriate type and grade without examination to any person who is properly registered on the "National Association of Boards of Certification" Reciprocity Register and who meets all other requirements of these Rules as set forth in G.S. 90A-40(b).
(x) "Regional office" means one of the seven local offices of the Division of Water Quality located across the State.
(y) "Residuals" means any solid or semisolid byproduct that is produced by the treatment of wastewater in a water pollution control system.
(z) "Reverse osmosis system" means a system which utilizes solutions and semipermeable membranes to separate and treat wastewaters.
(aa) "Successful completion" means the attendance of at least 80 percent of the approved training for examination eligibility and 100 percent of training for continuing education.
(bb) "Temporary certificate" means a certificate issued of an appropriate type and grade, without examination, to any person employed as a water pollution control system operator when the Commission finds that the supply of certified operators, or persons with the training and experience necessary for certification, is inadequate and the situation meets the requirements set forth in G.S. 90A-40(e).
(cc) "Ultrafiltration system" means a system which utilizes a membrane filter process to remove pollutants from wastewater.
(dd) "Valid certificate" means the certificate of an operator that has all required renewal fees paid, all required continuing education training completed, and has not been revoked relinquished, invalidated, or suspended.
(ee) "Water pollution control system" means any system for the collection, treatment, or disposal of wastewater and is classified under the provisions of G.S. 90A-37.

History Note: *Authority G.S. 143B-300;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

SECTION .0200 - DUTIES AND RESPONSIBILITIES

15A NCAC 08G .0201 RESPONSIBILITY OF SYSTEM OWNERS TO DESIGNATE CERTIFIED OPERATORS

Owners of classified water pollution control systems must designate operators, certified by the Water Pollution Control System Operators Certification Commission (WPCSOCC), of the appropriate type and grade for the system, and, for each classification must:

(1) designate one Operator In Responsible Charge (ORC) who possesses a valid certificate of the type and grade at least equivalent to the type and grade of the system;
(2) designate one or more Back-up Operator(s) in Responsible Charge (Back-up ORCs) who possesses a valid certificate of the type of the system and no more than one grade less than the grade of the system, with the exception of no backup operator in responsible charge is required for systems whose minimum visitation requirements are twice per year; and
(3) submit a signed completed "Water Pollution Control System Operator Designation Form" to the Commission (or to the local health department for owners of subsurface systems) countersigned by the designated certified operators, designating the Operator in Responsible Charge (ORC) and the Back-up Operator in Responsible Charge (Back-up ORC):
    (a) 60 calendar days prior to wastewater or residuals being introduced into a new system; or
    (b) within 120 calendar days following:
        (i) receiving notification of a change in the classification of the system requiring the designation of a new Operator in Responsible Charge (ORC) and Back-up Operator in Responsible Charge (Back-up ORC) of the proper type and grade; or
        (ii) a vacancy in the position of Operator in Responsible Charge (ORC) or Back-up Operator in Responsible Charge (Back-up ORC).

(c) within seven calendar days of vacancies in both ORC and Back-up ORC positions replacing or designating at least one of the responsibilities.

History Note: *Authority G.S. 90A-37; 90A-38; 90A-39; 90A-40; 90A-41; 90A-42; 90A-43; 90A-44; 90A-45;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0202 RESPONSIBILITIES OF SYSTEM OWNERS

History Note: *Authority G.S. 90A-37 through 90A-45;*
Eff. April 1, 1999;
Repealed Eff. December 1, 2006.

15A NCAC 08G .0203 RESPONSIBILITIES OF ALL CERTIFIED OPERATORS

Certified operators must:

(1) comply with all terms and conditions of their certification as set forth in these Rules;
(2) notify the Commission, in writing, within 30 calendar days of any changes in their mailing address;
(3) be responsible for the renewal of their certification(s) as specified in Section .0700 of this Subchapter; and
(4) comply with all statutes and rules regarding the operation of water pollution control systems.

History Note: *Authority G.S. 90A-40; 90A-41; 90A-42; 90A-44;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0204 RESPONSIBILITIES OF AN OPERATOR IN RESPONSIBLE CHARGE (ORC)

An Operator in Responsible Charge (ORC) of a water pollution control system must:

(1) possess a valid certificate of the appropriate type and grade for the system;
(2) visit the system as often as is necessary to insure the proper operation of the system but in no case less frequently than specified in the following schedule, unless otherwise specified in permit:
    (a) biological grade I systems with the exception of Sub-item (2)(e) of this Rule; weekly;
    (b) biological grade II, III, and IV systems, other than those systems specified in Sub-item(2)(f) of this Rule; five days per week, excluding holidays;
    (c) surface irrigation systems with the exception of Sub-item (2)(e) of this Rule; weekly;
    (d) collection systems; within 24 hours of knowledge of a bypass, spill, or overflow of wastewater from the system unless visited by a collection system Back-up Operator in Responsible Charge;
    (e) domestic wastewater systems with a treatment capacity of 1500 gallons per day or less; twice per year with a six month interval between visits;
    (f) domestic wastewater aerobic treatment units (ATUs) with a treatment capacity of 1500 gallons per day or less; weekly;
    (g) systems permitted under rules adopted by the Commission for Health Services; as required by 15A NCAC 18A .1961;
    (h) physical/chemical systems:
        (i) grade I systems, including groundwater remediation systems; weekly;
        (ii) grade II systems; five days per week, excluding holidays
    (i) land application systems during or within 48 hours after application of residuals;
    (j) systems not otherwise classified; as specified by the Commission based on the complexity of the system;
(3) operate and maintain the system efficiently and attempt to insure the compliance of the system with any permit(s) issued for the system as well as any other applicable local, state, and federal environmental permitting and regulatory requirements;
(4) certify, by signature, as to the validity of all monitoring and reporting information performed on the system as prescribed in any permit issued for the system and provide the owner a copy;
(5) document the operation, maintenance, and all visitation of the system in a daily log that must be maintained at the system;
(6) notify the owner of the system as soon as possible, and in writing within five calendar days of first knowledge, of any:
    (a) overflows from the system or any treatment process unit;
    (b) bypasses of the system or any treatment process unit; or
    (c) violations of any limits or conditions of the permit.
(7) notify the owner, in writing, of the need for any system repairs and modifications that may be necessary to

insure the compliance of the system with all local, state, and federal environmental permitting and regulatory requirements;

(8) be available:
  (a) for consultations with the system owner and regulatory officials;
  (b) to handle emergency situations; and
  (c) to provide access to the facility by regulatory agencies; and

(9) upon vacating an ORC position, notify the Commission and the appropriate regional office of the Division of Water Quality (or the local health department for owners of subsurface systems) of the vacancy, in writing within 14 calendar days.

History Note: *Authority G.S. 90A-37 through 90A-40; 90A-44;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0205 RESPONSIBILITIES OF A BACK-UP OPERATOR IN RESPONSIBLE CHARGE (BACK-UP ORC)

The Back-up Operator in Responsible Charge (Back-up ORC):

(1) may act as surrogate for the Operator in Responsible Charge (ORC), if he/she possesses a valid certificate of the appropriate type and grade for the system, for a period:
  (a) not to exceed 40 percent of the system visitations required per calendar year under Rule .0204(2) of this Section; or
  (b) not to exceed 120 consecutive calendar days when the Operator in Responsible Charge (ORC) is absent due to:
    (i) the vacancy of the Operator in Responsible Charge (ORC) position; or
    (ii) personal or familial illness; and

(2) must fulfill all of the requirements of Rule .0204 of this Section when acting as surrogate for the Operator in Responsible Charge (ORC); and

(3) upon vacating a Backup ORC position, notify, in writing, the Commission and the appropriate regional office of the Division of Water Quality (or the local health department for owners of subsurface systems) of the vacancy within 14 calendar days.

History Note: *Authority G.S. 90A-37; 90A-44;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

SECTION .0300 - CLASSIFICATION OF WATER POLLUTION CONTROL SYSTEMS

15A NCAC 08G .0301 APPLICABILITY

(a) The purpose of this Section is to establish procedures for the classification of water pollution control systems.

(b) Not withstanding the requirements in Rules .0302 through .0307 of this Section, the Commission may modify the classification of a water pollution control system when:

(1) conditions created by system design features, or inherent operational requirements, exist which make normal operation of the system more or less complex;
(2) upgrades or other modifications to a system are completed; or
(3) changes in Commission classification rules are made.

(c) In-plant processes and related water pollution control equipment which are integral parts of direct industrial production, are not considered water pollution control systems for the purpose of this Section.

(d) Water Pollution Control Systems permitted under rules adopted by the Commission for Health Services shall be classified pursuant to Rule .0307 of this Section.

(e) Water Pollution Control Systems permitted under rules adopted by the Environmental Management Commission shall be classified pursuant to Rules .0302 through .0308 of this Section.

(f) Reservoirs, settling ponds and associated pumps and piping which are an integral part of closed-loop water recycle systems for the non-biological and non-toxic treatment of process water at sand, gravel, crushed stone and similar operations shall not be subject to the requirements of these Rules unless the Commission determines that the system is not being properly operated or maintained in accordance with permit conditions.

(g) Any water pollution control system, regardless of type or ownership, may be classified and required to designate an Operator in Responsible Charge (ORC) and a Back-up Operator in Responsible Charge (Back-up ORC), in the event that the Commission determines that the system is not being properly operated or maintained.

History Note: *Authority G.S. 90A-37;*

Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0302 CLASSIFICATION OF BIOLOGICAL WATER POLLUTION CONTROL TREATMENT SYSTEMS

(a) The following discharging systems are assigned a classification of Grade I Biological Water Pollution Control System unless the permitted flow, or operational complexity of the system requires a higher classification:

(1) septic tank/sand filter systems;
(2) biological lagoon systems; and
(3) constructed wetlands and associated appurtenances.

(b) Systems that utilize an activated sludge or fixed growth process with a permitted flow less than or equal to 0.5 million gallons per day (mgd) are assigned the classification of Grade II Biological Water Pollution Control System.

(c) Systems utilizing an activated sludge or fixed growth process with permitted flows of greater than 0.5 through 2.5 million gallons per day (mgd) are assigned the classification of Grade III Biological Water Pollution Control System.

(d) Systems utilizing an activated sludge or fixed growth process with a permitted flow greater than 2.5 million gallons per day (mgd) are assigned a classification of Grade IV Biological Water Pollution Control System.

(e) Any system receiving a classification of Grade II Biological Water Pollution Control System that is required to achieve nutrient reduction is assigned the classification of Grade III Biological Water Pollution Control System.

(f) Any system receiving a classification of Grade III Biological Water Pollution Control System that is required to achieve nutrient reduction is assigned the classification of Grade IV Biological Water Pollution Control System.

History Note: *Authority G.S. 90A-37;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0303 CLASSIFICATION OF WATER POLLUTION CONTROL COLLECTION SYSTEMS

(a) Water pollution control collection systems operated to convey wastewater to water pollution control systems which are permitted or tributary to municipalities, regional water pollution control systems, water and sewer authorities, public utilities, or are a Grade II, III or IV state or federally owned system, are subject to classification in accordance with Rule .0303(b) of this Section. Any collection system, regardless of ownership, is classified pursuant to this Rule and required to designate an Operator in Responsible Charge (ORC) and a Back-up Operator in Responsible Charge (Back-up ORC) if the Commission determines that the system is not being operated and maintained in a manner which prevents the escape of wastewater from the system into the environment.

(b) Collection systems are assigned the lower grade classification that is either:

(1) the same as the grade of the biological water pollution control system to which the collection system is tributary; or
(2) based on the population served by the collection system in accordance with the following chart:
    (A) 1,500 or less Grade I;
    (B) 1,501 to 15,000 Grade II;
    (C) 15,001 to 50,000 Grade III;
    (D) 50,001 or more Grade IV.

In the event that the population served cannot be determined, the equivalent population served shall be calculated by using the design flow of the system divided by a flow of 60 gallons per day per person.

History Note: *Authority G.S. 90A-37;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0304 CLASSIFICATION OF SURFACE IRRIGATION WATER POLLUTION CONTROL SYSTEMS

(a) Systems which utilize surface irrigation for the treatment, reuse or disposal of wastewater are classified as surface irrigation water pollution control systems. Those systems which contain only preliminary treatment processes such as septic tanks, sand filters, oil/water separators, lagoons, storage basins, physical screening, or sedimentation processes are not subject to additional operator requirements as specified in Rule .0302 or .0306 of this Section.

(b) Any surface irrigation system that has, as part of its treatment process, systems other than those specified in Paragraph (a) of this Rule, is subject to additional classification pursuant to these Rules.

History Note: *Authority G.S. 90A-37;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0305 CLASSIFICATION OF LAND APPLICATION OF RESIDUALS SYSTEMS

Systems permitted for the land application of:

(1) residuals that are produced by a water pollution control system; or

(2) contaminated soils;

are classified as a land application of residuals system.

History Note: *Authority G.S. 90A-3;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0306 CLASSIFICATION OF PHYSICAL/CHEMICAL WATER POLLUTION CONTROL TREATMENT SYSTEMS

(a) Any water pollution control system, including systems designed for the remediation of contaminated groundwater, that utilizes a primarily physical process to treat wastewaters is classified as a Grade I Physical/Chemical Water Pollution Control System.

(b) Any water pollution control system that utilizes a primarily chemical process to treat wastewaters, including those systems whose treatment processes are augmented by physical processes, is classified as a Grade II Physical/Chemical Water Pollution Control System. Any reverse osmosis, electrodialysis, and ultrafiltration system is classified as a Grade II Physical/Chemical Water Pollution Control System.

(c) Any water pollution control system that has, as part of its treatment process, a biological water pollution control system is subject to additional classification as a biological water pollution control system.

(d) Any water pollution control system subject to classification under Rule .0302 of this Section, utilizing a physical or chemical process to enhance an activated sludge or fixed growth process, is not subject to additional classification under this Rule.

History Note: *Authority G.S. 90A-37;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0307 CLASSIFICATION OF SUBSURFACE WATER POLLUTION CONTROL SYSTEMS

(a) Systems permitted under rules adopted by the Environmental Management Commission which utilize the soil for the subsurface treatment and disposal of wastewater shall be classified as subsurface water pollution control systems.

(b) Any subsurface water pollution control system that is required to have a certified operator under 15A NCAC 18A .1961 shall be deemed classified as a subsurface water pollution control system.

(c) Any subsurface water pollution control system that has as part of its treatment process a water pollution control system that may be classified under Rules .0302 through .0307 of this Section shall be subject to additional classification. If the subsurface system consists only of septic tanks, pump tanks, siphon or pump dosing systems, sand filters, grease traps or grease interceptors, or oil/water separators, and subsurface disposal of the wastewater, no additional classification will be required.

History Note: *Authority G.S. 90A-37;*
Eff. April 1, 1999.

15A NCAC 08G .0308 SYSTEMS NOT OTHERWISE CLASSIFIED

The Commission may classify any water pollution control system which is not otherwise classified when that system is receiving wastewater that has distinctly different characteristics from typical domestic wastewater or is a water pollution control system which contains treatment processes that are sufficiently different from the conventional treatment processes classified in Rules .0302 through .0306 of this Section.

History Note: *Authority G.S. 90A-37;*
Eff. April 1, 1999.

SECTION .0400 - ELIGIBILITY REQUIREMENTS FOR EXAMINATIONS

15A NCAC 08G .0401 GENERAL REQUIREMENTS

(a) An applicant for certification as an operator of a water pollution control system must meet the following criteria and possess the knowledge and abilities listed as they relate to the specific type of system for which certification is being sought and shall, at a minimum, include:

(1) possess a high school diploma or a general educational development (GED) equivalent;
(2) be at least 18 years of age;
(3) have a general knowledge of typical wastewater characteristics and treatment processes; and
(4) have the ability to:
  (A) read and understand the statutes and rules which govern water pollution control system operators and the operation of the type of system for which certification is being sought;
  (B) perform mathematical calculations required to operate the system for which certification is being sought;
  (C) complete and maintain logs and regulatory reporting forms required to document the proper operation of the system; and
  (D) safely and effectively operate the equipment employed in the type of system for which certification is being sought; and
  (E) describe the general maintenance requirements for such equipment.

(b) An applicant who has failed to achieve a passing score on a specific type and grade of examination after three consecutive attempts must:

(1) attend and successfully complete approved training for the same type and grade as the certification being sought; and
(2) provide verification, in the form of a certificate of completion or other such documentation, of the successful completion of the required training with any subsequent application made to the Commission to sit for the examination.

(c) An applicant for certification must not have had any certification revoked by the Commission within the two - year period prior to the date of the application for certification.

(d) An applicant for certification is not allowed to sit for any examination offered by the Commission during the period of a suspension of any certification held by the applicant with the Commission.

(e) An applicant who holds a valid biological or collection certification of any level on April 1, 1999, may progress to the highest level of certification of the same type without meeting the requirements of Subparagraph (a)(1) of this Rule.

History Note: *Authority G.S. 90A-37;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0402 ELIGIBILITY REQUIREMENTS FOR BIOLOGICAL WATER POLLUTION CONTROL SYSTEM OPERATORS

Eligibility for certification as a Biological Water Pollution Control System Operator is based on the following qualifications:

(1) for Grade I certification, the applicant must:
  (a) have successfully completed approved training for Grade I Biological Water Pollution Control System operators.
(2) for Grade II certification, the applicant must:
  (a) hold a valid North Carolina Grade I Biological Water Pollution Control System Operator certificate;
  (b) have 6 months of actual experience at a Grade II or higher biological water pollution control system; and
  (c) have successfully completed approved training for Grade II Biological Water Pollution Control System operators.
(3) for Grade III certification, the applicant must:
  (a) hold a valid North Carolina Grade II Biological Water Pollution Control System Operator certificate;
  (b) have successfully completed approved training for Grade III Biological Water Pollution Control System operators; and
  (c) either:
    (i) have two years of actual experience at a Grade II, or higher, biological water pollution control system, or
    (ii) be a graduate of two or four year college or university and have taken, and passed, a

minimum of six courses in the basic sciences and have 18 months of actual experience at a Grade II, or higher, biological water pollution control system.

(4) for Grade IV certification, the applicant must:
  (a) hold a valid North Carolina Grade III Biological Water Pollution Control System Operator certificate;
  (b) have successfully completed approved training for Grade IV Biological Water Pollution Control System operators; and
  (c) either:
    (i) have three years of actual experience at a Grade III, or higher, biological water pollution control system, or
    (ii) be a graduate of a two or four year college or university and have taken, and passed, a minimum of six courses in the basic sciences and have two years of actual experience at a Grade III, or higher, biological water pollution control system.

History Note: *Authority G.S. 90A-39.*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0403 ELIGIBILITY REQUIREMENTS FOR WATER POLLUTION CONTROL COLLECTION SYSTEM OPERATORS

Eligibility for certification as a Water Pollution Control Collection System Operator is based on the following qualifications:

(1) for Grade I certification, the applicant must: have successfully completed approved training for Grade I water pollution control collection system operators.
(2) for Grade II certification, the applicant must:
  (a) hold a valid North Carolina Grade I Water Pollution Control Collection System Operator certificate;
  (b) have six months of actual experience in water pollution control collection system operations; and
  (c) have successfully completed approved training for Grade II water pollution control collection system operators.
(3) for Grade III certification, the applicant must:
  (a) hold a valid North Carolina Grade II Water Pollution Control Collection System Operator certificate;
  (b) have successfully completed approved training for Grade III water pollution control collection system operators; and
  (c) either:
    (i) have two years of actual experience in water pollution control collection system operations, or
    (ii) be a graduate of a two or four year college or university and have taken and passed, a minimum of six courses in a field directly related to the operation and maintenance of a collection system, e.g. civil, mechanical, or environmental engineering, and have one year of actual experience in the operation of a water pollution control collection system.
(4) for Grade IV certification, the applicant must:
  (a) hold a valid North Carolina Grade III Water Pollution Control Collection System Operator certificate;
  (b) have successfully completed approved training for Grade IV water pollution control collection system operators; and
  (c) either:
    (i) have three years of actual experience in water pollution control collection system operations, or
    (ii) be a graduate of a two or four year college or university and have taken and passed, a minimum of six courses in a field directly related to the operation and maintenance of a collection system, e.g. civil, mechanical, or environmental engineering, and have two years of actual experience in the operation of a water pollution control collection system.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0404 ELIGIBILITY REQUIREMENTS FOR LAND APPLICATION OF RESIDUALS OPERATORS

An applicant for certification as a Land Application of Residuals Operator must have successfully completed approved training for land application of residuals operators and:

(1) have one year of actual experience in the land application of residuals;
(2) be a graduate of a two or four year college or university and have taken and passed a minimum of six courses in the basic sciences; or
(3) hold a valid grade III or higher biological water pollution control system operator certification.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0405 ELIGIBILITY REQUIREMENTS FOR PHYSICAL/CHEMICAL WATER POLLUTION CONTROL SYSTEM OPERATORS

Eligibility for certification as a Physical/Chemical Water Pollution Control System Operator is based on the following qualifications:

(1) for the Grade I have successfully completed approved training for Grade I Physical/Chemical Water Pollution Control System Operators.
(2) for the Grade II:
    (a) possess a valid Grade I Physical/Chemical Water Pollution Control System Operator certificate;
    (b) have one year of actual experience at a Grade II Physical/Chemical Water Pollution Control System; and
    (c) have successfully completed approved training for Grade II Physical/Chemical Water Pollution Control System Operators.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0406 ELIGIBILITY REQUIREMENTS FOR SURFACE IRRIGATION WATER POLLUTION CONTROL SYSTEM OPERATORS

An applicant for certification as a Surface Irrigation Water Pollution Control System Operator must have successfully completed approved training for surface irrigation water pollution control system operators and:

(1) have one year of actual experience in the operation of a surface irrigation water pollution control system;
(2) be a graduate of a two or four year college or university and have taken and passed a minimum of six courses in the basic sciences;
(3) be a private homeowner who intends to operate only his/her own domestic spray irrigation water pollution control system; or
(4) hold a valid grade III or higher biological water pollution control system operator certification.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0407 ELIGIBILITY REQUIREMENTS FOR SUBSURFACE WATER POLLUTION CONTROL SYSTEM OPERATORS

An applicant for certification as a Subsurface Water Pollution Control System Operator must have successfully completed approved training for subsurface water pollution controls system operator and:

(1) have one year of actual experience in the operation of a subsurface water pollution control system;
(2) be a graduate of a two or four year college or university and have taken and passed a minimum of six courses in the basic sciences;
(3) be a private homeowner who intends to operate only his/her own domestic subsurface water pollution control system; or
(4) hold a valid grade III or higher biological water pollution control system operator certification.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0408 ELIGIBILITY REQUIREMENTS FOR OPERATOR IN TRAINING (OIT) CERTIFICATION

(a) The Commission may allow an applicant for any water pollution control system operator certificate to take the examination if the individual has met all of the prerequisite education and certification requirements but is unable to meet the actual experience requirement.
(b) Upon achieving a passing score on the examination, the applicant shall be issued an Operator In Training (OIT) certificate of the same type and grade as the examination.
(c) The Operator In Training (OIT) must not be designated as the Operator in Responsible Charge (ORC) or Back-up Operator In Responsible Charge (Back-Up ORC) of a system.
(d) Operator In Training (OIT) certificates must be renewed annually as stipulated in 15A NCAC 08G .0701.
(e) When the holder of an Operator in Training (OIT) certificate completes the prerequisite experience for the permanent certificate at that type and level, the holder must submit an application documenting the experience, with the appropriate fee for a replacement certificate in order to receive the permanent certificate at that level.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0409 ELIGIBILITY REQUIREMENTS FOR CONDITIONAL WATER POLLUTION CONTROL SYSTEM OPERATORS
Conditional Certificates shall remain valid contingent upon the individuals holding the certificates meeting renewal requirements as found in Section .0700 of this Subchapter.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0410 RECIPROCITY CERTIFICATION
(a) The Commission shall issue certification(s) to individuals certified in other States or legal jurisdictions if the individuals:
(1) meet or exceed all eligibility requirements or the equivalent thereof as determined by the Commission as found in Rules .0302 to .0308 of the Section, with the exception of completion of approved training,
(2) complete Application for Reciprocity Form and submit it with the appropriate non-refundable fee as specified in G.S. 90A-42,
(3) provide a letter of verification from certifying State agency that applicant is certified at stated level and that no disciplinary actions are outstanding against the applicant, and
(4) apply for and achieve a passing score on a Commission-administered examination of the same type and grade as that for which reciprocity certification is being requested. The requirement for completion of approved training is waived in the case of applicants pursuant to this Rule.
(b) Applicants pursuant to this Rule must not have taken and failed to achieve a passing score on a Commission – administered examination of the same type and grade as that for which reciprocity certification is being requested, within the previous two year period prior to the date of application for reciprocity.
(c) Applicants failing to achieve a passing score on three or more examinations of the same type and grade as that for which certification is being requested, must successfully complete approved training for that certification before being eligible for that examination.
(d) Applicants who obtain certification by providing false information to the Commission shall be subject to disciplinary actions as set forth in Section .0800 of this Subchapter.

History Note: *Authority G.S. 90A-4; 90A-40;*
Eff. December 1, 2006.

SECTION .0500 - CERTIFICATION BY EXAMINATION

15A NCAC 08G .0501 APPLYING FOR EXAMINATION
(a) All applications for examination submitted to the Commission must be:
(1) submitted on an a WPCSOCC Examination Application;
(2) accompanied by the appropriate non-refundable application fee per G.S. 90A-42;
(3) completed in entirety with all required information, documentation, and signatures provided; and
(4) postmarked at least 30 days prior to the scheduled date of the examination if an examination is scheduled.
(b) Upon receipt of an application by the Commission, the application shall be reviewed for completeness and a determination as to the eligibility of the applicant to sit for the requested examination shall be made. Incomplete applications shall be returned to the applicant.
(c) Each applicant shall be notified, in writing, of the applicant's eligibility to sit for the requested examination. Individuals

determined to be eligible for an examination shall be sent written notification containing information concerning the date, time and location of the examination. This written notification shall be considered a receipt from the Commission to the applicant for the examination fee. Applicants found to be ineligible for an examination shall be sent written notification of the ineligibility determination.
(d) Any applicant who obtains certification by supplying false information to the Commission shall be subject to disciplinary action(s) as set forth in Section .0800 of this Subchapter.

History Note: *Authority G.S. 90A-39; 90A-41; 90A-42;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0502 INELIGIBLE APPLICANTS

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Repealed Eff. December 1, 2006.

15A NCAC 08G .0503 EXAMINATION ADMINISTRATION
(a) The Commission shall set the dates, times, and locations for all examinations.
(b) Examinations may be administered by the Commission at any time, or at any location, when a sufficient number of applications have been received to warrant such an examination.
(c) Before each applicant receives an examination paper, an applicant shall display a valid driver's license, photo identification or other form of identification satisfactory to the proctor.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0504 EXAMINATION GRADING
(a) A passing score on any examination administered by the Commission is 70 percent of the available points on the examination.
(b) Each applicant, and only the applicant, shall be notified, in writing, of the results on an examination.
(c) If a passing score is attained by an applicant on an examination, the written notification to the applicant shall constitute the certification of the applicant as an operator or operator in training of a water pollution control system of the same type and grade as the examination.

History Note: *Authority G.S. 90A-39; 90A-40;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0505 EXAMINATION REVIEWS
(a) Any applicant who fails to make a passing score on an examination may request to review the examination. All requests to review an examination must be received by the Commission in writing within 15 calendar days of receiving notification of failing to make a passing score on an examination.
(b) Applicants who submit a written request to review an examination shall be notified of a date, time, and location at which the applicant shall be given the opportunity to review the examination. This shall be the only opportunity the applicant will be allowed for reviewing the examination.
(c) An applicant shall not be allowed to review the examination within 30 calendar days of an upcoming examination date.

History Note: *Authority G.S. 90A-39;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

SECTION .0600 - CERTIFICATION WITHOUT EXAMINATION

15A NCAC 08G .0601 RECIPROCITY CERTIFICATION

History Note: *Authority G.S. 90A-40; 90A-42;*
Eff. April 1, 1999;
Repealed Eff. December 1, 2006.

15A NCAC 08G .0602 TEMPORARY CERTIFICATES

(a) Temporary certificates, of any type and grade, may be issued by the Commission to the operator of a water pollution control system, for a period not to exceed one year, due to:

(1) the vacancy of the Operator in Responsible Charge (ORC) or the Back-up Operator in Responsible Charge (Back-up ORC);

(2) the suspension or revocation of the certification of the Operator in Responsible Charge (ORC) or the Back-up Operator in Responsible Charge (Back-up ORC);

(3) a change in the classification of the system due to a permit modification or the completion of an upgrade or expansion; or

(4) a modification to Commission rules.

(b) Temporary Certificates shall only be issued for the Operator in Responsible Charge (ORC) or the Back-up Operator in Responsible Charge (Back-up ORC) of the system specified on the application.

(c) All applications for a temporary certificate must:

(1) be submitted by the owner of the system for the applicant;

(2) be accompanied by the required fee; and

(3) include a letter from the owner that contains:

(A) an explanation for the need of a temporary certificate for the applicant;

(B) an explanation of all of the efforts that were made to employ an operator who possessed the required certification;

(C) a statement designating the applicant as either the Operator in Responsible Charge (ORC) or Back-up Operator in Responsible Charge (Back-up ORC) of the system; and

(D) a plan that describes the actions that:

(i) the applicant will pursue in order to attempt to obtain permanent certification during the effective period of the temporary certificate; and

(ii) the owner of the system will be pursuing in the event that the applicant fails to obtain permanent certification during the effective period of the temporary certificate.

(d) Applicants for a temporary certificate must:

(1) Either:

(A) for biological or collection system grade II or higher operator certification, possess a valid certificate of the same type as the system and that is no more than one grade lower than the classification of the system when applying as an Operator in Responsible Charge (ORC) and no more than two grades lower than the classification of the system when applying as a Back-up Operator in Responsible Charge (Back-up ORC); or

(B) for a Grade I biological, Grade I Physical/Chemical, Grade I Collection, Surface Irrigation, Land Application, or Subsurface Water Pollution Control System; have a minimum of three months of actual experience in the operation of the type of system for which a temporary certificate is being applied if the temporary certificate is requested.

(2) be eligible for permanent certification prior to the expiration date of the temporary certificate;

(3) not have made three previous unsuccessful attempts to make a passing score on the same type and grade examination as the temporary certificate; and

(4) have never relinquished, nor had revoked, any water pollution control operator certificate issued by the Commission.

(e) Applicants who obtain a temporary certificate by providing false information to the Commission shall be subject to disciplinary action(s) as set forth in Section .0800 of this Subchapter.

History Note: *Authority G.S. 90A-40; 90A-42;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0603 TEMPORARY CERTIFICATE RENEWAL

(a) All applications for renewal of a temporary certificate must:

(1) be submitted by the owner of the system 60 calendar days prior to the expiration date of the original temporary certificate;

(2) be accompanied by the required fee; and

(3) include a letter from the owner that explains:

(A) the need for renewal of the temporary certificate;

(B) the reasons for the failure of the applicant to obtain permanent certification during the original effective period of the temporary certificate;

(C) the efforts that have been made by the owner to employ a properly certified operator during the

effective period of the original temporary certificate; and

(D) the actions that will be taken by:

(i) the applicant in order to obtain permanent certification during the effective period of the renewed temporary certificate; and

(ii) the owner if the applicant does not obtain permanent certification during the effective period of the renewed temporary certificate.

(b) The renewal request shall be denied if the applicant has failed:

(1) to seek permanent certification by examination during the original effective period of the temporary certificate; or

(2) to obtain permanent certification after four examination attempts during the original effective period of the temporary certificate.

(c) A temporary certificate may be renewed only once for the same operator.

(d) Applicants who obtain a temporary certificate renewal by providing false information to the Commission shall be subject to disciplinary action(s) as set forth in Section .0800 of this Subchapter.

History Note: *Authority G.S. 90A-40; 90A-42;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0604 CONVERSION OF VOLUNTARY CERTIFICATION TO MANDATORY CERTIFICATION

History Note: *Authority G.S. 90A-39; 90A-40; 90A-42;*
Eff. April 1, 1999;
Repealed Eff. December 1, 2006.

SECTION .0700 - RENEWAL OF CERTIFICATION

15A NCAC 08G .0701 REQUIREMENTS

(a) In order to maintain a valid certificate, the certificate must be renewed annually by:

(1) Submitting payment of the appropriate required annual renewal fee, as set forth in G.S. 90A-42, by the end of the effective year; and

(2) Each operator must provide documentation of a minimum of six contact hours of Commission approved training during each year following the year of initial certification.

(b) Certificate(s) that are not renewed when due shall be considered invalid. In order to renew a certificate that has been invalid for up to two years, all outstanding renewal fees and supplemental processing fees and penalties that have accrued since the certificate was last renewed must be paid and all accrued continuing education requirements must be met. In order to renew a certificate that has been invalid for two or more consecutive years the operator shall be required to take and make a passing score on an examination of the same type and grade as the former certificate. In order to qualify for the examination, all relevant requirements of Section .0400 of this Subchapter must be met. Any requirements in Section .0400 of this Subchapter for Commission approved training must have been met within the previous 12 month period. Invalid Conditional Certificates are not renewable.

(c) Renewal notices shall be mailed to each certified operator, at the last known address for the operator on file with the Commission, 60 calendar days prior to the renewal due date. Failure to receive a renewal notice does not relieve a certified operator of the responsibility to renew the certificate by the renewal due date.

History Note: *Authority G.S. 90A-40; 90A-42; 90A-44; 90A-46.1;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

SECTION .0800 - DISCIPLINARY ACTIONS

15A NCAC 08G .0801 GROUNDS FOR DISCIPLINARY ACTIONS

The Commission may take disciplinary actions, in accordance with Rule .0802 of this Section, against a certified operator for:

(1) practicing fraud or deception in the performance of duties;

(2) failure to use reasonable care or judgment in the performance of duties;

(3) failure to apply their knowledge or ability in the performance of duties;

(4) incompetence or the inability to perform duties;

(5) supplying false information in order to obtain or maintain certification; or

(6) cheating on a certification examination.

History Note: *Authority G.S. 90A-41;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0802 DISCIPLINARY ACTIONS

(a) The Commission shall revoke or suspend the certification of an operator or issue a letter of reprimand to an operator in accordance with the provisions of G.S. 90A-41, 150B-3 and this Rule.

(b) The Chairman of the Commission may issue notification of summary suspension, the intention to revoke or suspend the certification of an operator or the intent to issue a letter of reprimand.

(c) The Chairman shall convene an advisory committee to review the circumstances of the proposed disciplinary action(s).

(1) The advisory committee shall include at least:
   (A) the Chairman of the Commission;
   (B) the Vice Chairman of the Commission;
   (C) the member of the Commission who represents the type of system at which the operator is employed or another member of the Commission appointed by the Chairman of the Commission; and
   (D) a certified operator appointed by the Chairman.
(2) The members of the advisory committee shall offer guidance to the Commission chairman in regards to the actions that should be taken against an operator.

(d) Notification of the advisory committee meeting shall be sent by certified mail at least 15 calendar days prior to the date of the meeting, to the last known address of the operator. This notification shall contain the alleged facts or conduct upon which the proposed revocation or suspension of the certification or letter of reprimand is based.

(e) The operator shall have an opportunity to submit a written response to the Chairman prior to the date of the advisory committee meeting. The operator shall also be given the opportunity to make an oral statement before the advisory committee.

(f) Within 10 working days of the conclusion of the advisory committee meeting, the Chairman shall issue a decision. If this decision is to issue a revocation or suspension or a letter of reprimand, the Chairman shall advise the operator of the effective date of the action and the facts or conduct upon which the action is based. The revocation or suspension of a certification or the letter of reprimand shall be delivered to the affected operator and the owner of the system(s) at which the operator works by certified mail, at the last known address for the operator and owner on file with the Commission, at least 20 calendar days prior to the effective date of the revocation or suspension or letter of reprimand.

(g) The revocation, suspension or letter of reprimand becomes a final Commission action if the operator does not file a petition for a contested case hearing in the Office of Administrative Hearings as provided in the Administrative Procedure Act, G.S. 150B.

(h) If an applicant is caught cheating on an examination by a proctor of the examination, the applicant shall be excused from the examination, the examination shall not be graded, the fee for the examination shall be forfeited by the applicant and any other certification(s) held by the applicant with the Commission shall be subject to revocation as set forth in G.S. 90A-41 and in this Rule.

(i) If the Commission determines, after the examination has been graded, that an applicant cheated on an examination and certification has been conveyed to the applicant, the certification obtained through the examination shall be revoked and any other certification(s) held by the applicant with the Commission shall be subject to revocation as set forth in G.S. 90A-41 and in this Rule.

History Note: *Authority G.S. 90A-40; 90A-41; 143B-300; 150B-23;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0803 CERTIFICATION FOLLOWING DISCIPLINARY ACTIONS

(a) An individual who has had certification revoked by the Commission shall petition the Commission for any new certification sought and may not petition the Commission for such new certification sooner than two years after the effective date of the revocation. Following the denial of eligibility for re-certification after relinquishment or revocation, an operator must wait one year before reapplying for certification.

(b) The following information must be included in the petition for certification:

(1) a written statement explaining the actions that the individual has taken to correct those problems that lead to the revocation of the certification previously held with the Commission; and
(2) a statement that attests to the Commission that, upon obtaining certification, the individual shall comply with all laws governing the proper operation of water pollution control systems.

(c) After submittal of the petition for certification, the petitioner may be required to appear before the Commission at a

regularly scheduled meeting. The petitioner shall be notified, by certified mail, of the date, time and location of the meeting at least 15 calendar days prior to the meeting.
(d) Within 120 calendar days following receipt of a petition for certification, the Commission shall notify the individual, in writing, of its decision to deny or grant examination eligibility in accordance with the procedures set forth in Section .0500 of this Subchapter. Eligibility for certification shall be granted only if there is substantial evidence that those conditions that lead to the revocation of previous certification held by the petitioner have been corrected.
(e) Certification of an individual whose previous certification has been revoked shall occur only after the individual sits for, and obtains a passing score on, an examination. Once approval is granted by the Commission for certification after reviewing the petition for certification, the individual must submit an application, accompanied by the appropriate examination fee, and meet the examination eligibility requirements for the type of certification being sought as set forth in Section .0400 of this Subchapter. The individual must begin the certification process at the lowest grade level offered for the type of certification sought. Operational experience accrued by the individual prior to the revocation of any previously held certification(s) shall not be considered when determining the eligibility of the individual for the examination.
(f) Applicants for certification who were previously determined to be ineligible for certification due to supplying false information to the Commission must follow the procedures set forth in Paragraphs (a) through (e) of this Rule in order to obtain certification.

History Note: *Authority G.S. 90A-39; 90A-41; 150B-23;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

15A NCAC 08G .0804 CONTESTED CASE PROCEDURES
(a) Administrative hearings shall be held in accordance with G.S. 150B and the administrative hearing procedures codified at 15A NCAC 01B .0200 et seq., are hereby incorporated by reference including any subsequent amendments and additions.
(b) For information on obtaining a copy of 15A NCAC 01B .0200, you may contact the Rules Division of the NC Office of Administrative Hearings at (919) 733-2678.

History Note: *Authority G.S. 143B-300; 150B-23;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

SECTION .0900 - CONTRACT OPERATION OF WATER POLLUTION CONTROL SYSTEMS

15A NCAC 08G .0901 RESPONSIBILITIES OF CONTRACT OPERATORS AND CONTRACT OPERATIONS FIRMS
Each contract operator, or contract operations firm, that enters into a contract with the owner of a water pollution control system to operate the system must notify the owner, in writing, within five calendar days of:

(1) any change in the designation of the Operator in Responsible Charge (ORC) or the Back-up Operator in Responsible Charge (Back-up ORC) of the system; or
(2) becoming aware of any situation or problem (preexisting, anticipated, or otherwise) which may interfere with the proper operation of the system and necessitate corrective action by the owner. This notice shall include the comments and recommendations of the operator in regards to actions or measures that should be taken to correct the noted situation or problem.

History Note: *Authority G.S. 90A-44; 90A-45;*
Eff. April 1, 1999.

15A NCAC 08G .0902 ANNUAL REPORT

History Note: *Authority G.S. 90A-45;*
Eff. April 1, 1999;
Repealed Eff. December 1, 2006.

SECTION .1000 - RULE MAKING PROCEDURES AND PETITIONS FOR REGULATORY ACTIVITY

15A NCAC 08G .1001 PETITIONS FOR REGULATORY ACTIVITY
(a) Any person(s) desiring to request the adoption, amendment, or repeal of a rule may make such request in a petition filed

pursuant to G.S. 150B-20, addressed to the Water Pollution Control System Operators Certification Commission and mailed to the Chairman at 1618 Mail Service Center, Raleigh, NC 27699-1618. Such petitions must contain:

(1) a draft of the proposed rule or a summary of its intent;
(2) reasons for adoption of the proposed rule(s) and the effect it will have on existing rules and practices; and
(3) the name(s) and address(es) of the petitioner(s).

(b) Petitions shall be placed on the agenda of the next regularly scheduled meeting of the Commission if received at least four weeks prior to the meeting. The Chairman shall prepare recommended responses to petitions for the Commission's consideration. Petitions shall be considered in accordance with the requirements of G.S. 150B-20.

History Note: *Authority G.S. 143B-300; 150B-20;*
Eff. April 1, 1999;
Amended Eff. December 1, 2006.

SECTION .1100 - ADMINISTRATIVE DUTIES

15A NCAC 08G .1101 REFUNDING OF FEES

History Note: *Authority G.S. 90A-42;*
Eff. April 1, 1999;
Repealed Eff. December 1, 2006.

Appendix 2: NPDES Permit

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF WATER QUALITY

PERMIT

TO DISCHARGE WASTEWATER UNDER THE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of North Carolina General Statute 143-215.1, other lawful standards and regulations promulgated and adopted by the North Carolina Water Quality Commission, and the Federal Water Pollution Control Act, as amended,

Town of Mount Pilot
Mount Pilot Wastewater Management Facility

is hereby authorized to discharge wastewater from a facility located at

Mount Pilot WWMF
Old Barney Road
North of Mount Pilot
Happy County

to receiving waters designated as Bee Creek in the Clear River Basin

in accordance with the discharge limitations, monitoring requirements, and other conditions set forth in Parts I, II, III, and IV hereof.

This permit shall become effective February 1, 2004.

This permit and the authorization to discharge shall expire at midnight on May 31, 2008.

Signed this day December 31, 2003.

Alan W. Klimek, P.E., Director
Division of Water Quality
By the Authority of the Environmental Management Commission

SUPPLEMENT TO PERMIT COVER SHEET

All previous NPDES Permits issued to this facility, whether for operation or discharge, are hereby revoked. [The exclusive authority to operate this facility arises under this permit. The authority to operate the facility under previously issued permits bearing this number is no longer effective.] The conditions, requirements, terms and provisions of this permit authorizing discharge under the NPDES govern discharges from this facility.

Town of Mount Pilot
Mount Pilot Wastewater Management Facility

is hereby authorized to:

1. Continue to operate an existing **2 MGD** wastewater treatment facility consisting of mechanical bar screens, manual bar screen, grit chamber, preaeration, primary clarifiers, biological nutrient removal, extended aeration basins, secondary clarifiers, polishing ponds, tertiary filters, methanol feed system, chlorination and dechlorination, post aeration, and anaerobic digesters located at Mount Pilot WWMF, Old Barney Road, north of Mount Pilot, Happy County, and

2. Discharge wastewater from said treatment works at the location specified on the attached map into Bee Creek which is classified C Sw-NSW waters in Clear River Basin.

3. Continue to operate a water reclamation and distribution system to provide beneficial reuse for treated effluent from the treatment plant, as approved pursuant to Permit No. WQ0000000.

A. (1.) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS – FINAL

During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge up to **2 MGD** of municipal wastewater from outfall 001. Such discharges shall be limited and monitored by the Permittee as specified below:

Effluent Characteristics	*Limits*			*Monitoring Requirements*		
	Monthly Average	**Weekly Average**	**Daily Maximum**	**Measurement Frequency**	**Sample Type**	**Sample Location**[1]
Flow	14 MGD			Continuous	Recording	Influent or Effluent
BOD, 5 day (20ºC)[2] [April 1 – October 31]	5.0 mg/l	7.5 mg/l		Daily	Composite	Influent & Effluent
BOD, 5 day (20ºC)[2] [November 1 – March 31]	10.0 mg/l	15.0 mg/l		Daily	Composite	Influent & Effluent
Total Suspended Solids[2]	30.0 mg/l	45.0 mg/l		Daily	Composite	Influent & Effluent
NH_3 as N [April 1 – October 31][3] [Through October 31, 2004]	2.0 mg/l	6.0 mg/l		Daily	Composite	Effluent
NH_3 as N [Nov. 1 – March 31][3] [Through October 31, 2004]	4.0 mg/l	12.0 mg/l		Daily	Composite	Effluent
NH_3 as N [April 1 – October 31][3] [Beginning November 2004]	1.0 mg/l	3.0 mg/l		Daily	Composite	Effluent
NH_3 as N [Nov. 1 – March 31][3] [Beginning November 2004]	2.0 mg/l	6.0 mg/l		Daily	Composite	Effluent
Dissolved Oxygen[4]				Daily	Grab	Effluent
Dissolved Oxygen				3/Week	Grab	Upstream & Downstream
Fecal Coliform (geometric mn)[5]	200/100 ml	400/100 ml		Daily	Grab	Effluent
Fecal Coliform (geometric mean)				3/Week	Grab	Upstream & Downstream
Total Residual Chlorine[6]			18 µg/l	Daily	Grab	Effluent
TKN (mg/l)	Monitor & Report			Weekly	Composite	Effluent
NO2-N + NO3-N (mg/l)	Monitor & Report			Weekly	Composite	Effluent
TN (mg/l)[7]	Monitor & Report			Weekly	Composite	Effluent
Total Monthly Flow (MG)	Monitor & Report			Monthly	Calculated	Effluent
TN Load[8]	Monitor & Report 157,684 lb/year (Annual Mass Loading)[9]			Monthly Annually	Calculated Calculated	Effluent Effluent
Total Phosphorus [10]	2.0 mg/L (*Quarterly Average*)			Weekly	Composite	Effluent
Temperature (ºC)				Daily	Grab	Effluent
Temperature (ºC)				3/Week	Grab	Upstream & Downstream
Conductivity				Daily	Grab	Effluent
Conductivity				3/Week	Grab	Upstream & Downstream
Chronic Toxicity[11]				Quarterly	Composite	Effluent
Total Copper				Monthly	Composite	Effluent
Total Zinc				Monthly	Composite	Effluent
pH[12]			6-9	Daily	Grab	Effluent

A. (1.) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS – FINAL
(Continued)

Footnotes:

1. Sample locations: Upstream at Old Buckcreek Road and downstream at NC Highway 251. Stream samples shall be grab samples and shall be collected 3/Week during June – September and 1/Week during the remaining months of the year. **Instream monitoring is provisionally waived in light of the permittee's participation in the Lower Clear Creek Basin Association. Instream monitoring shall be conducted as stated in this permit should the permittee end its participation in the Association.**

2. The monthly average effluent BOD5 and Total Suspended Solids concentrations shall not exceed 15% of the respective influent value (85% removal).

3. See Condition A.(5) regarding phased NH3-N limits. More stringent NH3-N limits shall become effective November 1, 2004.

4. The daily average dissolved oxygen effluent concentration shall not be less than 7.0 mg/l.

5. Refer to Condition A. (6) regarding fecal coliform limits.

6. Total residual chlorine monitoring is required only if chlorine or a chlorinated compound is used as a disinfectant (or elsewhere in the process).

7. TN means Total Nitrogen. For a given wastewater sample, TN is the sum of Total Kjeldahl Nitrogen and Nitrate-Nitrite Nitrogen: $TN = TKN + NO_2\text{-}N + NO_3\text{-}N$.

8. TN Load is the mass load of TN discharged by the Permittee in a period of time. See Special Condition A.(2.), Calculation of TN Loads.

9. The annual TN Load limit shall become effective with the calendar year beginning on January 1, 2003. Compliance with this limits shall be determined in accordance with Special Condition A.(3.), Annual Limits for Total Nitrogen.

10. The quarterly average for total phosphorus shall be the average of composite samples collected weekly during the calendar quarter (January-March, April-June, July-September, October-December).

11. Chronic Toxicity (*Ceriodaphnia dubia*) P/F at 90%: February, May, August, and November [see Special Condition A.(4)]. Toxicity monitoring shall coincide with metals monitoring.

12. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

A.(2.) CALCULATION OF TOTAL NITROGEN LOADS

a. The Permittee shall calculate monthly and annual TN Loads as follows:

i. Monthly TN Load (lb/mo) = TN x TMF x 8.34

where:

TN = the average Total Nitrogen concentration (mg/L) of the composite samples collected during the month

TMF = the Total Monthly Flow of wastewater discharged during the month (MG/mo)

8.34 = conversion factor, from (mg/L x MG) to pounds

ii. Annual TN Load (lb/yr) = Sum of the 12 Monthly TN Loads for the calendar year

b. The Permittee shall report monthly Total Nitrogen results (mg/L and lb/mo) in the discharge monitoring report for that month and shall report each year's annual results (lb/yr) in the December report for that year.

A.(3.) ANNUAL LIMITS FOR TOTAL NITROGEN

a. Total Nitrogen (TN) allocations and TN Load limits for NPDES dischargers in the Neuse River basin are annual limits and are applied for the calendar year.

b. For any given calendar year, the Permittee shall be in compliance with the annual TN Load limit in this Permit if:

i. the Permittee's annual TN Load is less than or equal to said limit, or

ii. the Permittee is a Co-Permittee Member of a compliance association.

c. The TN Load limit in this Permit (if any) may be modified as the result of allowable changes in the Permittee's TN allocation.

i. Allowable changes include those resulting from purchase of TN allocation from the Wetlands Restoration Fund; purchase, sale, trade, or lease of allocation between the Permittee and other dischargers; regionalization; and other transactions approved by the Division.

ii. The Permittee may request a modification of the TN Load limit in this Permit to reflect allowable changes in its TN allocation. Upon receipt of timely and proper application, the Division will modify the permit as appropriate and in accordance with state and federal program requirements.

iii. Changes in TN limits become effective on January 1 of the year following permit modification. The Division must receive application no later than August 31 for changes proposed for the following calendar year.

iv. Application shall be sent to:

NCDWQ / NPDES Unit
Attn: Neuse River Basin Coordinator
1617 Mail Service Center
Raleigh, NC 27699-1617

d. If the Permittee is a member and co-permittee of an approved compliance association, its TN discharge during that year is governed by that association's group NPDES permit and the TN limits therein.

   i. The Permittee shall be considered a Co-Permittee Member for any given calendar year in which it is identified as such in Appendix A of the association's group NPDES permit.

   ii. Association roster(s) and members' TN allocations will be updated annually and in accordance with state and federal program requirements.

   iii. If the Permittee intends to join or leave a compliance association, the Division must be notified of the proposed action in accordance with the procedures defined in the association's NPDES permit.

      (1) Upon receipt of timely and proper notification, the Division will modify the permit as appropriate and in accordance with state and federal program requirements.

      (2) Membership changes in a compliance association become effective on January 1 of the year following modification of the association's permit.

e. The TN monitoring and reporting requirements in this Permit remain in effect until expiration of this Permit and are not affected by the Permittee's membership in a compliance association.

A. (4.) CHRONIC TOXICITY PERMIT LIMIT (QRTRLY)

The effluent discharge shall at no time exhibit observable inhibition of reproduction or significant mortality to *Ceriodaphnia dubia* at an effluent concentration of **90 %**.

The permit holder shall perform at a minimum, *quarterly* monitoring using test procedures outlined in the "North Carolina *Ceriodaphnia* Chronic Effluent Bioassay Procedure," Revised February 1998, or subsequent versions or "North Carolina Phase II Chronic Whole Effluent Toxicity Test Procedure" (Revised-February 1998) or subsequent versions. The tests will be performed *during the months of* **February, May, August, and November**. Effluent sampling for this testing shall be performed at the NPDES permitted final effluent discharge below all treatment processes.

If the test procedure performed as the first test of any single quarter results in a failure or ChV below the permit limit, then multiple-concentration testing shall be performed at a minimum, in each of the two following months as described in "North Carolina Phase II Chronic Whole Effluent Toxicity Test Procedure" (Revised-February 1998) or subsequent versions.

The chronic value for multiple concentration tests will be determined using the geometric mean of the highest concentration having no detectable impairment of reproduction or survival and the lowest concentration that does have a detectable impairment of reproduction or survival. The definition of "detectable impairment," collection methods, exposure regimes, and further statistical methods are specified in the "North Carolina Phase II Chronic Whole Effluent Toxicity Test Procedure" (Revised-February 1998) or subsequent versions.

All toxicity testing results required as part of this permit condition will be entered on the Effluent Discharge Monitoring Form (MR-1) for the months in which tests were performed, using the parameter code TGP3B for the pass/fail results and THP3B for the Chronic Value. Additionally, DWQ Form AT-3 (original) is to be sent to the following address:

Attention: North Carolina Division of Water Quality
Environmental Sciences Branch
1621 Mail Service Center
Raleigh, North Carolina 27699-1621

A. (4.) CHRONIC TOXICITY PERMIT LIMIT (QRTRLY) (cont'd.)

Completed Aquatic Toxicity Test Forms shall be filed with the Environmental Sciences Branch no later than 30 days after the end of the reporting period for which the report is made.

Test data shall be complete, accurate, include all supporting chemical/physical measurements and all concentration/response data, and be certified by laboratory supervisor and ORC or approved designate signature. Total residual chlorine of the effluent toxicity sample must be measured and reported if chlorine is employed for disinfection of the waste stream.

Should there be no discharge of flow from the facility during a month in which toxicity monitoring is required, the permittee will complete the information located at the top of the aquatic toxicity (AT) test form indicating the facility name, permit number, pipe number, county, and the month/year of the report with the notation of "No Flow" in the comment area of the form. The report shall be submitted to the Environmental Sciences Branch at the address cited above.

Should the permittee fail to monitor during a month in which toxicity monitoring is required, monitoring will be required during the following month.

Should any test data from this monitoring requirement or tests performed by the North Carolina Division of Water Quality indicate potential impacts to the receiving stream, this permit may be re-opened and modified to include alternate monitoring requirements or limits.

NOTE: Failure to achieve test conditions as specified in the cited document, such as minimum control organism survival, minimum control organism reproduction, and appropriate environmental controls, shall constitute an invalid test and will require immediate follow-up testing to be completed no later than the last day of the month following the month of the initial monitoring.

A. (5.) Effective Date for More Stringent NH3-N Limits

The limits of 2 mg/l (April 1 – October 31) and 4 mg/l (November 1 through March 31) shall be in effect until **November 1, 2004**, at which time new limits of 1 mg/l and 2 mg/l shall become effective.

A. (6.) Fecal Coliform Compliance Condition

Should the Town of Mount Pilot be deemed by the Division of Water Quality to be chronically noncompliant with the weekly average and/or monthly average fecal coliform limit after completion of the expansion to 14 MGD, the City shall submit plans and specifications within 90 days after notification by the Division. The plans and specifications shall provide for an adequately designed chlorine disinfection facility. If another method of disinfection is proposed, it should conform to conventional design parameters, as well as any minimum requirements specified by the Division. Bidding and subsequent construction of the project shall commence immediately after the issuance of the Authorization to Construct permit.

A. (7.) EFFLUENT POLLUTANT SCAN

The permittee shall perform an annual pollutant scan of its treated effluent for the following parameters:

Ammonia (as N)
Chlorine (total residual, TRC)
Dissolved oxygen
Nitrate/Nitrite
Total Kjeldahl nitrogen
Oil and grease
Total Phosphorus
Total dissolved solids
Hardness
Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc
Cyanide
Total phenolic compounds

Volatile organic compounds:

Acrolein
Acrylonitrile
Benzene
Bromoform
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane
2-chloroethylvinyl ether
Chloroform
Dichlorobromomethane
1,1-dichloroethane
1,2-dichloroethane
Trans-1,2-dichloroethylene
1,1-dichloroethylene
1,2-dichloropropane
1,3-dichloropropylene
Ethylbenzene
Methyl bromide
Methyl chloride
Methylene chloride
1,1,2,2-tetrachloroethane
Tetrachloroethylene
Toluene
1,1,1-trichloroethane
1,1,2-trichloroethane
Trichloroethylene
Vinyl chloride

Acid-extractable compounds:

P-chloro-m-cresol
2-chlorophenol
2,4-dichlorophenol
2,4-dimethylphenol
4,6-dinitro-o-cresol
2,4-dinitrophenol
2-nitrophenol
4-nitrophenol
Pentachlorophenol
Phenol
2,4,6-trichlorophenol

Base-neutral compounds:

Acenaphthene
Acenaphthylene
Anthracene
Benzidine
Benzo(a)anthracene
Benzo(a)pyrene
3,4 benzofluoranthene
Benzo(ghi)perylene
Benzo(k)fluoranthene
Bis (2-chloroethoxy) methane
Bis (2-chloroethyl) ether
Bis (2-chloroisopropyl) ether
Bis (2-ethylhexyl) phthalate
4-bromophenyl phenyl ether
Butyl benzyl phthalate
2-chloronaphthalene
4-chlorophenyl phenyl ether
Chrysene
Di-n-butyl phthalate
Di-n-octyl phthalate
Dibenzo(a,h)anthracene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3-dichlorobenzidine
Diethyl phthalate
Dimethyl phthalate
2,4-dinitrotoluene
2,6-dinitrotoluene
1,2-diphenylhydrazine
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclo-pentadiene
Hexachloroethane
Indeno(1,2,3-cd)pyrene
Isophorone
Naphthalene
Nitrobenzene
N-nitrosodi-n-propylamine
N-nitrosodimethylamine
N-nitrosodiphenylamine
Phenanthrene
Pyrene
1,2,4-trichlorobenzene

1. The total set of samples analyzed during the current term of the permit must be representative of seasonal variations.
2. Samples shall be collected and analyzed in accordance with analytical methods approved under 40 CFR Part 136.
3. Unless indicated otherwise, metals must be analyzed and reported as total recoverable.
4. Test results shall be reported to the Division in DWQ Form- DMR-PPA1 or in a form approved by the Director, within 90 days of sampling. Two copies of the report shall be submitted along with the DMRs to the following address: Division of Water Quality, Water Quality Section, Central Files, 1617 Mail Service Center, Raleigh, North Carolina 27699-1617.

Appendix 3: DMR Forms and Instructions

General Instruction for Completing DMRs

I. Facility Information

1.NPDES Permit No. - Number issued by the Division of Water Quality consisting of the letters "NC" followed by a seven digit number. Information from non-discharge facilities should not be reported on the MR series of forms.

2. Discharge No. - Three-digit number which corresponds to the effluent pipe for which the data are being reported (i.e., 001, 002, 003, etc.). Numbers are found within the NPDES permit.

3. Facility Name - Name of the facility as it appears on the NPDES permit.

4. Class - The class of the facility as designated by the Water Pollution Control System Operators Certification Commission. The rating will be either 0, I, II, III or IV. You should enter the water quality classification of the receiving stream in this space.

5. County - County in which the discharge outfall is located.

6. Operator In Responsible Charge -The printed name of the certified WWTP operator designated as operator in responsible charge. Unrated (class 0) facilities do not require an operator in responsible charge.

7. Grade - Certificate grade of the operator in responsible charge as awarded by the Water Pollution Control System Operators Certification Commission.

8. Certified Laboratory - Name of the certified laboratory (-ies) performing analyses (if applicable).

9. Person(s) Collecting Samples - Printed name of the individual who collected the sample for which the data was reported. In the case of several individuals, please specify as a group name, such as "operators" or "staff," etc.

10. Signature Of Operator In Responsible Charge- Dated signature of the operator in responsible charge. Each month’s report must include an original signature in ink. Copies are not acceptable.

II. Data Reporting

1. Operator Arrival Time -Record the time of arrival of a certified operator using a 2400 clock value. If the facility is staffed by operators 24 hours a day, record the arrival time of the 1st shift operator.

2. Operator Time On Site - Record the number of hours spent by certified operators at the facility. If the facility is staffed on all three shifts, enter "24." If more than one operator is on duty at the same time, this value is not the sum of all hours worked by the operators, but the total number of hours the facility was staffed.

3. ORC On Site? - Record yes (Y) or no (N) as to whether the designated ORC visited the site on that date. If the designated backup operator served as ORC on a particular day, record "B" in this column for that date. It is also appropriate to record "H" in the cell if the date is a legal holiday.

4. Data - Enter the analytical results for each sample under the appropriate parameter code in the row that corresponds to the day upon which the sample was taken. Please note that Flow should always be reported as a decimal number (do not use scientific notation) in units of millions of gallons per day (MGD), unless the permit states otherwise.

5. Parameter Codes - Codes for the more commonly monitored parameters can be found on the back of form MR-1 or MR-1.1. Click here if you are uncertain about the correct code for a particular parameter, or please contact your local DWQ Regional Office, a member of the Point Source Compliance/Enforcement Unit staff.

6. Units of Measurement - All data values must be accompanied by corresponding units of measurement, noted at the top of the data column for the particular parameter. If your permit contains a numeric limit for any parameter, then the reporting units must be the same units of measurement of that limit. If your reporting units are other than those on the pre-printed form, the printed units should be marked out and the reporting units be clearly designated at the top of the column.

7. Additional Parameters - Enter the appropriate parameter code, name of the parameter and units of measurement in the space provided.

8. Average, Maximum, Minimum - Enter the average, maximum and minimum values for the results recorded in the data column. Please note no average is to be calculated for pH. Any average for Fecal Coliform is to be calculated as a geometric mean. If you are uncertain about how to calculate the geometric mean, please contact your local DWQ Regional Office or a member of the Point Source Compliance/Enforcement Unit staff. If only one value is reported for a parameter during the reporting month, that value should be reported as the average, maximum and minimum.

9. Sample Type - Enter the sample description in each column for which data is being reported. Enter the letter "C" for composite or the letter "G" for grab.

10. Monthly Limit - Enter the monthly limit for each parameter as found in the current NPDES permit, Special Order by Consent or Judicial Order by Consent.

III. Facility Status Information

1. Facility Status - Mark the appropriate box to show whether facility was compliant or noncompliant with regard to permit, SOC or JOC requirements. If noncompliant, use the comment section to explain in detail the course of action taken or to be taken to achieve compliance.

2. Signature of Permittee - Record the name of the permittee or his or her authorized agent (printed or typed), the dated signature of that person and a mailing address and phone number at which he or she may be reached during working hours. If someone other than the permittee

is to be the signatory, the requirement noted by the double asterisk "**" must be met. Also record the expiration date of the current permit in this section. While this is not on the form, you may also wish to provide an e-mail address in this space that can provide the Division with another avenue of communication.

IV. Stream Monitoring Information

1. Stream - Name of the stream from which the upstream or downstream monitoring samples are taken.
2. Location - Location of the site on the stream from which the sample was taken. This may be recorded as a distance (e.g. "100 feet upstream of outfall") or a specific location (e.g. "S.R. 1111").

V. General

1. Submitting Reports - An original and one copy of each month's monitoring report is required to be submitted to the Division of Water Quality's Central Files office (address listed on form MR-1) and must be received by the Division within thirty (30) days after the end of the month for which the report is made.

2. Appearance - Forms must be completed in ink. Please make all entries on forms legible. All information other than signatures must be printed or typed. If you fill out forms by hand, please make sure the originals are completed in ink and that all entries are legible. Copies of the original report must also be readable and must include a reproduction of the back side of the effluent reporting form containing the permittee's certification. If you utilize a computer-generated report, you must also ensure that the report is legible and that proper copies are made. DWQ will notify if you are the user of a form that is deemed deficient and will advise you of what modifications need to be made.

3. Calculations(a) Averages All averages are to be calculated as the arithmetic mean of the recorded values with the exception of that of Fecal Coliform, which is to be calculated as a geometric mean. If you are uncertain about how to calculate the geometric mean, please contact your local DWQ Regional Office or a member of the Point Source Compliance/Enforcement Unit staff.
(b) Use of "less than" values For calculation purposes only, recorded values of less than a detectable limit (< #.##) may be considered to equal zero (0) for all parameters except Fecal Coliform, for which values of "less than" may be considered to be equal to one (1). Values of testing results which are less than a detectable limit should be reported in the daily cells using the "less than" symbol (<) and the detectable limit used during the testing (or the value with appropriate unit conversion). Please note there is never a case when an average would need to be recorded along with a "less than" symbol.
(c) Use of "greater than" values Such values are only expected (and then only infrequently) in the reporting of Fecal Coliform and BOD. If a "greater than" value is reported, the numeric portion of the value should be sufficiently high so as to make the facility aware of the extent of any problems with treatment efficiency. Upon receipt of "greater than" testing results, a facility should consult its laboratory to see if changes in testing procedure need to be made in order to get discreet values from the analysis. For calculation purposes only, the numeric portion of the value must be used to calculate either an arithmetic or geometric mean.

4. Enforcement - Failure to comply with any of the requirements listed above may result in the facility being issued a Notice of Violation or being subject to other appropriate enforcement action.

5. Order of Report Forms-DMR submittals typically include the results of monitoring of the facility's effluent, its influent and its receiving stream. It is requested that for any DMR, the report be bound with the Effluent page(s) (DWQ form MR-1 or MR-1.1) on top, followed by the Influent page (form MR-2, if influent monitoring is required) and finally the Upstream/Downstream page (form MR-3).
6. Number of Reports-You are required to submit the original and one copy of the report to DWQ. Each copy should be a discreet report for the month, put together in the order described above.

7. Multiple Submittals-School systems and contract operations, please take note of this request. If you submit reports for multiple permits within one mailing, please bind together the submittals (original and one copy) for the various facilities. Please do not segregate the reports into any other type of organization (e.g., binding together all effluent or stream monitoring pages). To do so will cause reports to be taken apart and placed together properly, which slows processing and introduces opportunity for mistakes to be made. If you send many DMRs in one envelope, it is advisable that you send a summary sheet along with the DMRs that lists what reports are contained in the package.

8. Permits for Other Program Areas-Please note that this discussion pertains to submittal of DMRs required of NPDES permittees (point source discharges – pipes to streams). You may have permits for activities in other program areas such as DWQ's non-discharge program (wastewater spray irrigation or land application of residuals) or the Division of Environmental Health's public water supply program (drinking water). Please consult those permits for instructions for their submittal. It is not advisable to submit any other reports along with your DMR submittals.

9. Toxicity Reporting-Some permittees will have monitoring requirements for Toxicity within their permits. Please be aware that this parameter has a dual reporting requirement. Results of toxicity testing should be reported on DMR forms, but the toxicity testing results forms must be submitted to the Aquatic Toxicity Unit at the address listed below.

Aquatic Toxicology Unit
DWQ Environmental Sciences Branch
1621 Mail Service Center Raleigh, NC 27699-1621

10. Corrected or Amended Reports-In the event that you omit or erroneously report data on a DMR, the information should be updated with the submittal of an amended report. To best handle the amended data, the following procedure is recommended.

A. Regenerate or make a copy from your files of the DMR previously submitted to DWQ.

B. Make changes to the individual data points on the form, including updated summary information.

C. Initial and highlight changes to the original submittal.

D. At the top of the reporting page, write very conspicuously: "Amended Report" or "Corrected Report."

E. Provide a short cover page describing the changes to the DMR or note changes in the comment area on the back of the MR-1 form.

Use of this procedure will be a great help to DWQ's data entry staff. Without specifically identifying changes on the DMR, each data point must be evaluated between the original and amended reports to ensure the values in our database are correct. Calling attention to just those values that are changed both speeds up our processes and decreases the possibility for errors to be made.

11. Contacts-DWQ deals with a tremendous number of permitted entities that may be experiencing their own changes involving administration and personnel. In dealing with NPDES permit matters, DWQ must deal with only one representative of the permitted facility (someone with authority to see that changes are made at the facility if they are necessary) in order to be effective. You are encouraged to keep DWQ informed of any updates as to the person responsible for the permit, addresses or phone numbers in order to facilitate the best possible communication between our two organizations. This can be done by sending an e-mail to our Unit or by using the back of the MR-1 form under the permittee certification section. Regulations regarding who may be deemed responsible for a permit and who may sign as the "permittee" on the DMR can be found (respectively) in the North Carolina Administrative Code in sections 15A NCAC 2H .106(e) and 15A NCAC 2B .0506 (b)(2).

Appendix 4: CFR 503 Regulations

Pollutant Limits, Pathogen and Vector Attraction Reduction Requirements

All biosolids applied to the land must meet ***the ceiling concentrations for pollutants,*** listed in the first column of Table 2-1.

TABLE 2-1
Pollutant Limits

Pollutant	Ceiling Concentration Limits for All Biosolids Applied to Land (milligrams per kilogram)[a]	Pollutant Concentration Limits for EQ and PC Biosolids (milligrams per kilogram)[a]	Cumulative Pollutant Loading Rate Limits for CPLR Biosolids (kilograms per hectare)	Annual Pollutant Loading Rate Limits for APLR Biosolids (kilograms per hectare per 365-day period)
Arsenic	75	41	41	2.0
Cadmium	85	39	39	1.9
Chromium	3,000	1,200	3,000	150
Copper	4,300	1,500	1,500	75
Lead	840	300	300	15
Mercury	57	17	17	0.85
Molybdenum [b]	75	—	—	—
Nickel	420	420	420	21
Selenium	100	36	100	5.0
Zinc	7,500	2,800	2,800	140
Applies to:	All biosolids that are land applied	Bulk biosolids and bagged biosolids[c]	Bulk biosolids	Bagged biosolids[c]
From Part 503	Table 1, Section 503.13	Table 3, Section 503.13	Table 2, Section 503.13	Table 4, Section 503.13

[a] Dry-weight basis

[b] As a result of the February 25, 1994, Amendment to the rule, the limits for molybdenum were deleted from the Part 503 rule pending EPA reconsideration.

[c] Bagged biosolids are sold or given away in a bag or other container.

TABLE 2-5
Summary of Class A and Class B Pathogen Reduction Requirements

CLASS A

In addition to meeting the requirements in one of the six alternatives listed below, fecal coliform or *Salmonella* sp. bacteria levels must meet specific density requirements at the time of biosolids use or disposal or when prepared for sale or give-away (see Chapter Five of this guidance)

Alternative 1: Thermally Treated Biosolids

Use one of four time-temperature regimens

Alternative 2: Biosolids Treated in a High pH-High Temperature Process

Specifies pH, temperature, and air-drying requirements

Alternative 3: For Biosolids Treated in Other Processes

Demonstrate that the process can reduce enteric viruses and viable helminth ova. Maintain operating conditions used in the demonstration

Alternative 4: Biosolids Treated in Unknown Processes

Demonstration of the process is unnecessary. Instead, test for pathogens—*Salmonella* sp. or fecal coliform bacteria, enteric viruses, and viable helminth ova—at the time the biosolids are used or disposed of or are prepared for sale or give-away

Alternative 5: Use of PFRP

Biosolids are treated in one of the Processes to Further Reduce Pathogens (PFRP) (see Table 5-4)

Alternative 6: Use of a Process Equivalent to PFRP

Biosolids are treated in a process equivalent to one of the PFRPs, as determined by the permitting authority

CLASS B

The requirements in one of the three alternatives below must be met

Alternative 1: Monitoring of Indicator Organisms

Test for fecal coliform density as an indicator for all pathogens at the time of biosolids use or disposal

Alternative 2: Use of PSRP

Biosolids are treated in one of the Processes to Significantly Reduce Pathogens (PSRP) (see Table 5-7)

Alternative 3: Use of Processes Equivalent to PSRP

Biosolids are treated in a process equivalent to one of the PSRPs, as determined by the permitting authority

Note: Details of each alternative for meeting the requirements for Class A and Class B designations are provided in Chapter Five.

TABLE 2-6
Summary of Vector Attraction Reduction Options

Requirements in one of the following options must be met:

Option 1:	Reduce the mass of volatile solids by a minimum of 38 percent
Option 2:	Demonstrate vector attraction reduction with additional anaerobic digestion in a bench-scale unit
Option 3:	Demonstrate vector attraction reduction with additional aerobic digestion in a bench-scale unit
Option 4:	Meet a specific oxygen uptake rate for aerobically treated biosolids
Option 5:	Use aerobic processes at greater than 40°C (average temperatures 45°C) for 14 days or longer (e.g., during biosolids composting)
Option 6:	Add alkaline materials to raise the pH under specified conditions
Option 7:	Reduce moisture content of biosolids that do not contain unstabilized solids from other than primary treatment to at least 75 percent solids
Option 8:	Reduce moisture content of biosolids with unstabilized solids to at least 90 percent
Option 9:	Inject biosolids beneath the soil surface within a specified time, depending on the level of pathogen treatment
Option 10:	Incorporate biosolids applied to or placed on the land surface within specified time periods after application to or placement on the land surface.

Note: Details of each vector attraction reduction option are provided in Chapter Five.

Appendix 5: Math Formulas

Mathematics
Conversion Factors

REFERENCE - Operation Of Wastewater Treatment Plants Vol. I, Appendix

1.Arithmetic Mean - The sum of the values divided by the number of values or, simply, the average.

5. **Circumference of a circle** - The length of the external boundary of a circle.

6. **Chlorine Dosage** - The amount of chlorine added to wastewater.

7. **Chlorine Demand** - The difference between the amount of chlorine added to wastewater and the amount of residual chlorine remaining after a given contact time. Chlorine demand may change with dosage, time, temperature, pH, nature and the amount of impurities in wastewater.

Chlorine Demand = Chlorine Dosage - Chlorine Residual

11. **Chlorine Residual** - The quantity of chlorine in excess of the chlorine demand, expressed in mg/l. The residual must remain for a sufficient contact time, usually 30 minutes, to insure the killing of pathogens.

12. **Detention Time** - The time required to fill a tank at a given flow or the theoretical time required for a given flow of wastewater to pass through a tank.

13. **Diameter of a circle** - The distance from one side of a circle to the other, passing through the center.

14. **Geometric Mean** - For any set of values, it is the *n*th root of the product of the individual values where *n* is equal to the number of individual values. It is equivalent to the antilog of the arithmetic means of the logarithms of the individual values and is used in averaging results from the fecal coliform analysis because an extreme value has a lesser influence on the final result.

15. **Hydraulic Loading** - This is the number of gallons of wastewater applied per day per square foot (or per acre) of filter surface. The hydraulic loading for a standard rate trickling filter is usually between 25 to 100 gal/day/sq. ft. and for a high rate trickling filter the hydraulic loading may be between 100 to 1000 gal/day/ft^2.

16. **Milligram per liter (mg/l)** - One-thousandth of a gram in one liter of solution.
e.g. : 1 mg/l = 0.001 gram in 1 liter

14. **Trickling Filter Organic Loading** - This is the number of pounds of BOD per day per 1000 cubic feet of filter medium. Pounds per acre-foot or per cubic yard of filter medium are also occasionally used. The organic loading for a standard rate trickling filter is 5 to 25 pounds of BOD per day per one thousand cubic feet of media. The organic loading for a high rate trickling filter is usually between 25 to 300 pounds of BOD per day per one thousand cubic feet of filter media.

15. **Population Equivalent** - A means of expressing the strength of organic material in wastewater. In a domestic wastewater system, microorganisms use up about 0.2

pounds of BOD per day for each person using the system (as measured by the standard BOD test).

16. **Part per million (ppm)** - This term is used interchangeably for milligram per liter (mg/l) with the explanation for that interchangeability being as follows:

$$\frac{1 \text{ milligram}}{1 \text{ liter}}$$

$$= \frac{1 \text{ milligram}}{1{,}000 \text{ milliliters}}$$

$$= \frac{1 \text{ milligram}}{1{,}000 \text{ milliliters x } 1{,}000 \text{ milligrams per millilite}}$$

$$= \frac{1 \text{ milligram}}{1{,}000{,}000 \text{ milligrams}}$$

$$= \frac{1 \text{ part}}{1 \text{ million parts}}$$

= 1 part per million or 1 ppm

22. **Radius of a circle** - One-half of the diameter or the distance from the center of the circle to a side of the circle.

23. **Sludge Age** - Average time in days a particle of suspended solids remains under aeration in the activated sludge process.

24. **Sludge Volume Index (SVI)** - This is a calculation used to indicate the settling ability of activated sludge (aerated solids) in the secondary clarifier. The calculation is a measure of the volume of sludge compared with its weight.

25. **Surface Settling Rate** - This term is expressed in terms of gpd/sq. ft. of tank surface area. The suggested surface settling rate varies from 300-1200 gallons per day per square foot of surface area.

26. **Velocity** - The time rate of motion in a given direction or, simply, the speed.

27. **Volume** - The capacity of a container or the amount it can hold.

28. **Weir Diameter** - Circular clarifiers have a circular weir within the outside edge of the clarifier. All of the water leaving the clarifier flows over this weir. The diameter is the length of the line from one edge of a weir to the opposite edge and passing through the center of the circle formed by the weir.

29. **Weir Overflow Rate** - Wastewater leaves the clarifier by flowing over some type of weir arrangement. The number of linear feet of weir in relation to the flow is important to prevent short circuits or high velocity near the weir which might pull settling solids into the effluent. The weir overflow rate is the number of gallons of wastewater that flow over one

linear foot of weir per day. Most designers recommend 10,000 to 20,000 gallons per day per linear foot of weir.

30. **Loss of Alkalinity due to Nitrification, mg/l** = 7.2 mg/l of alkalinity is consumed per mg/l of NH_3 converted to NO_3. (*Please note that some literature sources use 7.1 or 7.14 mg/l as the conversion factor.)

31. **Watts** = volts x amps = $\frac{\text{voltage}}{\text{ohms}}$

Math Formulas for Wastewater Systems

Grade I/II: General

1) **Lbs/day** = concentration,mg/l x flow,MGD x 8.34 lbs/gal
   or **Lbs** = concentration,mg/l x volume,MG x 8.34 lbs/gal

2) **Circumference of a circle =** π x diameter, or 2 x π x radius where π = 3.14

3) **Area of a circle =** π (r^2), **or** 0.785 x (d^2) d=diameter r=radius

4) **Area of a triangle** = $\frac{1}{2}$ base x height

5) **Area of a rectangle** = length x width

6) **Volume of a cylinder** = area of the circular base x height

7) **Volume (ft^3)** = length (ft) x width (ft) x depth (ft)

8) **Volume of a cone** = 1/3 x (volume of a cylinder)

9) **Volume of a tank** = cubic feet (ft^3) in the tank x 7.48 gals/ft^3

10) **Temperature Conversions:**

$$\text{Centigrade} = \frac{\text{Fahrenheit} - 32}{1.8},$$

$$\text{Fahrenheit} = (1.8 \times \text{Centigrade}) + 32$$

(Centigrade is the same as Celsius)

Grade III/IV: General

11) Geometric mean = antilog of $\frac{\text{sum of logs of sample results}}{\text{number of samples}}$

12) Volume/Concentration conversion mls x normality = mls x normality

13) Slope = Rise/Run

14) Percent Slope = Rise/Run x 100%

15) Watts = volts x amps = $\frac{\text{voltage}}{\text{ohms}}$

Grade I: Process Control

1) Detention time (hrs.) = $\frac{\text{tank volume in gallons x 24 hr./day}}{\text{flow in gallons per day}}$

2) Percent (%) Efficiency of Removal = $\frac{\text{in – out}}{\text{in}}$ x 100

3) Pond population equivalent, in persons =

$$\frac{\text{Flow in MGD x BOD in mg/l x 8.34 lbs/gal}}{\text{0.2 lbs BOD/day/person}}$$

4) Pond area, acres = $\frac{\text{average width in ft. x average length in ft}}{43560\ ft^2/acre}$

5) Pond volume, acre feet (ac ft) = area in acres (ac) x depth in feet (ft)

6) Pond influent flow in ac-ft/day = $\frac{\text{gals per day}}{7.48\ gal/ft^3 \times 43560\ ft^2/acre}$

7) Pond detention time (days) = $\frac{\text{pond volume in ac-ft}}{\text{influent rate in ac-ft/day}}$

8) Pond hydraulic loading, inches per day = $\frac{\text{depth of pond in inches}}{\text{detention time in days}}$

9) Pond organic loading (lbs. BOD/day/acre) = $\frac{\text{BOD, mg/l x MGD x 8.34 lbs/gal}}{}$

Pond area, acres

10) Pond population loading, person/acre = $\frac{\text{population served in \# of persons}}{\text{pond area in acres}}$

Grade II: Process Control

11) % Settleable Solids = $\frac{\text{mls of settled sludge after 30 min.}}{\text{vol. of settleometer}}$ x 100

12) Sludge Volume Index (SVI) = $\frac{\text{(\% settleable solids x 10,000)}}{\text{MLSS in mg/l}}$

13) Recirculation ratio for trickling filters = $\frac{\text{recirculated flow}}{\text{influent wastewater flow}}$

14) Surface loading (overflow) rate, gpd/ft^2 = $\frac{\text{flow in gpd}}{\text{surface area in ft}^2}$

15) Weir overflow rate, gpd/ft of weir = $\frac{\text{flow in gpd}}{\text{feet of weir}}$

16) Trickling Filter Organic Loading, lbs/day/1000 ft^3 =
$\frac{\text{BOD applied in lbs. per day}}{\text{volume of media in 1000 ft}^3}$

17) Trickling Filter Hydraulic Loading, gpd/ft^2 =
$\frac{\text{gal/day (including recirculation flow)}}{\text{surface area in ft}^2}$

18) Mean cell residence time (MCRT) in days

$$= \frac{\text{MLSS, mg/l x volume, MG (aer. Tank + sec. Clar. Volume) x 8.34 lbs/gal}}{\text{(Eff. SS, mg/l x flow, MGD x 8.34 lbs/gal) + (WAS, mg/l x WAS flow, MGD x 8.34 lbs/gal)}}$$

19) Sludge age, days

$$= \frac{\text{MLSS, mg/l x aerator volume in MG x 8.34 lbs/gal}}{\text{Primary Eff. SS, mg/l x flow, MGD x 8.34 lbs/gal}}$$

20) BOD_5 (unseeded), mg/l = $\frac{DO_1 - DO_5}{p}$

Where DO_1 = Initial DO
DO_5 = DO after 5 days

$$p = \frac{\text{mls of sample}}{\text{300 (mls in a BOD bottle)}}$$

21) BOD_5, mg/l (seeded) = $\frac{[(DO_1 - DO_5) - (\text{seed correction})] \times 300 \text{ mL}}{\text{mL of sample volume}}$

Where:

$$\text{seed correction} = \frac{\text{5 day depletion of seed sample}}{\text{mL seed}}$$

DO_1 = Initial DO, in mg/L
DO_5 = DO after 5 days, in mg/L

22) Wasting rate, gpm = pumping rate, MGD x 694 gpm/MGD

Grade III: Process Control

23) Total Suspended Solids (TSS), mg/l = $\frac{\text{dry solids in grams x 1000 mg/g x 1000 ml/l}}{\text{sample volume in mls}}$

or = $\frac{\text{weight of solids in mg x 1000 mls/l}}{\text{sample volume in mls}}$

24) Total Solids (TS), mg/l = $\frac{\text{A - B x 1000}}{\text{sample volume in mL}}$

where A = weight of dish + dried residue in milligrams
B = weight of dish in milligrams

25) Volatile Solids (VS), mg/L = $\frac{\text{(A - B) x 1000}}{\text{sample volume in mL}}$

where A = weight of residue + dish before ignition in milligrams
B = weight of residue + dish after ignition in milligrams

26) Percent (%) Volatile Solids = $\frac{\text{(A - C) x 100}}{\text{A-B}}$

where A = weight of dish + dried residue in milligrams
B = weight of dish in milligrams
C = weight of residue + dish after ignition in milligrams

27) F/M (food to microorganism) ratio

$$= \frac{\text{BOD (or COD), mg/l x flow, MGD x 8.34 lbs/gal}}{\text{MLVSS, mg/l x aeration basin volume, MG x 8.34 lbs/gal}}$$

28) Dry solids to a digester, lbs/day = sludge in gpd x 8.34 lbs/gal x % total solids

29) Volatile Solids to a digester, lbs/day

= sludge in gpd x 8.34 lbs/gal x % total solids x % volatile solids

30) Volatile Solids Destroyed in a digester, lbs/day/ft^3

$$= \frac{\text{sludge volume, gal/day x \% TS x \% TVS x \% reduction x 8.34 lbs/gal}}{\text{digester volume, ft}^3}$$

31) % Volatile Solids Destroyed in a digester

$$= \frac{\text{(in – out)}}{\text{in – (in x out)}} \times 100$$

32) Return Activated Sludge (RAS) Rate calculated using Settleability

MGD = Secondary influent flow, MGD x Return Sludge Rate Ratio

Return Sludge Rate Ratio = $\frac{\text{30 min settled sludge volume in ml/l}}{\text{clear liquid volume in ml/l}}$

Grade IV: Process Control

33) Total waste activated sludge (WAS) in MGD

= current rate in MGD + additional rate in MGD

34) Stream Conc. Formula =

$$\frac{\text{lbs/day discharged from plant + lbs/day upstream total flow}}{\text{MGD (plant flow + stream flow) x 8.34}}$$

35) Nitrogenous Oxygen Demand (NOD), mg/l = NH_3, mg/l x 4.6 mg/l O_2 per mg/l NH_3 converted to NO_3

36) Ultimate Oxygen Demand (UOD), mg/l = (1.5 x BOD, mg/l) + (4.6 x NH_3, mg/l)

37) Chemical Oxygen Demand, mg/l

$$= \frac{(\text{mls of FAS to titrate blank - mls of FAS to titrate sample}) \times \text{normality of FAS} \times 8000}{\text{mls of sample}}$$

(*FAS = Ferrous Ammonium Sulfate)

38) Waste Activated Sludge (WAS) pumping rate

$$= \frac{\text{solids to be wasted, lbs/day}}{\text{WAS SS, mg/l} \times 8.34 \text{ lbs/gal}}$$

Pump and/or Flow

39) Q = A x V where Q = quantity of flow (in units of ft^3/sec.)
A = cross sectional area (ft^2)
V = velocity (ft/sec)

40) Velocity in ft/sec $= \frac{\text{flow rate - in } ft^3/\text{sec}}{\text{cross-sectional area - in } ft^2}$

41) Water horsepower (Water HP) $= \frac{\text{gpm x total head in ft}}{3960}$

42) Brake horsepower (Brake HP) $= \frac{\text{flow in gpm x total head in ft}}{3960 \times \text{pump efficiency}}$

43) Motor horsepower (Motor HP) $= \frac{\text{gpm x total head in ft}}{3960 \times \text{pump efficiency} \times \text{motor efficiency}}$

44) Pump electrical costs per year

= hp x 0.746 kW/hp x # of hrs pump operates per day x cost ($) per kW/hr x 365 day/yr.