North Carolina

Physical Chemical Wastewater

Treatment Plant

Operator's

'Needs To Know' Manual

For

Grades 1 AND 2

Revised October 12, 2007

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Physical Chemical Grade Two

References

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Naval Facilities Engineering Service Center http://nfesc.navy.mil

Contacts For Ordering Copies Of The Noted References

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General

1. Origins and general characteristics of wastewater for Physical/Chemical Treatment.

2. Concepts of pH, temperature, solids concentrations, biochemical oxygen demand, chemical oxygen demand, nutrient loading, dissolved oxygen, septicity, toxicity and other pollutants (O&G Priority Pollutants, VOC's, etc.) and flow and turbidity.

3. General characteristics of industrial processes and effluent characteristics

4. Define physical and chemical treatment processes.

5. Describe the types of receiving streams.

6. Operators must be able to follow safe operating procedures for generators, recognize the electrical and mechanical safety hazards associated with generator operation or maintenance, and follow procedures to be taken in response to each hazard.

LAWS AND REGULATIONS

1. Identify the North Carolina government agency, which has principal responsibility for water pollution control activities statewide.

2. Identify the federal agency, which has primary responsibility for establishing policy and regulations concerning water pollution control in the United States.

3. Explain the regulatory requirement for certified *"operator in responsible charge"* (ORC) for each water pollution control system in North Carolina.

4. Describe the need for requiring stand-by-power.

5. Describe the current State regulatory procedure with respect to water pollution violations (i.e., Notices of Violation – NOV) and identify penalties which can be imposed for those violations.

6. Identify the agency to which NPDES reports must be sent and explain the frequency with which those reports must be submitted to the agency.

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

Records and Reports

REFERENCES - Industrial Waste, Third Edition, Chapter 3- Regulatory Requirements and North Carolina Statutes-15A NCAC 02B-/0500

1. State the purpose of NPDES Permit monthly monitoring reports. {Chapter 3 page 84 & 15A NCAC 02B .0505 & .0506}

2. Explain NPDES reporting procedures, including frequency of data collection, report preparation, report submission, responsibility for accuracy, and timeliness. {15A NCAC 02B .0506}

3. Identify the agency to which the NPDES reports should be submitted. {02B .0506}

4. State the type of records and reports which must be kept at the wastewater treatment plant and how long they must be kept there. {02B .0506}

5. Given appropriate forms (DMR or NDMR,etc.)and data, prepare a monthly report to the State. (nondischarge forms, dual class reporting, etc.)

6. What additional (reporting is) required by the State?(24 Hr report, Bypass report, failure, etc.)- {02B .0506}

7. 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; {.0506}
    b. Wastewater flows (maximum, minimum, average);{.0505}
    c. Wastewater temperature; {.0505}
    d. Weather conditions;
    e. Plant units in operation; {.0506}
    f. Plant units out of service and reasons why; {.0506}
    g. Laboratory analytical results (see sampling laboratory procedures); {.0506 & .0508}
    h. Work in progress;
    i. Work completed;
    j. Important communications received and sent; (24 hour, DMR or NDMR, etc.) {.0506}
    k. Breakdowns; {.0506}
    l. Personnel absences; Certified by ORC/BUORC {.0506}
    m. Accidents; {OSHA 29 CFR-1910}
    n. Visitors; {OSHA 29 CFR-1910}
    o. Miscellaneous; {OSHA 29 CFR-1910}
    p. Sludge disposal records. {.0505 Process Control, etc.}
    q. Future Planning (80% Rule requirement for upgrades, etc.) {Chapter 3}

8. Industrial User Permit Requirements- May include above or have limited requirements. Operator must consider above list as minimum records. This ties in Pretreatment systems that may be required to use certified operators.

Monitoring and Reporting

According to the North Carolina Department of Environment and Natural Resources Monitoring and Reporting Regulations; Administrative Code: Title 15, Chapter 2B, Section 0.0500.

NPDES Permits:

NPDES stands for National Pollutant Discharge Elimination System. NPDES permits are required by the Federal Water Pollution Act Amendments of 1972 (PL 92-500) with the intent of making the Nation's waters suitable for swimming and for fish and wildlife. The permits regulate discharges into navigable waters from all point sources of agricultural feed lots and return irrigation flows. These permits may outline a schedule of compliance for a plant design, engineering, construction and or treatment process changes. An industry discharging into a municipal collection and treatment system does not need to obtain an NPDES permit but may be issued a permit by the municipality receiving its discharge and may be required to meet certain specified pretreatment standards.

Monitoring Requirements {02 B .0505}

Classified plants must have a device or method approved by DENR for determining the rate of flow.

Sampling and Analysis {.0505}

Frequency, locations, and type of samples will be specified by the NPDES Permit. The following test shall be performed on grab samples, dissolved oxygen, settable matter, temperature, turbidity, pH, and residual chlorine, Cyanide, (O&G), Sulfides, Phenols, VOC's.

The methods used in collection, preservation, and analysis of samples shall conform to those set by the Water Programs Section of the EPA and contained in the latest issue of the Federal Register. Other analytical procedures shall conform to those found in the latest approved edition of "Standard Methods for the Examination or Water and Wastewater" or "Methods for Chemical Analysis of Waters and Wastes" or such other method as may be approved by the DENR and adopted by the Environmental Management Commission.

Emergency Reporting Requirements

A report shall be filed, either by telephone or , to the Central Office of the Division of Water Quality (DWQ) in Raleigh, or the appropriate field office, within 24 hours following the knowledge of the occurrence of any of the following:

- Any failure of a pumping station or treatment facility resulting in the by-pass directly to the receiving waters without treatment of all or any portion of the influent;

- Any occurrence at the facility which results in the discharge of significant amounts of wastes which are abnormal in quantity or characteristic, such as the dumping of the contents of a sludge digester or the known passage of a slug of hazardous substance through the facility.

- Any process unit failure that renders facility incapable of adequate wastewater treatment. Person shall also file a written report within five (5) days following first knowledge.

Summaries Of North Carolina Rules Which Affect Water Pollution Control System Operators

(NOTE: The following are summations of the laws and regulations that apply to most wastewater treatment plant operators and are presented as they existed at the time of the printing of this edition of the Needs To Know manual and are subject to modification.)

The major laws and regulations affecting wastewater treatment system operators in North Carolina are located in the North Carolina Administrative Code. The location and purpose of these laws and regulations are:

1. Point Source Discharges To The Surface Waters

Title 15A - Subchapter 2H - Section .0100.

These rules provide the requirements and procedures for application and issuance of state NPDES permits for systems discharging to the surface waters of the state. Some highlights of this section are:

A. Any person who discharges or who proposes to discharge pollutants to the surface waters of the State shall submit an application and processing fee to the Department of Environment and Natural Resources (DENR).

B. An annual fee for administering and compliance monitoring shall be charged in each year of the term of the NPDES permit.

C. Permittees which maintain full compliance with all permit conditions during the previous calendar year will have its administering and compliance monitoring fee reduced by twenty-five (25) percent.

D. Failure to pay an annual fee can result in revocation of the permit.

E. Applications for permit renewals, with processing fee, shall be filed at least 180 days prior to expiration of permit.

F. An acceptable residuals management plan shall be submitted with the application for permit renewal.

G. All Authorization to Construct applications shall be filed at least ninety (90) days in advance of the proposed commencement date of construction of water

pollution control facilities.

H. Permits may be revoked or modified for any of the following:

1. violation of terms or conditions of the permit;
2. obtaining a permit by misrepresentation;
3. a change in any condition that requires a reduction or limitation of the permitted discharge;
4. refusal of the permittee to permit the Director or his authorized representative upon presentation of credentials:
   a. to enter upon permittee's premises in which an effluent source is located or in which any records are required to be kept under terms and conditions of the permit;
   b. to have access to and copy any records required to be kept under terms and conditions of the permit;
   c. to inspect any monitoring equipment or method required in the permit, or;
   d. to sample any discharge of pollutants.
5. failure to pay the annual fee for administering and compliance monitoring.

H. Staff of the Department of Environment and Natural Resources (DENR) are authorized to conduct any investigations for the purpose of determining compliance with water quality standards, effluent limitations, permit conditions and any duly adopted rule of the Commission.

I. Prior to issuance or reissuance of a permit for a wastewater facility, the applicant must either provide evidence to show that the applicant has been designated as a public utility by the State Utilities Commission or enter into a properly executed operational agreement with the Division of Water Quality.

J. All facilities shall provide adequate measures that will insure continued treatment and disinfection where the interruption of such treatment would render the waters unsafe for their best-intended uses. The reliability measures shall include the following:

1. Multiple components (pumps, aeration equipment, etc.) for new or hydraulically expanding facilities with mechanically operated components;
2. Dual or standby power supply on site, or approval by the Director for an exemption;
3. For new or hydraulically expanding mechanical facilities, the treatment plant must contain parallel units for components in the liquid line, unless it can be demonstrated to the Director that this requirement is unwarranted;
4. For mechanical facilities with a design capacity equal to or greater than 5.0 MGD, continuous operation, 24 hours, seven days per week, with each shift staffed by at least one certified wastewater operator shall be provided on or before October 1, 1993, unless it can be demonstrated to the Director that this requirement is unwarranted;
5. For facilities permitted under this Section, the permittee, upon classification, must designate an Operator in Responsible Charge and a back-up operator;
6. The Operator in Responsible Charge, or back-up operator when appropriate, must operate and visit the facility as required by the Water Pollution Control System Operators Certification Commission, Class I - weekly and Class II, III,

IV - five (5) days per week;

7. Compliance with other reliability measures that, in the opinion of the Director, are necessary in a particular case.

2. Waste Not Discharged To Surface Waters

Title 15A - Subchapter 2T - Section .0200.

These rules set forth the requirements and procedures for application and issuance of permits for the following systems which do not discharge to surface waters of the state: a) sewer system, b) disposal systems, c) treatment works, d) residual and residue disposal/utilization systems, e) animal waste management systems, f) treatment of petroleum contaminated soils. Some highlights of this section are:

A. Permit applications, for activities which require a permit under this section, must be submitted to the N.C. Department of Environment and Natural Resources (DENR) along with the processing fee.

B. An annual fee for administering and compliance monitoring shall be charged in each year of the term of the State permit.

C. Permittees which maintain full compliance with all permit conditions during the previous calendar year will have its administering and compliance monitoring fee reduced by twenty-five (25) percent.

D. Failure to pay an annual administering and compliance monitoring fee may cause the Division to revoke the permit.

E. Applications for permit renewals, with the processing fee, shall be filed at least 180 days prior to expiration of permit.

F. Pump and Haul permits are not acceptable long term domestic wastewater treatment alternatives. Permits will only be issued to facilities under the authority of the DWQ in cases of environmental emergencies, nuisance conditions, health problems or other unique situations.

G. For sewer system construction or sewer system extensions, the staff of the Division shall determine whether the treatment works or the sewer system to which the proposed system will discharge is adequate to receive waste which will be discharged from the proposed system.

H. Permits may be revoked or modified for any of the following:
   1. violation of terms or conditions of the permit
   2. obtaining a permit by misrepresentation
   3. refusal of the permittee to permit the Director or his authorized representative upon presentation of credentials:
      a. to enter upon permittee's premises in which an effluent source is located or in which any records are required to be kept under terms and conditions of the permit,
      b. to have access to and copy any records required to be kept under terms

and conditions of the permit,
c. to inspect any monitoring equipment or method required in the permit, or
d. to sample any discharge of pollutants.

4. failure to pay the annual fee for administering and compliance monitoring

I. Municipalities, counties, local boards or commissions, water and sewer authorities, or groups of municipalities and counties may apply to the Commission for approval of programs for permitting construction, modification, and operation of public and private sewer systems in their utility service areas. Permits issued by approved local programs serve in place of permits issued by the Division.

J. Minimum design requirements for all facilities requiring a permit pursuant to this Section are outlined.

K. No permits for sewer line extensions will be issued to wastewater treatment systems owned or operated by municipalities, counties, sanitary districts or public utilities unless they meet the following requirements:

1. Prior to exceeding eighty (80) percent of the wastewater treatment system's permitted hydraulic capacity (based on the average flow of calendar year 1993 or any subsequent calendar year), the permittee must submit an approvable engineering evaluation of their future wastewater treatment needs. This evaluation must outline specific plans for meeting future wastewater treatment needs by either expansion of the existing system, elimination or reduction of extraneous flows, or water conservation and must include the source(s) of funding for the improvements. If expansion is not proposed or is proposed for a later date, a detailed justification must be made and approved by the Director based on past growth records and future growth projections and, as appropriate, shall include conservation plans or other specific measures to achieve waste flow reductions.
2. Prior to exceeding ninety (90) percent of the wastewater treatment system's permitted hydraulic capacity, (based on the average flow of calendar year 1993 or any subsequent calendar year), the permittee must obtain all permits needed for the expansion of the wastewater treatment system and, if construction is needed, submit approvable final plans and specifications for expansion including a construction schedule. If expansion is not proposed, or is proposed for a later date, a detailed justification must be made and approved by the Director based on past growth records and future growth projections and, as appropriate, shall include conservation plans or other specific measures to achieve waste flow reductions.

L. For facilities permitted under this Section, the permittee, upon classification, must designate an Operator in Responsible Charge and a back-up operator when appropriate.

M. The Operator in Responsible Charge, or back-up operator when appropriate, must operate and visit the facility as required by the Water Pollution Control System Operators Certification Commission.

3. Point Source Monitoring Rules

Title 15A- Subchapter 2B - Section .0500.

These rules set forth the requirements of the Environmental Management Commission for monitoring and reporting the quantity and quality of wastewater discharges to, and their effects upon, the water resources of the state. Some highlights of this section are:

A. Every person subject to this Section shall be required to establish, operate and maintain a monitoring program consistent with their NPDES Permit.

B. Flow measurement devices shall be accurately calibrated at a minimum of once per year. Records of the calibrations shall be kept on file by the permittee for a period of at least three (3) years and at a minimum shall include the date of calibration and the name of person performing calibration.

C. Stream sampling may be discontinued at such times as flow conditions in the receiving waters or extreme weather conditions will result in a substantial risk of injury or death to persons collecting samples. On each day that sampling is discontinued, written justification for the discontinuance shall be specified in the monitoring report for the month in which the event occurred.

D. All test procedures must produce detection and reporting levels that are below the permit discharge requirements and all data generated must be reported to the approved detection level or lower reporting level of the procedure. If no approved methods are determined capable of achieving detection and reporting levels below permit discharge requirements, then the approved method with the lowest detection and reporting level must be used.

E. Every person subject to this Section shall file <u>monitoring reports</u> setting forth the results of tests and measurements conducted pursuant to NPDES permit monitoring requirements <u>no later than 30 calendar days</u> after the end of the reporting period.

1. Reports shall be on forms furnished or approved by the Director and be submitted in duplicate to Central Files/DWQ.
2. A copy of all reports shall be retained by the owner of each water pollution control facility for a period of at least three years from the date of submission and be readily available to the Division for inspection.
3. The owner of each pollution control facility is required to retain or have readily available for inspection by the Division, the following items for a period of at least three years from report submission:
   a. the original laboratory reports from any certified laboratory used for sample analysis. Such reports must be signed by the laboratory supervisor and must indicate the date and time of sample collection and analysis and the

analyst's name:

b. bench notes and data logs for sample analyses performed by the pollution control facility staff or ORC, whether or not the facility has a certified lab; and

c. copies of all process control testing

4. In situations where no discharge has occurred from the facility during the report period, the permittee is required to submit a monthly monitoring report giving all required information and indicating "NO FLOW" unless the Director agrees to waive the reporting requirement during extended conditions of no discharge.

F. Every person subject to this Section shall report by telephone to either the central office or appropriate regional office of the Division as soon as possible but no later than 24 hours after occurrence or on the next working day (if occurrence is one which may endanger the public health, or fish or wildlife, and the appropriate Division office can not be notified, such person shall report as soon as possible to the State Highway Patrol Warning Point) following the occurrence or first knowledge of the occurrence of any of the following:

1. Any failure of a collection system pumping station or treatment facility resulting in a by-pass without treatment of all or any portion of the wastewater.
2. Any occurrence at the water pollution control facility which results in the discharge of significant amounts of wastes which are abnormal in quantity or characteristic.
3. Any process unit failure, due to known or unknown reasons, that renders the facility incapable of adequate wastewater treatment. Persons reporting such occurrences by telephone shall also provide a written report to the Division to be received by the Division within five days following first knowledge of the occurrence.

G. When a facility is operated on an independent contract basis, the ORC shall notify the owner of the facility in writing of any existing or anticipated conditions at the facility which may interfere with its proper operation and which need corrective action by the owner. The notice shall include recommendations for corrective action. Two (2) copies of the notice shall be sent to the Division as an attachment to the next monthly monitoring report.

H. A log demonstrating visitation at the proper frequency for the assigned classification, including dates and times of visits, and documentation of proper process control monitoring shall be maintained and shall be submitted to the Division upon request.

4. Water Pollution Control System Operators Certification Commission Rules

Title 15A - Subchapter 8G

These rules set forth: a) the duties and requirements for certified operators, b) the

requirements and procedures for the certification of operators, c) the procedures for the classification of water pollution control systems, and d) the procedures for the revocation, relinquishment or invalidation of certification. Some highlights of these sections are:

A. The system owner must submit a letter to the Certification Commission which designates the ORC and back-up ORC of the system and is countersigned by the designated operators.

B. The ORC of a water pollution control system must possess a certificate of the type and grade at least equivalent to the type and grade of the system and the Back-up ORC must possess a certificate of the type and grade no more than one grade less than the system.

C. The ORC of a water pollution control system must operate and maintain the system efficiently, certify monitoring and reporting information as prescribed in the permit, document daily visitations, notify the owner of problems with or permit violations by the system, and be readily available for consultations, emergencies, regulatory agency inspections and similar matters.

D. An application being filed for examination must be postmarked by the U.S. Postal Service at least thirty (30) days prior to the date upon which the examination is scheduled to be administered and must be accompanied by the appropriate application fee.

E. Definitions and eligibility requirements for the following certificates are outlined: 1) Grade I-IV biological water pollution control systems; 2) Grade I-IV collection systems; 3) subsurface systems; 4) spray irrigation systems; 5) land application systems; 6) physical/chemical systems.

F. Holders of certificates shall notify the Certification Commission, in writing, within thirty (30) days of any change in his/her address (failure to notify the Commission of address changes may result in the failure of a renewal notice to reach the individual which could lead to a loss of certification).

G. The Commission may allow an applicant for any operator certificate to take the examination at that level if the individual has met all of the prerequisite education and certification requirements but is unable to meet the experience requirement, for the purpose of becoming an operator-in-training (OIT). The OIT certificate does not qualify the individual to be the ORC or Back-up ORC of a facility of the same type and grade as the OIT certificate.

H. Certification that are not renewed when due will be considered invalid. To renew a certificate that has been invalid for up to two consecutive years, the individual will be required to pay all outstanding fees and penalties that have accrued and document the completion of all required continuing education. In order to renew a certificate that has been invalid for more than two consecutive years, the individual must take and make a passing score on an examination of the same type and grade as the former certificate.

I. Temporary certification, without examination, may be issued by the Certification

Commission at its discretion. Issuance of temporary certificates shall be limited to situations where the supply or availability of certified operators is found to be inadequate.

J. Individuals who hold certificates of competency issued under a voluntary certification program approved administered by the NCWEA may apply for the conversion of the voluntary certificate into a certificate issued by the Certification Commission once a mandatory certification program of the same type and grade as the voluntary program has been established by the Commission.

K. All Contract Operators Firms must file an annual report with the Certification Commission on or before April 1 of each year. Report requirements are included in the Section.

L. The Certification Commission may revoke or suspend the certification of an operator, or issue a letter of reprimand to an operator, if it finds that the operator has practiced fraud or deception; that reasonable care, judgment, or the application of his/her knowledge or ability was not used in the performance of his/her duties; or that an operator is incompetent or unable to properly perform his/her duties.

5. Laboratory Certification

Title 15A - Chapter 2 - Subchapter 2H- Section .0800

These rules set out the certification criteria for laboratory facilities performing any tests, measurements or monitoring which will be reported to comply with the State surface water monitoring, groundwater, and pretreatment rules and to establish fees for certification. The Rules apply to commercial laboratories and municipal or industrial wastewater treatment plant laboratories which perform analyses subject to the EMC Rules for Surface Water Monitoring and Reporting and the Groundwater rules. These Rules also apply to all WWTP laboratories for municipalities having Local Pretreatment Programs. Some highlights of this section are:

A. Municipal and industrial laboratories that perform analyses for three (3) or less of the parameters listed in this Section may be exempted from the requirements of these Rules. Written requests for the exemption will be considered by the State Laboratory on a case by case basis.

B. Parameters for which certification may be requested are listed.

C. Prerequisites and requirements for certification and renewal of certification are stated for: 1) laboratory procedures, 2) performance evaluations, 3) supervisory requirements, 4) laboratory manager, 5) application, 6) facilities and equipment, 7) analytical quality control program, 8) issuance of Certification, 9) maintenance of Certification, 10) Certification renewals, 11) data reporting, 12) discontinuation of Certification.

D. Fees associated with the Certification program are outlined.

6. **Pretreatment Programs**

Title 15A - Chapter 2 - Subchapter 2H - Section .0900

These rules set forth the requirements for Publicly Owned Treatment Works (POTWs) that treat wastewater from Significant Industrial Users (SIU) that discharge to their (the POTW's) collection system. Some highlights of this section are:

A. The definition of a Significant Industrial User (SIU) is a user who:
   1. discharges greater than **25,000** gpd of process wastewater or;
   2. contributes more than five (5) percent of any design capacity of the POTW, or;
   3. is required to meet a national categorical pretreatment standard, or;
   4. is determined to have the potential to adversely impact the POTW.

B. If a POTW has a Significant Industrial User (SIU) discharging to their collection system, the POTW is required to submit a pretreatment program to the State. This program must include the following:

   1. An Industrial Waste Survey which documents the efforts of the POTW to locate all possible Significant Industrial Users (SIUs) discharging to their collection system;
   2. A Sewer Use Ordinance (SUO) for pretreatment which includes discharge prohibitions and the authority to enforce pretreatment standards;
   3. A Headworks Analysis (HWA) to provide the technical basis for establishing specific limitations for prohibited pollutants;
   4. The design of a Long Term Monitoring Plan to provide site-specific data for developing the necessary technical basis for pollutant limitations;
   5. A list of the monitoring equipment needed by the POTW to analyze industrial wastewater;
   6. An outline of the procedures to be followed for permitting, construction, operation and discharge from pretreatment units;
   7. An Enforcement Response Plan (ERP) for enforcing the Sewer Use Ordinance requirements;
   8. A request for pretreatment program approval.

C. The Division evaluates submitted programs and all program modifications for approval.

D. All POTWs with an approved pretreatment program are required to submit Annual Reports to the Division which include industrial discharge monitoring data and any enforcement actions taken.

E. As National Pretreatment Standards, including prohibited discharges and industry-specific categorical standards, are modified, the POTW must also adjust limits in their industrial user permits.

G. The public shall have access to information and data submitted under the pretreatment program.

H. Permits issued to industrial users must meet numerous minimum requirements among these being:
   1. information on the industry's processes and pollutants present in its discharge;
   2. limits and monitoring requirements;
   3. general and specific conditions.

I. The POTW has ninety (90) days to approve or deny any permit application.

J. The POTW must offer a hearing procedure to any user whose permit application is denied or whose permit contains unacceptable conditions.

K. The Division has thirty (30) days, from the receipt of a final pretreatment permit, to object to or comment on the permit.

These highlights are just a very brief summary of some of the various Rules that affect wastewater treatment plant operators. For a copy of the Rules, please send a written request, stating the section needed, to:

NC DENR DWQ Water Quality Section
Technical Assistance and Certification Unit
1618 Mail Service Center
Raleigh NC 27699-1618

Examination Schedule and Other Certification Information

The permanent examination schedule for all examinations offered by the Water Pollution Control System Operators Certification Commission is, unless modified by the Commission, as follows:

All examinations will be given on the second Thursday in:

March
June
September
November

Examinations will begin at 1:00 p.m. at various locations throughout the state. Please refer to the examination application form for the exact testing locations.

Listed below is the most recent fee schedule that became effective January 1, 1999:

Standard Examination	$ 85.00

Conditional Certification	$ 75.00
Temporary Certification	$ 200.00
Temporary Certification Renewal	$ 300.00
Annual Renewal	$ 50.00
Replacement of Certificate	$ 20.00

*** Late payment of the Annual Renewal Fee - Please Read Carefully***

Payment of an **annual renewal fee and six contact hours of approved training each year** is required in order to keep a certification active and valid. If the annual renewal fee is not paid or the requirement for contact hours is not documented by the designated due date the certificate(s) will become invalid. A $50.00 late payment penalty will be assessed the first year it is late. The second year a renewal remains unpaid, a late payment penalty of $100.00 (plus the annual renewal fee for that year and the fee and penalty from the previous year) will be assessed and all required continuing education will have to be documented. In order to renew a certificate that has been invalid for more than two consecutive years, the individual must take and make a passing score on an examination of the same type and grade as the former certificate.

Submittal of Applications for Certification Examinations

Applications for certification **must** be received by the Commission **no later than 30 days** prior to an exam date in order to be processed for that exam. **Applications received after this date will not be processed**.

If you need applications or more information, please feel free to contact the Division of Water Quality's Technical Assistance and Certification Unit in Raleigh at (919) 733-0026.

PERSONAL AND PUBLIC SAFETY

1. List the federal and state organizations that are responsible for ensuring worker safety in North Carolina.

2. Describe the health and safety responsibilities of:

   a. System owners;
   b. Site supervisors;
   c. Site employees.

3. List the components of a typical site safety program:

   a. Accident / Incident Reporting;
   b. Emergency Response and Spill Prevention Plan;
   c. Personal Protective Equipment **-** use and care of personal protective equipment;
   d. Understand the basic requirements of the site chemical hazard communication plan and Chemical Hygiene Plan if a laboratory is present on site;
   e. Hazard recognition and abatement.

4. Identify the agencies that need to be contacted in case of spill or release.

5. Be able to implement the basic steps in the Emergency Response and Spill Prevention Plan:

   a. Stop the release;
   b. Assess the extent of the release;
   c. Contact the appropriate agencies;
   d. Implement procedures necessary to rectify and repair damage.

6. Know how to identify the types of personal protective equipment (as required by NC Department of Labor) and understand the use and limitations of the required personal protective equipment. As an example at a minimum, operators should know how to use, care for and know the limitations of:

   a. Hard hats;
   b. Safety shoes and / or boots;
   c. Safety glasses, goggles and face shields;
   d. Gloves, abrasive, exposure, voltage, and others;
   e. Aprons protective clothing for example abrasive, voltage, and others;
   f. Traffic vests;
   g. Personal flotation devices;
   f. Hearing protection.

7. Understand the general types of hazards present on various sites and how to

control those hazards.

8. Understand the requirements for machine guards.

9. Understand the principles of a lockout and tagout program.

10. Define the types of confined spaces and the hazards associated with those spaces:

    a. General confined space;
    b. Permit required confined space;
    c. Non-permit required confined space.

11. Understand how to safely work in confined spaces and the requirements necessary for working in confined spaces. Specifically, operators must understand how to:

    a. Test for hazardous atmospheres;
    b. Understand the dangers of oxygen deficient atmospheres;
    c. Understand what is meant by PEL, TLV, STEL, and IDLH;
    d. Understand and be able to describe the emergency procedures required to be in place for person(s) working in confined spaces.

12. Understand the requirements of process safety management (PSM) and risk management program (RMP) and when such programs are necessary.

13. Understand how to perform a safety analysis of the work areas and understand the following:

    a. Hazards associated with the physical condition of the work area;
    b. Hazards associated with the nature of the work to be performed;
    c. Hazards associated with the time the work is to be performed.

14. When working with hazardous chemicals, operators must:

    a. Be able to properly identify the hazardous chemical(s) used on site;
    b. Know the hazardous by-products of the industrial processes at their facility;
    c. Be able to describe the safe methods for working with strong bases and acids;
    d. Know how to add acids or bases to dilution water;
    e. Understand how to safely transfer chemicals from one container to another;
    f. Be able to list the common symptoms of over exposure to the hazardous chemicals used on site;
    g. Understand how to interpret the chemical container labeling system in use on site;
    h. Understand how to interpret the information presented in material safety data sheets (MSDS).

15. Operators must be able to define the following terms:

a. Oxygen deficiency;
b. Fume;
c. Vapor;
d. Dust;
e. Mist;
f. Olfactory fatigue;
g. Asphyxiant;
h. Combustible;
i. Explosive limits, upper (UEL) and lower (LEL);
j. Corrosive;
k. Flash point.

16. Operators must understand:

a. The potential for electrical shock on site;
b. The level of electrical current that may end in fatal shock;
c. The following terms: insulator, conductor, open circuit, closed circuit;
d. Electrical repairs can only be done by qualified individuals;
e. The site specific equipment lockout and tagout policy and procedures.

17. Operators must be able to demonstrate safe methods for working with strong acids and bases, including adding acids and bases to dilution water, transferring chemicals from one container to another, using protective clothing, and washing after spills or after contact with chemicals.

18. Operators must be able to describe all start-up, lock-out, and shutdown procedures for individual motors in their facility, including especially such procedures as checking for missing or loose coupling guards, loose hold-down bolts, improper wiring connections, and improper circuit identification.

19. Operators must be able to carry out safe scum removal procedures. If primary clarifier scum is subjected to further treatment, operators must know how to safely dispose of the scum through incineration, burial, or digestion.

LABORATORY ANALYSES, SAMPLING, AND MONITORING

1. Discuss representative sampling.

2. Compare the types of samples:

    a. Grab;
    b. Composite;
    c. Flow proportional composite and;
    d. Time composite.

3. Where can sampling frequency requirements for your facility be found?

4. Which analyses must be conducted “immediately”?

5. Describe the difference between sampling for process control and sampling for compliance reporting.

6. Within how many minutes must a sample be analyzed to be considered “immediate”?

7. Why should approved methods be used for performing sample analysis?

8. Describe the testing method for settable solids.

9. In what documents are sampling requirements listed:

    a. NPDES Permit;
    b. Pretreatment Permit;
    c. Non-discharge Permit;
    d. Sewer-Use Ordinance;
    e. Federal Register and;
    f. North Carolina General Statutes.

10. Discuss the determination of total sludge solids.

11. Compare the settleablity test and the settable solids test.

12. Describe the COD determination methods.

13. Discuss the measurement of pH.

14. Describe the determination of metals in wastewater.

15. Explain nitrogen in wastewater and its determination.

16. Discuss the determination of ammonia nitrogen using an ion-selective electrode.

17. Discuss the method of oil and grease determination.
18. Discuss the determination of phosphorus in wastewater.
19 Discuss the determination of surfactants.
20. Describe the determination total organic carbon (TOC).
21. Discuss the terms “solution” and “normality” and glossary of laboratory terms.
22. Discuss the importance of effluent disposal.
23. Explain the treatment requirements of wastewater.
24. Describe monitoring D.O. (dissolved oxygen) in receiving waters.
25. Describe types of receiving waters other than streams and rivers.
26. Discuss the need for analyzing and presenting data.
27. Describe the average or arithmetic mean of data.
28. Describe the range of values of collected data.
29. Describe the terms “variance”, “standard deviation” and “mode”.
30. Explain how one decides how many samples need to be collected.
31. Discuss who will analyze the samples after collection.
32. Discuss what kind of sample containers will be used.

MATHEMATICS

1. Tank Volume Calculations:

    a. Given the dimensions of a square, rectangular or circular tank, calculate volumes in cubic feet and gallons;
    b. Given the diameter and length of pipe, calculate the volume of the pipe in cubic feet and gallons.

2. Milligrams Per Liter to Pounds Per Day Calculations:

    a. Using the "pounds formula", be able to figure all variables (pounds, concentration or flow);
    b. Be able to calculate chemical dosages in lbs./day using results from a jar test;
    c. Calculate suspended solids loading in pounds;
    d. Calculate suspended solids removal rates.

3. Hydraulic Loading Rate Calculations:

    a. Given the appropriate data, be able to calculate hydraulic loading rates (gpd/sq. ft.);
    b. Given the appropriate data, be able to calculate surface loading rates (gpd/sq. ft., gpm/sq. ft.);
    c. Given the appropriate data, be able to calculate filtration rates (gpm/sq. ft.);
    d. Given the appropriate data, be able to calculate weir overflow rates (gpm/sq. ft.).

4. Detention Times Calculations: Be able to determine detention time (or filling time) of various square, rectangular and circular structures.

5. Efficiency and Other Percent Calculations:

    a. Given the appropriate data, be able to evaluate process efficiency by percent removal of a wastewater constituent and
    b. Understand and calculate solution strength when expressed as percent.

6. Chemical Dosage: Given the appropriate data, be able to calculate chemical feed rates.

7. Clarifier Solids Production:

    a. Given the appropriate data, be able to determine the lbs./day solids removed by a clarifier and
    b. Given the appropriate data, be able to determine clarifier efficiency.

8. Solids Handling:

a. Given the appropriate data, be able to calculate hydraulic loading of a belt filter press;
b. Given the appropriate data, be able to calculate sludge feed rates to various dewatering devices;
c. Given the appropriate data, be able to calculate the necessary duration of filter operation per day, the solids recovery %, and the filter yield in lbs./sq. ft./hr. and
d. Operators should be able to calculate the following items in regards to sludge handling:% recovery, filter yield, and calculate the duration of time the filter must operate each day, in hr./day.

9. Jar Test, Metal Precipitation, and pH Adjustment Calculations

10. General Mathematics -- Operators must be able to perform the following:

a. Add, subtract, multiply, and divide whole numbers, decimals and proper and improper fractions;
b. Square and cube whole numbers, decimals, and proper and improper fractions;
c. Convert fractions to percentages and decimals, and vice versa;
d. Interpret graphs, including line, bar, percentage, and broken-line graphs;
e. Read tables; and
f. Using conventional formulas, solve for direct and inverse proportions; calculate area of rectangles, triangles, and circles; calculate surface area of cylinders, cones, and spheres; and determine volume of cubes, cylinders, cones prisms and spheres.

Physical Chemical

Grade I

MOTORS, COUPLING and DRIVE MECHANISMS

1. Operators must be able to define resistance, RPM (revolutions per minute), amperage wattage, voltage, phase, ground, kilowatt-hours, alternating current (AC), direct current (DC), brake horsepower, single and three phase, neutral, hot wire, ground fault, and motor efficiency.

2. Operators must be able to inspect an operating electrical motor to verify that it is running normally, with no excessive heat or vibration.

3. Operators must be able to measure for proper motor operating temperatures, as specified on motor data plates and proper rotation and alignment.

4. Operators must be able to properly service all accessible lube points in a motor.

5. Operators must understand how to re-start motors using a proper sequence in order to avoid damage or excessive power draw.

6. Operators must be able to explain the following additional functions of couplings:

    a. Accommodation of shaft misalignment;
    b. Electrical insulation;
    c. Simplification of maintenance;
    d. Dampening of vibration; and
    e. Use of shear pins for torque overload protection.

7. For all belt driven equipment, operators must be able to locate and describe the functions of the following components:

    a. Belt guards;
    b. Belts;
    c. Sheaves (pulleys); and
    d. Drive and pump shafts.

8. Operators must be able to describe all of the main types of “hub” mounting procedures for attaching coupling to shafts, including slip-fit, press-fit, shrink-fit, tapered shaft, or tapered bushing.

9 For variable speed reducers, operators must be able to ensure that the vent plug is not clogged with dirt or grease. Also, operators must be able to replace belts and adjust belt tension in variable speed reducers.

    a. With variable speed reducers, operators must understand that, in order to prevent damage to the drive belt and movable pulley, speed changes are made only while equipment is running.

b. For all speed reducers, operators must know proper oil change intervals and the location of all lubrication points. In addition, operators should be able to carry out all required lubrication and be able to explain why the grade of oil or grease called for in each application has been specified.

10. Operators must be able to specify the location and type of each bearing or gear in clarifiers and chain drives and must be able to specify a lubrication program for each of them.

11. Operators must be able to inspect lubrication levels, drive alignment, and assembly integrity of clarifier units prior to starting up or returning them to service.

PUMPS

1. Operators must be able to identify and describe the principles of operation for each of the following types of positive displacement pumps:

   a. Rotary (including gear, screw, and progressive cavity); and
   b. Reciprocating (including diaphragm, piston, and plunger).

2. Operators must be able to identify and describe the principles of operation for each of the following types of pumps:

   a. Centrifugal;
   b. Turbine;
   c. Screw;
   d. Progressive cavity;
   e. Airlift;
   f. Ejector.

3. For centrifugal pumps, operators must be able to explain the function of each of the following:

   a. Volute;
   b. Impeller;
   c. Lantern ring;
   d. Wear ring (or plate);
   e. Stuffing box;
   f. Packing gland;
   g. Inlet;
   h. Discharge;
   i. Mechanical seal;
   j. Shaft sleeve; and
   k. Cut tip.

4. For positive displacement pumps, operators must be able to define the function of each of the following:

    a. Check valve;
    b. Stroke adjustment knob;
    c. Packing.

5. Operators must be able to define:

    a. Cavitation;
    b. Lock out;
    c. Pressure;
    d. Head;
    e. Prime;
    f. Weepage;
    g. Friction loss;
    h. Series operation;
    i. Parallel operation;
    j. Velocity;
    k. Air bind;
    l. Vacuum
    m. Suction head, discharge head, total dynamic head (TDH), and net positive suction head (NPSH).

6. Operators must be able to diagnose the need for pump repacking by observing the rate of weepage and adjustment potential remaining on a pump's packing gland. Operators must also be able to demonstrate proper repacking techniques.

7. Operators should be able to disassemble a pump to the extent necessary to troubleshoot pump efficiency problems and replace worn internal parts such as seals, sleeves, impellers, and wear rings.

8. Operators must be able to prime installed in suction lift condition for repriming a pump that has lost prime or become air locked.

9. Operators must be able safely to drain and flush pumps in which septicity is likely, due to residual sewage being contained in the volute or connecting pipes.

10. Because blowers and compressors are similar to pumps in construction and operation, the skills listed here are usually applicable to those pieces of equipment. Operators must be able to recognize and describe the principles of operation of the main types of compressors, including rotary lobe, rotary vane, and piston. For compressors and blowers, operators must be able to clean and maintain (or replace) air intake filters; locate and maintain pressure relief valves and pressure switches; and identify and maintain support equipment such as moisture traps, air dryers, and regulators.

11. Operators must be able to explain why valves located on the discharge side of all pumps, particularly positive displacement pumps, must be open and /or operable

(for example, check valves) before start-up. (**Note**: this excludes centrifugal blowers.) Operators must also understand why no valves should be closed until a positive displacement pump has been shut down, come to rest, and been locked out.

12. For gate valves and other manually adjustable flow control valves, operators must know the full open point, full closed point, normal operating point, and proper throttling technique, if appropriate.

13. Operators should understand how labeling systems are used to distinguish individual piping systems (including electrical conduit).

14. Operators should understand the different types of piping materials and chemical compatibilities.

HYDRAULIC AND FLOW MEASUREMENT EQUIPMENT

1. Operators must be able to explain the importance of maintaining unrestricted hydraulic flow above, in and below a flume.

2. To ensure that a weir is providing accurate flow data, operators must be able to define, locate, and describe the significance of the following: head behind weir, weir crest, and nappe (the overflowing sheet of water).

3. For sharp-crested weirs, operators must be able to explain why the proper orientation of the weir plate always places the level on the downstream side.

4. Given relevant hydraulic data and flume or weir flow tables, operators must be able to measure flow through a flume or weir.

5. Operators must be able to maintain equipment and flow logs that make it immediately obvious when data from measurement devices are unusual or well outside of expected values.

6. For all passive flow measurement devices, operators must be able to follow appropriate maintenance programs such as algae removal, leakage prevention and grease removal.

7. Operators must know the regulations concerning flow meter calibration to check accuracy of flow meters.

8. Operators must know to check flow rates at a time of representative flow.

9. Operators must know what a staff gauge is and how to use it.

10. Operators must know the typical uses and operational parameters for the following flow measuring devices:

    a. Parshall flume;

b. Weirs;
c. Venturi flow tube;
d. Magnetic meter;
e. Transient time ultrasonic;
f. Doppler ultrasonic;
g. Propeller;
h. Turbine;
i. Orifice;
j. Rotometer;
k. Float operated system.

INSTRUMENTATION (Meters, Alarms and Control Systems)

1. Operators must be able to recognize the units of measurement used on the scales or gauges of meters.

2. Operators must be able to calibrate, use and maintain the following portable test equipment:

   a. Pressure gauges, both compound and vacuum;
   b. Thermometers;
   c. DO, pH, and Cl_2 residual meters; and atmospheric monitoring devices.

3. Operators must be able to describe the general design principles of each major type of control system, including pneumatic, float, hydraulic, electrical, and timing systems

4. For any alarm system which is activated in a facility, operators must be able to respond by identifying the specific cause triggering the alarm and then solving the problem or identifying and contacting those who can.

5. Operators must be able to establish and maintain correct parameters within which their control systems operate, or have sufficient access to manufacturers' literature or technical representatives to be able to easily establish such parameters.

6. Operators should be able to specify an expected range (reading) under normal operating conditions for each meter or gauge in their facility or facilities.

7. Operators must be able to test alarm systems under non-emergency conditions, and be able to develop and implement a schedule of performance tests which will ensure proper operational status at all times.

8. For each alarm system in their facility or facilities, operators must be able to specify purpose, location of sensor, signal sending unit, signal receiving unit, and all modes of the alarm signal (sonic, visual, electronic, or telemetric). In addition,

operators must be able to demonstrate reset procedures.

9. Operators must be able to diagram the reporting chain or network through which to communicate the need for emergency response procedures when an alarm system indicates an emergency situation (e.g., fire, major chemical spill, or dangerous atmosphere).

10. In the event of suspected malfunctions, operators must be able to contact by telephone the manufacturer or manufacturer's representative for any emergency alarm system in their facility.

CLARIFICATION

1. Operators must be able to safely and effectively perform routine start up operation and maintenance.

2. Operators must be able to divert flow from a clarifier, shut the unit down, wash the unit out (diverting the wash flow to the head of the plant), and safely make routine (minor) repairs to the structure or drive mechanism.

3. Operators must understand the effects of the following on clarifier efficiency:

    a. Detention time;
    b. Removal efficiency;
    c. Weir overflow rate;
    d. Surface loading rate;
    e. Solids loading rate.

4. Operators must know the causes and remedies for clarifier short-circuiting.

5. Operators must know the difference between vertical and horizontal flow clarifiers.

6. Once a clarifier is loaded, operators must know how to establish and maintain a correct sludge withdrawal rate.

7. Operators must understand the effects of the following on clarifier efficiency:

    a. Particle size;
    b. Particle shape;
    c. Water temperature.

8. Operators must be able to locate and identify the main components of clarifiers, including parts common to all clarifiers:

    a. Influent pipe;
    b. Effluent weirs;

c. Effluent channel;
d. Sludge collector mechanism;
e. Sludge withdrawal system; and
f. Sludge/scum collector drive mechanism.

9. Operators must be able to carry out the following performance inspections of clarifiers:

   a. Monitor scum levels on water surface and
   b. Measure sludge blanket depth.

10. Operators must be able to recognize hydraulic overload and, if possible, take corrective action before the sludge blanket in clarifiers is threatened with washout, resulting in permit violations and fines.

11. Operators of clarifiers must be able to design and implement an emergency response plan for dealing with mechanical failure of a clarifier. The minimum objectives of such a plan must include methods for:

   a. Removal of the sludge blanket as quickly as possible;
   b. Diversion of flow away from the affected clarifier;
   c. Protection against freeze-up, if failure occurs during cold weather; and
   d. Protection of the sludge collection mechanism from jamming or other malfunction.

12. Operators must be able to carry out routine inspections and mechanical maintenance of clarifiers, including:

   a. Cleaning weirs and effluent channel;
   b. Changing or adjusting packing on all pumps;
   c. Lubricating drive motors, pumps, and collector mechanisms;
   d. Exercising all valves;
   e. Visually inspecting for proper rotation of collector mechanisms;
   f. Listening for any unusual mechanical sounds (for example, scraping, “chirping,” whining, or bumping);
   g. Inspecting oil or grease leaks; and inspecting airlifts and related piping for correct pressure.

13. Before starting up a clarifier, operators must be able to inspect for:

   a. Debris or other foreign material in the clarifier;
   b. Proper mechanical and electrical operation of the collector mechanism; and
   c. Correct operation of the sludge pumps after loading begins.

GROUNDWATER REMEDIATION SYSTEM

1. Contaminants—identify the most common types of contaminants found in groundwater that are being remediated.

    a. Volatile Organic Compounds (VOC),
    b. Semi-Volatile Organic Compounds (SVOC)
    c. petroleum hydrocarbons
    d. solvents
    e. pesticides
    f. nitrates, metals

2. Define the following terms:

    a. groundwater
    b. saturated zone
    c. unsaturated zone
    d. capillary fringe
    e. permeability
    f. confined aquifer
    g. unconfined aquifer
    h. drawdown
    i. yield

3. Identify and explain properties of contaminants including:

    a. solubility
    b. vapor pressure
    c. charges

4. Identify and describe the common types of groundwater remediation systems:

    a. pump and treat
    b. inorganic remediation processes
    c. in-situ treatment
    d. soil vapor extraction
    e. air sparging
    f. combined systems
    g. intrinsic bioremediation

5. Identify and describe the operation and O&M of components of a pump and treat system

    a. pumps
    b. oil water separator
    c. bioreactors

d. air stripper
e. UV oxidation
f. carbon adsorption
g. offgas treatment
h. filtration
i. control systems

6. Identify and describe the methods of remediating inorganic contaminants:

a. Neutralization
b. precipitation/flocculation/sedimentation
c. oxidation-reduction
d. ion exchange
e. carbon adsorption

7. Regulatory—Operator should be aware of the different agencies that may have regulatory authority.

a. NCDENR – Division of Water Quality;
b. NCDENR – Division of Waste Management;
c. NCDENR – Division of Air Quality;
d. US EPA.

TREATMENT USING GRANULAR MEDIA FILTRATION AND MICROSCREENING

1. Operators must be able to describe the function of granular media filtration and specify the location of such a filter in a typical industrial wastewater process stream.

2. Operators must be able to define and describe the filtration and backwashing phases of the filter operation:

a. Breakthrough;
b. Head loss;
c. Differential Pressure;
d. Run length;
e. Channeling;
f. Fouling;
g. Air scouring;
h. Surface wash;
i. Media loss.

3. Operators should be able to differentiate between the operation of downflow, upflow, and bi-flow filters; single and multimedia filters; and gravity and pressure filters.

4. Operators looking at a cross-section of a typical downflow gravity filter must be

able to identify and describe the function of the following components:

a. Influent piping and valve;
b. Washwater trough;
c. Media;
d. Support gravel;
e. Underdrain system;
f. Effluent piping and valve;
g. Washwater piping and valve; and
h. Drains

5. Operators should be able to explain how filter influent characteristics, flow rate, media characteristics, and available head determine run length of a filter.

6. Operators must be able to describe the three important types of flow control systems used in granular media filtration: effluent rate control, influent flow splitting, and declining rate filtration.

7. Operators must be able to identify the typical causes and implement control measures for the following common operational problems:

a. Turbidity breakthrough;
b. Grease build-up;
c. Loss of filtering medium;
d. Gravel mounding;
e. Short filter runs;
f. Mudballs
g. High suspended solids concentrations

8. Operators must be able to identify and perform routine maintenance on the following components of a typical microscreen system:

a. Drum;
b. Microfabric;
c. Water spray system;
d. Solids waste hopper.

9. Operators must be able to describe how microscreens remove small solids from wastewater and must be able to explain the significance of the size of the openings in microfabric.

10. If filters or microscreens are used, operators must be able to perform backwashing at the recommended frequency. If automatic or continuous backwashing filters are used, operators must be able to check their performance regularly and adjust the backwash cycle or backwash water flow rate as necessary.

FLOW AND LOAD EQUALIZATION

1. Hydraulics: Operators must understand the basic principles of hydraulics and how they relate to flow through a treatment plant.

   a. Basic principles – Conservation of Energy Equation
      - Understand how material and pump selection can affect the hydraulic**s** in a treatment plant
      - Understand how a change in elevation can affect flow through a treatment plant
      - Understand how pressure affects flow through a treatment plant –including how this relates to fluid levels in equalization tanks

   b. Basic principle – Continuity Equation
      - Understand how a change in flow conveyance geometry can affect flow velocity and how the change can affect treatment processes

2. Operators must be able to describe the following principles:

   a. Flow equalization;
   b. Load equalization;
   c. Emergency retention.

3. Operators must know the difference between variable volume and constant volume equalization and where each is applicable.

4. Operators must know the role of mixing in equalization.

5. Operators must know how to adjust flow rates from an equalization tanks in response to influent flow rates and the impact such adjustment will have on downstream unit processes.

6. Operators must understand the difference between sideline and inline equalization.

RESIDUAL SOLIDS MANAGEMENT

1. Operators need to know that prior to the Clean Water Act it was common practice to discharge treatment waste directly to receiving stream.

2. Operators must know that specific effluent discharge limits are now required and regulated through the NPDES permitting program.

3. Operators must know what NPDES stands for. (National Pollutant Discharge Elimination System)

4. Operators must know the negative effect residual solids have on the receiving stream. (Sediment builds up in rivers and streams, toxic effect to biological life,

detrimental to wildlife)

5. Operators must know that the disposal of residual solids requires a Non-Discharge Permit issued by DWQ (Division of Water Quality).

6. Operators must know the sources of residual solids (sludge) production (ex. Filter backwash water, sedimentation tanks or basins, metal precipitation).

7. Operators must know the methods of residual solids removal. (Manual: drain tank, wash down and squeegee tank. Continuous: mechanical rakes or scrapers, vacuum methods, upflow clarifiers)

8. Operators must know solids handling alternatives. (Thickening, Conditioning, Dewatering, Disposal)

9. Operators must know that the primary function of thickening is to reduce the sludge volume.

10. Operators must know various thickening processes. (gravity thickener, diffused air floatation, centrifuge, gravity belt thickener, rotary drum thickener)

11. Operators must know that Conditioning facilitates the removal of water in thickening and dewatering processes.

12. Operators must know various products used in Conditioning. (ferric chloride, lime, polyelectrolytes)

13. Operators must know that synthetic organic chemicals know as Polyelectrolytes used in conditioning are commonly called Polymers.

14. Operators must know the three (3) general types of polymers and their charge (anionic-negative charge, cationic-positive charge, and nonionic-neutral charge).

15. Operators must know that the objective of Dewatering is to reduce the sludge moisture and sludge volume.

16. Operators must know the various methods used for dewatering residual solids. (pressure filtration including plate & frame filter press and belt filter press, vacuum filtration, sand drying beds, vacuum assisted drying beds, drying lagoons, and bag filters)

17. Operators must know where laws that regulate the disposal of industrial residual solids are found. [40 CFR Parts 257 and 258]

18. Operators must know the various methods available for disposal of residual solids. (land application, distribution & marketing, monofilling, surface disposal, discharged to sanitary sewer.

ASH SEDIMENTATION BASIN

1. Operators must know the reason for having ash basins (History)

2. Operators must understand the use of precipitators for increased solids removal prior to basin use.

3. Operators must know the environmental impacts of not using an ash basin.

4. Operators must know the process of ash sedimentation and metals removal.

5. Operators must know control technologies pertaining to ash basin operations.

6. Operators must know the common testing parameters for ash basin effluents.

7. Operators must know the effect and importance of pH control for operations.

8. Operators must know the effects of thermal differences for ash basin operation.

9. Operators must know the characteristics of the influent slurry stream.

10. Common effluent testing parameters.

11. What regulatory agency(s) control ash basin operations?

ENGINES and GENERATORS

1. Operators must be able to locate the following on an engine: throttle; choke; battery (if appropriate); pull-rope; spark plugs or glow plugs; air, fuel, and oil filters (if appropriate); oil drain plug; cooling system; and fan or other belts (if appropriate).

2. Operators must be able to interpret typical engine operating gauges such as tachometers; oil, temperature, and pressure gauges; fuel gauges; and thermometers.

3 Operators should be able to perform the following routine preventive maintenance tasks for any internal combustion engine:

   a. Change or clean all filters according to prescribed schedule;
   b. Change oil according to prescribed schedule and manufacturer's recommendations;
   c. Replace and gap new spark plugs and points for gasoline engines according to prescribed schedule;
   d. Inspect belts for wear and replace if necessary, restoring proper tension;
   e. Check and maintain battery, cables, and terminal posts;
   f. Check coolant level and add coolant when necessary; and

g. Add appropriate fuel additives for winter operation.

4. Operators should be able to perform the following simple troubleshooting tasks for engines:

   a. Check all spark plug connections;
   b. Check and replace a battery;
   c. Check fuel lines for blockage;
   d. Diagnose engine flooding;
   e. Check air filters for blockage; and
   f. Prime diesel fuel injectors when dry.

5. If the system has not been designed for automatic start-up after power failure or when the automatic device fail, operators must know exactly how to start up and shut down a stand-by electrical generating system.

6. Operators must be able to interpret accurately any gauges designed to measure generator performance (voltage, amperage, kilowatt/hours, etc.) and understand proper documentation.

CARBON ADSORPTION

1. Operators must be able to describe in general terms the physical process of adsorption of the non–biodegradable and slowly biodegradable organic compounds on to organic carbon along with factors affecting process effectiveness.

2. Operators must be able to define the following:

   a. Electrostatic attraction;
   b. GAC (Granular activated carbon);
   c. PAC (powdered activated carbon);
   d. Head loss;
   e. Quench;
   f. Organic;
   g. Regeneration;
   h. Defining;
   i. Breakthrough;
   j. Turbidity;
   k. Flux;
   L Channeling;
   m. Delta P and;
   n. Backwashing.

3. Operators must be able to calculate and trend COD removal efficiencies in carbon adsorption columns, by comparing COD analyses of carbon column influent and effluent.

4. Operators must be able to determine if there has been fouling of carbon in a

column, due to decreased upstream organic compounds, and should be able to take necessary corrective actions.

5. Operators must be familiar with various carbon adsorption processes and common components along with most common associated problematic and / or emergency conditions.

6. Operators must be able to describe and conduct typical process monitoring that should be performed on a carbon adsorption unit.

7. Operators must be able to determine if pumps are pumping adequate amounts of carbon slurry.

8. Operators must be able to describe some of the typical industrial applications for activated carbon treatment.

9. Operators must be aware of necessary activities to start up and shut down a carbon adsorption unit.

10. Operators must be familiar with various regeneration processes and common components along with typical associated problems and situations.

DISSOLVED AIR FLOTATION

1. Operators must know the two primary purposes for utilizing a DAF?

2. Operator must know the six primary parts of a DAF and their functions:

    a. Air Injection Equipment;
    b. Pressurized Retention Tank;
    c. Recycle Pump;
    d. Distribution assembly;
    e. Sludge Scrappers and;
    f. Effluent Baffle.

3. Operator must know the preferred mode of operation from a Maintenance standpoint.

4. Operator must know the normal pressure for the DAF recycle tank.

5. Operator must be able to calculate hydraulic and solids loading rate.

6. Operator must know the typical range of recycle rate on a DAF.

7. Operator must know the normal float level under the water line for proper operation of a DAF.

8. Operator must know the most common method of Dissolved air flotation.

9. Operator must know the following factors affecting DAF operational efficiency:

    a. Solids Loading;
    b. Hydraulic Loading;
    c. Air to Solids Ratio;
    d. Recycle Rate and;
    e. Sludge Blanket Depth.

10. Operators must know proper startup procedures.

11. Operators must know proper shutdown procedures.

12. Operators must know proper chemical use, addition and effect on system efficiency.

GREASE AND OIL REMOVAL

1. Operators must be able to describe/understand local regulatory pretreatment standards (oil/grease limitations).

2. Operator should understand and make an attempt to find out how the oil/grease is being generated and why it is being introduced into the wastewater waste stream.

3. Operators must be able to describe the types of oily waste encountered by operators: free oils, emulsified /water soluble oils, and greases.

4. Operators must be able to describe the treatment options associated with the free oils.

5. Operators must be able to describe the treatment options associated with emulsified/water soluble oils.

6. Operators must be able to describe the treatment options associated with *greases*.

7. Operators should understand (and describe basic operating principles) on the following oil/grease removal systems:

    a. Physical/Chemical Systems (including DAF);
    b. API (American Petroleum Institute Oil/Water Separators;
    c. Oil Skimmers and;
    d. Grease Traps.

8. Operators must be able to describe floatation, coagulation, and the role of chemicals used in destabilization of oil and grease emulsions.

9. Operators must be able to verify normal operation of DAF System thickeners by

determining the proper water, waste, and chemical feed rates, air pressure, and by checking sampling results.

10. Where oil and greases are separated by coagulation in settling tanks, operators must be able to establish correct feed pump coagulant rates, determine accuracy of associated metering devices, and verify flow through chemical dosing lines.

11. Operators must be able to verify satisfactory operation of centrifuges, special media filters, or heat treatment devices, if these devices are used to separate oils and greases from waste streams.

12 Operators must be able to carry out routine maintenance of equipment used to separate oil and greases:

    a. Lubricating units at the recommended frequency; and
    b. Examining bearings and seals.

13. Operator must be able to establish schedules for and implement regular cleaning of oil & grease separation equipment:

    a. Grease traps;
    b. Oil Skimmers;
    c. Oil/Water Separators and;
    d. Coalescer.

14. Operator must be able to describe NCDENR regulations regarding storage, accumulation of used oil/grease.

15. Operator must be able to describe (be familiar) with local options for recycling used oil and the collection requirements for recycling agencies.

Physical Chemical

Grade II

CHEMICAL TREATMENT PROCESSES

1. Describe how the following common chemicals are used for treatment:

    a. Aluminum Sulfate (dry & liquid)
    b. Ferric chloride;
    c. Lime;
    d. Polymeric Flocculants (dry and liquid)
    e. Coagulants

2. Define anhydrous and describe how it relates to the physical properties of flocculants.

3. Describe the following equipment used to feed flocculants and coagulants:

    a. Positive displacement pumps;
    b. Screw feeders;
    c. Vibrating trough feeders;
    d. Rotary feeders;
    e. Belt-type gravimetric feeders.

4. Describe why the use of metering equipment is important for a chemical feed system.

5. Describe what considerations must be made when a chemical feeder is selected?

6. Describe the start-up procedure for a chemical feed system.

7. Describe how to determine chemical dosage.

8. Describe the procedure for performing a jar test.

CHLORINATION/DECHLORINATION AND ULTRAVIOLET DISINFECTION

1. Operators must be able to define disinfection and identify the primary reasons for the disinfection of industrial wastewater effluent.

2. Operators must be able to explain the basic factors that influence the effectiveness of chlorine and bromine disinfection, including temperature, contact time, disinfectant concentration, pH, and effluent quality.

3. Operators must be aware of the reactions of chlorine with water, ammonia, and readily oxidizable substances, specifically describing the formations of

hypochlorous acid, hydrochloric acid, and the types of chloramines.

4. Operators must be able to describe the breakpoint curve, and define *free available chlorine and combined chlorine residual*.

5. Operators must be able to: (a) describe the influence of adequate mixing on the overall chlorination process, (b) define chlorine demand, and (c) calculate required chlorine dosages when given chlorine demand and wastewater flow rates. Operators must also be able to describe and perform the test for residual chlorine.

6. For chlorine feed systems, operators must be able to identify typical components and describe how they function, including:

    a. For chlorine containers (150 lb., one ton), identify gas outlet (s), liquid outlet(s), fusible plug, maximum gas and/or liquid withdrawal rate; and;
    b. For gas chlorinators, define and describe:

        1) Direct feed (or dry feed);

        2) Solution feed;

        3) Vacuum feed (including manual and automatic flow and residual feed control);

        4) Scales;

        5) Piping, valves, and connections; and

        6) Rotameter

7. Operators must be able to define and describe operational components, maintain and operate a hypochlorite feed system.

8. Operators must be able to describe the potential toxicity to fish and other aquatic organisms caused by discharges to receiving streams of excessively chlorinated effluent.

9. Operators must be able to describe the effects of over-sulfonation on effluent streams, including lowered pH and reduced DO.

10. Operators must be able to describe the purpose of dechlorination and be able to identify components of a typical sulphur dioxide or other dechlorination system.

11. For sulfur dioxide dechlorination, operators must be able to explain the importance of rapid and positive mixing.

12. Operators must be able to describe the basic principles of disinfection by ultraviolet radiation and be able to identify and describe key components of such systems, including UV lamps, lamp enclosures, and ballasts.

a. Operators must be able to describe the effect of dirty radiation lamps, and explain the importance of regular lamp cleaning to the overall efficiency of the disinfection process.

b. Operators must be able to explain how higher suspended solids**,** the presence of dyes or color, and higher turbidity will lower the rate of light transmission, and thus negatively affect ultraviolet disinfection.

13. Operators must be able to cite common advantages and disadvantages of disinfection with UV radiation, including:

Advantages:
a. No oxidant residual formed (with its potential for toxicity, odor, etc); and
b. Effective disinfectant for a variety of microorganism types;

Disadvantages
c. Control of disinfection process made more difficult by the lack of a method for accurately measuring UV dose; and
d. Lack of residual disinfection agent for control of regrowth.

pH ADJUSTMENT/NEUTRALIZATION

1. Operators must be able to define pH, and describe the need for chemical control of pH in a waste stream.

2. Operators must be able to ensure satisfactory operation of the mixing device in a pH adjustment tank by observing control panels, surface turbulence, vibration, and noise.

3. Operators must be able to describe startup, shut down and cleaning procedures for mixing equipment in pH tanks.

4. Operators must be able to inspect chemical feed systems, including feed pumps, metering devices. And dosing lines to verify normal operation.

5. Operators must be able to flush chemical feed lines and clean tanks and lines when not in use.

6. Operators must know the effects and common uses for the following, including safety practices:

a. CaO (calcium oxide, [lime]);
b. MgO (magnesium oxide);
c. CaOH (calcium hydroxide);
d. $Mg(OH)_2$ (magnesium hydroxide);
e. H_2SO_4 (sulfuric acid);
f. HCL (hydrochloric acid);

g. CO_2 (carbon dioxide);
h. SO_2 (sulfur dioxide);
i. NaOH (sodium hydroxide)

7. Operators should be aware of pH limits in regards to hazardous waste rules.

COAGULATION, RAPID MIX, FLOCCULATION, AND CLARIFICATION

1. Operators must be able to describe and implement the three sequential unit operations of the wastewater coagulation process:

   a. Rapid mix;
   b. Flocculation; and
   c. Separation through clarification.

2. Operators must be able to optimize the chemical and environments in the tanks where the three (3) above unit operations occur. Specifically, operators, must be able to:

   a. Observe the quality of the floc and the location of settling particles in the rapid mix and flocculation basins, and adjust mixing and paddle rates (break-up of the floc will indicate over-mixing, while settling of excessive amounts of particles or dead spots will indicate under-mixing);
   b. Measure the depth of sludge in chemical clarifiers with a “sludge judge” and adjust sludge removal pumping rates to maintain correct sludge levels; and
   c. Conduct jar tests to select appropriate coagulants and to determine correct dosing rates based upon operational pH range.

3. Operators must be able to verify normal operation of chemical feed systems by observing feed pump operation, metering devices and process observation.

4. Operators must also be able to perform maintenance of chemical feed pumps, including replacement of bearings, diaphragms, seals and when necessary prime the chemical feed pumps.

5. Operators must be able to take a coagulation unit out of service, conduct routine maintenance, and bring the unit back on line.

6. Operators must be able to describe the basic principles of polymer addition to waste streams, including:

   How polymers assist the coagulation process;
   a. Why some polymers are negatively charged (anionic) and some are positively charged (cationic); and
   b. Polymer mix and/or storage tank.

7. Residuals management must be handled according to appropriate Federal, State and Local requirements.

Operator must be able to "troubleshoot" a Physical/Chemical Treatment System.

METAL PRECIPITATION AND REMOVAL

1. Operators must be able to describe the general chemical process of hydroxide precipitation and explain how the process is used to remove metal ions from waste solutions.

    - In addition, operators must be able to explain the relationship of the efficiency of a metal precipitation process to pH and display a precise understanding of the optimum pH required for each metal to be removed from solution.

2. Operators of precipitation processes treating several metals in solution simultaneously must be able to demonstrate techniques for optimizing precipitation of whichever metal has the most stringent discharge permit requirement.

3. Operators must be able to explain how metal hydroxides precipitating out of solution can be made to form flocs through the addition of pH adjusting chemicals.

4. Operators using flocculation basins or tanks must be able to calculate dosages of any polymers added to strengthen floc formation of waste metal hydroxides.

5. Operators must be able to define "complexed" metals and should be able to explain why complexed metals tend more strongly to remain in solution and to resist precipitation, until the complexing agent can be degraded through oxidation.

6. Operators must know safe techniques for treatment of cyanide and cyanide compounds without producing hydrogen cyanide gas.

7. Operators must be able to distinguish visually between batch and continuous flow systems. Batch systems are used for treating smaller volumes and require longer hydraulic retention times (that is, larger tanks for treating the equivalent volume).

8. Operators must be able to estimate the operating pH of a metals precipitation unit by observing the performance of the flocculating and settling basins, and by monitoring the effluent quality. Poor floc formation may be related to operation at a pH level outside the optimum pH range or the presence of chelating agents.

9. Operators must be able to determine the adequacy of mixing following addition of floc promoting chemicals. Contact time and tank size must be understood in this process. For example, poor mixing of the lime or caustic feed with the metal waste stream may cause rapid fluctuations in pH levels.

10. Operators must be able to determine adequacy of lime, caustic, and/or polymer

doses by observing the pH, the quality of the floc, and the clarity of the effluent.

11. Operators must be able to perform daily inspections of mixers in pH adjustment tanks, flocculating paddles in the flocculation basins, and moving parts in the settling tanks. Operators must also be able to perform preventive maintenance of moving parts at the frequency recommended by the manufacturer.

12. Operators must be able to inspect tanks and metal plates for unusual rust and corrosion.

13. Operators must be able to calibrate pH probes using standardized solutions at the recommended frequency.

14. To prevent caking and build-up within chemical feed lines, operators must be able to properly flush chemical feed lines at regular intervals. This is very important in systems using lime and magnesium hydroxide that are in operation for only part of the day.

15. Operators must be able regularly to clean lamella plates of chemical clarifiers to prevent build-up of deposits on the plates. Operators must be able to explain how excessive build-up of metal precipitates can lead to periodic sloughing of metal sludges into the effluent, increasing the concentration of metals in the final effluent.

16. Operators must be able to implement adequate precautions when handling fifty (50) percent caustic soda. These precautions include the use of adequate personal protective equipment.

17. Operators must be able to follow all safety precautions when handling dry or liquid polymers.

18. When acid addition systems are used to adjust the pH following metals removal, operators must be able to describe and implement precautions (including adequate PPE) to be used while handling acids.

19. Operators must be able to explain precious metal recovery techniques and their common applications.

ULTRA-FILTRATION (UF)

1. The operator must know what size particles UF is capable of filtering.

2. The operator must know what size particles UF is capable of filtering.

3. The operator must know different examples of membrane filtration technology.

4. The operator should know the relative range order of membrane filtration.

5 The operator must have a basic knowledge of key components and system operation.

a. fast flushing
b. reverse (back) flushing
c. service flush
d. Cleaning

6. The operator must understand some of the limitations and problems encountered with a UF system.

REVERSE OSMOSIS

1. What is the definition of reverse osmosis.

2. Name the two types of membranes and the differences in each:

a. cellulose acetate
b. thin film composite

3. Operator must know the differences in a two stage and three stage RO system.

4. Operator must know operational concerns with RO reject (fouling, scaling).

5. Operator must know indications of pressure drop across first and second stage of system.

6. Operators must know why, what type and operation of pretreatment systems prior to the RO system:

a. multi-media filtration
b. carbon filtration
c. filtration ie. bag, cartridge
d. Cl removal

7. Operator must know how to perform maintenance on a RO system (ie. cleaning, problem causes and correct chemical application to be used.

8. Operator must know concerns and effects on a RO system by biological organisms.

9. Operators must be able to calculate rejection and recovery rates and perform each action.

10. Operator should know what Silt Density Index is.

ION EXCHANGE

1. Operators must be able to define ion exchange.

2. Operators must be able to identify different applications of the ion exchange process in wastewater treatment.
3. Operators must be able to describe the different components of an ion exchange resin.

4. Operators must be able to describe the difference between a cationic and anionic ion exchange resin.

5. Operators must be able to identify the four stages of operation in a typical ion exchange unit.

    a. Service
    b. Backwash
    c. Regeneration
    d. Rinse

6. Operators must be able to describe the following for each stage of operation:

    a. Purpose
    b. Factors that impact stage duration

7. Operators must be able to explain the concept of “breakthrough” in the service stage including:

    a. The definition of “breakthrough”
    b. Identify when “breakthrough” occurs
    c. The different methods to determine “breakthrough” in an ion exchange column
    d. Hydrometer uses in process operations

8. Operators must be able to describe the composition of a typical regenerant solution and how to properly dispose of “spent/used” solution.

    a. What type regenerant?
    b. Uses of each one
    c. Problems associated with each
    d. Uses of brine? (bed exhaustion, organic removal)

9. Operators must be able to explain advantages and disadvantages of different unit configurations, including:

    a. Lead/lag configuration
    b. Series configuration

c. Parallel configuration

10. Operator must be able to identify the following operational concerns, and describe causes and remedies to each concern.

    a. Capacity loss
    b. Failure to produce specified water quality
    c. Excessive pressure drop

11. Operator must understand channeling, operational concerns and corrective actions

INDUSTRIAL WASTE

1. What are the four types or classifications of waste discharge?

2. Why is knowledge of industrial wastes important in the operation of an industrial wastewater treatment system?

3. What are some of the beneficial effects that industrial waste may have on a Public Owned Treatment Works (POTW)?
   Understand the different effects of industrial wastewaters on collection and treatment systems.

4. What types of heavy solids can cause plugging in collection systems?

5. Understand how toxic or odorous vapors or fumes can be produced and the importance of identification.

6. Be able to recognize the different effects pH has on the collection and treatment systems.

7. Describe how industrial waste discharges can interfere with a POTW. (interference)

8. Why is it important to prevent slug loadings?

9. Understand the difference between ‘direct” and “indirect” discharges.

10. What is the difference between “new source” and “existing source”?

11. What is the purpose of the Pretreatment Regulations?

12. What is the definition of Significant Industrial User?

13. What are the general prohibitions that are required by the pretreatment program?

14. Identify the eight specific prohibitions and why are they important.

15. What are categorical pretreatment standards?

16. The Operator should be knowledgeable of requirements and potential enforcement actions for non-compliance which includes resampling requirements.