INDUSTRIAL / COMMERCIAL WASTEWATER OPERATOR CERTIFICATION EXAMINATION GUIDE

This guide is intended to provide information regarding certification exam format and to give the examinee an indication of general topics which may be covered on each exam. This guide is not intended to suggest specific study material and should not be considered a limitation of exam content.

Exam Format

Industrial / Commercial Wastewater Certification exams are comprised of two parts, a General Knowledge Exam and a Process Specific Exam. The General Knowledge exam counts 40 points; that score is combined with the score for each Process Specific Exam for a total of 100 points. Examinees must attain a combined score of at least 70 points to pass each exam.

General Knowledge Exam

The General Knowledge exam includes 40 multiple choice questions covering such topics as:

1. Pump, valve, and motor maintenance,
2. Basic electricity
3. Safety
4. Common wastewater terminology
5. Certification rules
6. Sampling
7. Calculation of area, volume, flow rate, detention time

Process Specific Exams:

As the name implies, this part of each exam is specific to the wastewater treatment process involved, and counts 60 points of the 100 point total. Exams may include multiple choice, fill in the blank, short answer, matching, and calculation questions. A brief description of each Process Specific Exam follows:

A-1b Plain Clarification

Solids removal by gravity separation in a mechanical clarifier.

This exam tests the ability to operate and maintain a clarifier. The exam begins with a series of questions regarding general maintenance and troubleshooting, factors influencing settleability of solids, and testing for clarifier efficiency, including related calculations.

The exam is then divided into two sections, one section covering conventional clarifiers, and the other covering inclined plate clarifiers. The examinee may choose which one of these sections will be completed. Each section includes questions regarding operation, maintenance, and troubleshooting. Also covered are identification and function of parts, as well as calculation of hydraulic and solids loading rates.

A-1d Impoundment

> A tank, basin, or reservoir intended to hold wastewater to allow for a controlled discharge; may or may not provide settling of solids. Does not include basins intended to provide biological treatment.

This exam includes questions regarding the proper operation and maintenance of earthen and concrete wastewater impoundments. The examinee must be familiar with methods to control nuisance plants and animals, safety, sampling, groundwater monitoring, and odor control. The examinee should be prepared to calculate parameters such as volume, flow rate, storage capacity, and discharge rates.

A-1f Land Surface Disposal

> Disposal of wastewater by means of application to the surface of the land with percolation into the ground.

This exam includes questions regarding spray irrigation systems, overland flow processes, and rapid infiltration basins. Questions involve principles of treatment, nutrient removal, groundwater monitoring, maintenance, and troubleshooting. Calculations required may include application rates, discharge rates, and pumping rates.

A-1g Sub Surface Disposal

> Tile field system used for discharge of wastewater with percolation into the ground. Does not include under-drain systems used to collect wastewater for further treatment and/or discharge.

Questions on this exam involve the proper operation and maintenance of tile field systems, causes of system failure, detecting system failure, and system rehabilitation. Examinees must be familiar with terms related to soil types and layers, soil conditions, and groundwater. Questions may also include basic construction of various types of subsurface disposal systems, and related applications and advantages.

A-2b Filtration of Wastewater

> Filtration of wastewater for the purpose of removing particulate materials. Specifically for rapid sand filters, but may also include such processes as pressure sand filters, and continuous backwash sand filters.

This exam includes questions regarding operating and maintaining single media and multi-media gravity filters, pressure filters, and continuous back-wash filters. Questions involve identifying and explaining the functions of various equipment, monitoring performance and efficiency, troubleshooting, and calculation of efficiency and loading.

A-2c Air Flotation

A wastewater treatment process for separation in which fine air bubbles are utilized to raise suspended materials to the surface where they are collected.

The air flotation exam includes questions regarding the proper operation and maintenance of air flotation units. The examinee should be familiar with operational controls, maximizing efficiency, and troubleshooting. Questions may also include identification and explanation of system components and related equipment. Calculations may include solids handling, efficiency, hydraulic and solids loading.

A-2d Air Stripping

Air stripping of volatile substances from wastewater or groundwater using packed-column or tray type strippers.

This exam includes questions involving the proper operation and maintenance of an air stripper to remove volatile organic components from water. The examinee must be familiar with both packed tower and tray-type air strippers. Questions may include operational adjustment, troubleshooting, and safety. Also included may be questions regarding types of materials removed, Henry's Constants, and factors determining removal efficiency. Calculations may involve operational parameters such as loading and determination of removal efficiency.

A-2e Centrifuging

A wastewater treatment process in which a centrifuge is used to apply centripetal force to accelerate the separation of substances.

The examinee should be familiar with types of centrifuges, operational adjustments, troubleshooting, and maintenance. Questions may include procedures for start-up and shut-down, identification and description of process components, and factors that affect process efficiency.

A-2g Deep Well Injection

Pressure injection of wastewater into a sub-surface formation.

This exam includes questions regarding the operation, maintenance, and troubleshooting of a deep well wastewater disposal system. Examinees must be able to identify system components, define related terms, and explain various monitoring parameters. Questions may also include appropriate reporting requirements, corrective measures, and operational calculations.

B-1b Neutralization

A chemical treatment process whereby a wastewater is neutralized (acid and/or base addition) to achieve a pH level required to meet a discharge permit limit.

This exam includes questions regarding the concepts of acids, bases, pH, and related parameters and instrumentation. Questions may include chemical addition, storage and handling, safety practices, and determination of pH. The examinee should be familiar with the various chemicals typically used in neutralization systems, and the reactions involved. The exam may include chemical addition calculation questions.

B-2a Chemical Clarification

Coagulation and/or precipitation for solids removal from wastewater.

Chemical coagulation – The removal of suspended solids from wastewater through the addition of polymer, ferric chloride, alum, or other coagulants added to wastewater just prior to clarification.

Chemical precipitation – The removal of dissolved solids from wastewater by precipitation through the addition of a base, ferric chloride, alum or other chemical agent just prior to clarification.

Processes included in this exam include hydroxide precipitation of heavy metals, and addition of coagulants to remove suspended solids. Questions may include monitoring instrumentation, determination of suspended and dissolved solids, jar testing and calculations, sludge handling and calculations, and chemical feed calculations. Examinees should be knowledgeable in dealing with chelating compounds, and other factors affecting precipitation and/or coagulation of wastewater components.

B-2b Ion Exchange

A wastewater treatment process in which undesirable ionic materials in wastewater are exchanged for other ions on a resin material.

Questions on the ion exchange exam involve process principles, as well as the operation and maintenance of the process. Questions may include applicable wastewater components, types of resins, regeneration, and determination of efficiency.

B-2c Oil Water Separation

Separation of oil from water with or without chemical addition.

Questions on this exam may involve sampling and analysis, emulsion breaking, factors affecting separation of oil from water, operation and maintenance of equipment used in oil separation, and troubleshooting. Calculations may involve calculation of oil separation rates, process loading, and reporting requirements.

B-2d Ultraviolet Oxidation

A wastewater treatment process in which ultraviolet radiation is used to oxidize organic contaminants.

Questions on this exam involve the principles of UV oxidation, system components, operation and maintenance of the process, and safety. The examinee should have knowledge of the types of chemicals treated with this method, and factors which limit removal efficiency.

B-3b Carbon Adsorption

Removal of organic compounds from wastewater by adsorption on activated carbon.

Questions may include principles of the carbon adsorption process, wastewater components typically treated by this method, identification and function of process components, typical process parameters, operation and maintenance, and safety. Examinees also will be expected to answer questions related to definition of terms used in this process, monitoring the adsorption process, and the various parameters used in characterizing carbon. Questions may be included regarding the regeneration of carbon.

B-3c Reduction of Hexavalent Chromium

A wastewater treatment process in which hexavalent chromium is chemically reduced to trivalent chromium.

Questions on this exam may involve process control and troubleshooting, process monitoring, and limiting factors. The examinee should be familiar with the various chemicals used, along with advantages and disadvantages. Calculations may involve chemical addition, solids handling, and reporting requirements.

B-3d Oxidation of Cyanide

The removal of cyanide from wastewater through the process of alkaline chlorination.

This exam will include questions regarding the principles of alkaline chlorination, terms used, chemical reactions involved, and chemical products formed. Questions will include methods of monitoring the process, chemical storage and handling, and safety.

C-1b Aerated Lagoons

A man-made pond or lagoon with mechanical or diffused aeration intended to provide aerobic biological treatment.

Exam will include questions regarding operation, maintenance, and troubleshooting aerated lagoon systems. Examinees should be familiar with different types of aeration systems and associated equipment, along with advantages and disadvantages. Phosphorus removal, nitrification, sampling, groundwater monitoring, and safety questions may be included. Calculations may involve discharge rates, electrical costs, and organic loading.

C-1c Stabilization Ponds

A man-made pond or lagoon intended to provide natural biological treatment without the addition of supplemental aeration

This exam will include questions regarding the biological principles, operation, and maintenance of stabilization ponds. Questions may involve the biological process, control of nuisance plants and animals, troubleshooting, terminology, and safety. Calculations may involve area, volume, storage capacity, discharge rates, and organic loading.

C-2a Disinfection

The chemical or ultraviolet radiation disinfection process to destroy pathogenic organisms in wastewater just prior to discharge.

This exam includes questions regarding chlorination / dechlorination and ultraviolet radiation. Questions may include topics such as safety, operation, maintenance, troubleshooting, terminology, sampling, and bacterial analysis. Calculations may include chemical dosage, coliform analysis, and data reporting.

C-2b Trickling Filters

An attached growth wastewater treatment process in which wastewater is distributed over a media (usually rock or plastic) which supports the biological system and is designed to convert colloidal and dissolved organic compounds into settleable sludge.

This exam includes questions involving operation, maintenance, and troubleshooting of rock media and plastic media trickling filter systems. The examinee should also be familiar with nitrification and phosphorus removal in a trickling filter system. Calculations may involve recirculation rates, hydraulic loading, volumetric and media surface organic loading, discharge reporting, and process efficiency.

C-2c Biological Sand Filters

Sand filtration systems intended to provide biological treatment of wastewater as well as physical filtration.

This exam includes questions regarding the operation, maintenance, and troubleshooting of single-pass and recirculating sand filters. The examinee should be familiar with the processes of nitrification and denitrification in these systems. Questions may include terminology, the biological process, and actions appropriate in correcting operational problems. Calculations may involve hydraulic and organic loading, recirculation rates, and treatment efficiency, dosing cycles, and discharge reporting.

C-2d Rotating Biological Contactors

An attached growth wastewater treatment process utilizing rotating plastic media designed to convert colloidal and dissolved organic compounds into settleable sludge.

This exam includes questions related to the operation, maintenance, and troubleshooting of RBC systems. Questions may involve the biological process, nitrification, process monitoring, terminology, and typical ranges for monitoring parameters. Calculations may involve hydraulic and organic loading, efficiency, and discharge reporting.

C-2f Constructed Wetlands

A man-made complex that simulates natural wetlands, intended to treat wastewater through microbial utilization and plant uptake of nutrients.

This exam may include questions regarding both surface flow and subsurface constructed wetlands. Examinees will be expected to be knowledgeable regarding the physical and biological processes involved, control of nuisance plants and animals, nitrogen removal, and troubleshooting.

C-3a Activated Sludge

A suspended growth, biological treatment system designed to convert colloidal and dissolved organic compounds in wastewater into settleable sludge.

This exam may include questions related to the operation, maintenance, and troubleshooting of conventional activated sludge systems, as well as modifications of activated sludge. Questions may involve the biological and physical process, related equipment, nitrogen and phosphorus removal, process control parameters, and identification of indicator and nuisance organisms. Calculations may include settleability, F:M, CRT, wasting rates, return rates, organic and hydraulic loading, and nutrient addition.

C-3b Sequencing Batch Reactor

A modification of the activated sludge process in which treatment occurs in batch mode and the reactor also serves as the secondary clarifier. The treatment sequence is largely computer controlled.

The SBR exam includes questions involving the operation, maintenance, and troubleshooting of that process. Questions may involve operational parameters, biological and physical processes, indicator and nuisance organisms, nitrogen and phosphorus removal, and solids handling. Calculations may include all of the commonly used control parameters and nutrient addition.