

SWOTC Training Course Descriptions

BASIC COURSES (100 level)

101 - BASIC COURSE FOR WASTEWATER TREATMENT PLANT OPERATORS Educational Point: One (1)

This training program consists of four units. The Characteristics of Sewage unit of the program provides the student with a basic understanding of the characteristics and composition of sewage. The Natural Biological Treatment Process unit provides the student with the practical background theory of his occupation. This unit deals with the biological process involved in wastewater treatment such as aerobic and anaerobic decomposition; and aerobic, facultative and anaerobic bacteria. The Waste Treatment Methods unit begins with a generalized picture of a conventional wastewater treatment plan, briefly introducing flow and processes. Each process phase is then examined in more detail. Included are introductory discussion on pretreatment, primary treatment variations, and solids handling and disposal. Specifically, this unit covers processes such as activated sludge and trickling filter processes, and distinguished between the different kinds of waste stabilization ponds.

102 - BASIC ELECTRICITY REVIEW AND READING ELECTRICAL DIAGRAMS Educational Point: One (1)

This Basic Electricity Review training program is designed to provide maintenance students with a review of fundamental electrical concepts. The major topics covered in this unit are: the nature of electricity; basic electrical quantities; series and parallel circuits; Ohm=s Law; electromagnetism; inductance; and capacitance

The Reading Electrical Diagrams training program is designed to teach students how to read four types of electrical diagrams; block diagrams, single line diagrams, schematics, and wiring diagrams. *Prerequisite: Basic understanding of electricity.*

103 - PLANT SAFETY Educational Point: One (1)

Training material: NUS Training Corporation video-based program. This training program consists of four videos. Fire Safety covers types of fires and the most effective extinguishing techniques and equipment are explained in this unit. Hazardous Substances cover dangerous or toxic substances found in the plant and the safety equipment necessary for mitigating these effects. Personal Safety covers various plant hazards (electrical, eye, machinery, etc.) And personal safety equipment (hard hats, safety shoes, eye wear, etc.). And Respiratory Protection describes various types of respiratory hazards (particulates, gasses, oxygen deficiency) and respiratory protection gear.

104 - WASTEWATER COLLECTION SYSTEMS BASIC COURSE Educational Point: One (1)

This training program is for those already employed as collection systems workers as well as those new to the field. It is an introduction to the operation and maintenance of wastewater collection systems. Several objectives include: (a) describe why the work of a collection system worker is

important; (b) describe the three types of wastewater collection systems; (c) identify main types of sewers; (d) describe basic components of the collection system; (e) describe what is meant by and what should be done about inflow, infiltration, and exfiltration; (f) indicate the importance of dissolved oxygen and microorganisms in wastewater; (g) describe the difference between aerobic and anaerobic decomposition; etc.

105 - WASTEWATER MATHEMATICS Educational Points: Two (2)

This training course is designed to assist the wastewater treatment operator in reviewing and refreshing his or her skills in solving various basic and related mathematics problems countered in everyday activities.

106 - HAZARD COMMUNICATION PROGRAM Educational Point: One-half point (0.5)

This training course is designed to provide you with information and training on hazardous chemicals in your work area. Employee training will include the location and availability of the written hazard communication program, including the required list of hazardous chemicals and material safety data sheets required. Other topics include: methods and observation that may be used to detect the presence or release of a hazardous chemicals in the work area (such as monitoring conducted by the employer, visual appearance or odor of hazardous chemicals when being released, etc.); the physical and health hazards of the chemicals, and details of the hazard communication program, including an explanation of the labeling system and the material safety data sheet, and how you can obtain and use the appropriate hazard information.

107 - MULTIPLE HEARTH FURNACE Educational point: One (1)

This training course is designed to teach maintenance personnel and operators the theory, operations and basic maintenance procedures of the multiple hearth furnace. (MHF). Objectives of the course includes: the components of a MHF; description of how sludge moves through a MHF; purpose of the furnace refractory; identification of in-hearth, out-hearth, lute cap, drop holes, and castable insulation; purpose of the flap gate; rabbling; variable speed shaft drive mechanisms; purpose of the top and lower bearings; ash handling systems; components of an off-gas systems; goals of furnace operations; furnace zones; safety precautions; examples of energy conservation measures, etc. *Prerequisites: Knowledge of mechanical maintenance.*

108 - NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEMS (NPDES) AND UIC PERMITS AND CWA REGULATIONS Educational Point: One-half (0.5)

This training course is designed to instruct operators, supervisors, and managers on NPDES/UIC permit requirements and other wastewater operations regulatory requirements. The course will include a discussion of NPDES and UIC permits, what they include and how to read them. Copies of all NPDES and UIC permits in the State of Hawaii will be available for students to look at the permit from his/her plant during these discussions. The Federal Clean Water Act (CWA) will be discussed and a summary of the important information from it will be provided to each students. Applicable State of Hawaii Revised Statutes and Administrative Rules pertaining to wastewater operations will also be discussed and summaries of the important information from these documents will also be provided to each student. If there are any County directives, ordinances, rules or regulations pertaining to wastewater operations, they will also be identified and discussed.

109 - TRAINING THE TRAINER Educational Point: One (1)

This training course is designed to instruct the elements of effective training, planning for effective training, instructing to facilitate learning, methods for teaching skills, methods for teaching information, using visual aids effectively, teaching your first class, and learning about visual aid equipment such as slide projectors, overhead projectors, TV/VCR, and DVD players. Prerequisite: Instructional experience and/or supervisor=s recommendation.

110 - PUMP STATION OPERATIONS COURSE Educational Point: One (1)

This course is designed to instruct students the following major subject areas: history of the city and county pumps stations , pump station security and equipment. Pump station equipment includes: wet well, recorder system, pumps, bubbler/float system, flow meters and generator system. Pump station operations include: use of station O&M manuals, use of pump operating curves, optimizing pump use, pump sequencing, wetwell operating levels, and generator systems operations. Bypasses/overflows/spills will include: reporting, flow rate computations, volume computations, contamination monitoring, sample grab technique, warning signs, and clean-up procedures. Emergency operations will include: back-up equipment and standby power generation. Plus records and reports.

111 - PROGRAMMABLE LOGIC CONTROLLERS Educational Point: point 3 (0.3)

This course is designed to give WWTP operators, supervisors and maintenance personnel a basic understanding of programmable logic controllers (PLCs). The course covers (1) PLC basic fundamental (2) PLC programming (3) basic troubleshooting (4) fundamental of communication and (5) various input and outputs.

112 - STATE REGULATIONS AFFECTING WTW's WORKSHOP Educational Point: One-half (0.5)

This course is designed for WWTP operators and supervisors. Course covers: (1) O&M inspections, (2) spill protocols (for spills reaching surface waters - spills within the confines of a wastewater facility; spills outside of the confines of a wastewater facility, etc.); (3) enforcement policies and types of enforcement; (4) sewage sludge regulations - what is Part 503, land application of sewage sludge, pathogen reduction, etc.; (5) effluent reuse - classes of reclaim water, allowable uses of reclaim water, design requirements for treatment & distribution systems, engineering and other reports needed for reuse projects, etc. (6) underground injection control (UIC) -regulation, definition of a well, examples of injection well facilities, specifics of regulation and how it affects you, and the future developments; and (7) wastewater operator certification - general rule making, role of the Board of Certification, who must be certified, major responsibilities of operators in "direct responsible charge", enforcement, examination, and proposed changes to rules.

114 - PERMIT-CONFINED SPACE ENTRY Educational Point: One-half (0.5)

The Permit - Confined Space Entry Course is mandated by Federal and State regulations. The course covers the procedures required to ensure the safety of employees entering and working in confined spaces. Class covers: scope, definition of confined space, permit - required confined space,

prohibited condition, evaluation of workplace, mandatory training, authorized entrants, permit system requirements of entry supervisor, attendants must know hazards and rescue service.

115 - BLUEPRINT READING Educational Point: One-half (0.5)

This course consists of videotapes and exercises which explain the basics of blueprint reading for the manufacturing and construction industries. The videotapes are: (1) Line and View Interpretation; (2) Dimensions & Tolerance Specifications; and (3) Auxiliary Print Information & Geometric Tolerancing. Using these as a basis, the basics of blueprint reading for wastewater facility construction facilities and projects are demonstrated.

116 - ULTRAVIOLET DISINFECTION Educational Point: One (1)

This course discusses: the three common methods for removing pathogens, operation, and maintenance of the air intake system, fuel system, exhaust system, lubricating oil system, and cooling system. Maintenance jobs commonly performed on each of these systems are explained and demonstrated on stationary and automotive diesel engines. Two units on Preventive and Predictive Maintenance and Maintenance Safety are also to understand how UV rays destroy the genetic material in pathogens; calculate lamp age, intensity, and exposure time for peak efficiency of the system; understand how ozone is generated and used to kill pathogens; and avoiding the many safety hazards of each system. Also includes troubleshooting and a field trip to a treatment plant.

INTERMEDIATE COURSES

(200 Level)

201 - ACTIVATED SLUDGE PROCESS CONTROL (INTERMEDIATE) Educational Point: One (1)

This training program deals with the process control in an activated sludge system. As a plant operator, you know that the success of the treatment system is measured by the quality of the effluent. So, your main concern is to make sure that your effluent meets your regulatory agencies requirement. In many cases the required values for the biochemical oxygen demand (BOD) and suspended solids (SS) are less than 30 mg/l and that for the chemical oxygen demand (COD) is less than 100 mg/l. To maintain these levels and, thus have an effective operation, you must: (a) maintain an adequate number of microorganisms; (b) maintain good settling properties; (c) supply adequate air to the aeration tank; and (d) remove sludge from the clarifier before septic conditions or de nitrification problems occur. Other objectives include: (a) identify the components of aeration and clarification methods; (b) describe the purpose, operation, and maintenance requirements of major components; (c) use checklist to start-up, shut down and troubleshoot a system; and (d) demonstrate knowledge of F/M ratio, respiration rate, and then mean cell retention time for analyzing plant data. *Prerequisite: Successful completion of the Basic Course #101.*

202A - CERTIFICATION EXAMINATION REFRESHER (GRADES 1&2). Educational Point: One (1)

This training course is designed to help operators in all categories and classes for the certification examination. General math and maintenance principles, as well as various process control principles, will be covered to meet the needs of those persons attending.

202B - CERTIFICATION EXAMINATION REFRESHER (GRADES 3&4) Educational Point: One (1)

This training course is designed to help operators in all categories and classes for the certification examination. General math and maintenance principles, as well as various process control principles, will be covered to meet the needs of those persons attending.

204 - DIESEL ENGINE - OPERATION AND MAINTENANCE, PREVENTIVE AND PREDICTIVE MAINTENANCE, AND MAINTENANCE SAFETY AND EFFICIENCY Educational Point: One (1)

Training material: Industrial Training Corporation videotapes and workbooks. This mechanical maintenance program is a comprehensive program that covers basic diesel engine operation including the function, operation and maintenance of the air intake system, fuel system, exhaust system, lubricating oil system, and cooling system. Maintenance jobs commonly performed on each of these systems are explained and demonstrated on stationery and automotive diesel engines. Two units on Preventive and Predictive Maintenance and Maintenance Safety are also covered. *Prerequisite: Knowledge of Mechanical Maintenance.*

205 - EQUIPMENT OPERATION Educational Point: One (1)

Training material: Industrial Training Corporation video-based program. This training program is designed for students to learn the basic techniques and practices involved in equipment operations. The program will provide the students with guidelines and safety considerations for operating equipment, monitoring normal operations, making adjustments to equipment, performing inspections, and responding to problems. The students will also learn the role of the operator in troubleshooting problems and monitoring the operation or repaired equipment. Four (VHS) videotapes will be discussed: (a) Techniques and Practices for Equipment Operators, (b) Valve Operation, (c) Lubrication for Equipment Operators, and (d) Heat Exchangers. *Prerequisite: Knowledge of Mechanical Maintenance.*

206 - PRESSURE MEASUREMENT AND FLUID FLOW MEASUREMENT Educational Point: One (1)

This training program consists of two units. The Pressure and Pressure Measurement unit is designed to provide technicians and operators with a basic understanding of the concept of pressure; the unit commonly used to indicate pressure; and some devices and instruments used to measure changes in pressure. It is also intended to teach students about some of the conditions that may prove harmful to instruments and pressure elements and methods of alleviating these conditions. The Fluid Flow Measurement is designed to teach fundamental information on how differential pressure

measurements can be used to determine fluid flow and to teach how several common fluid flow meters are used to measure fluid flow. *Prerequisite: Knowledge of Mechanical Maintenance.*

207 - MECHANICAL MAINTENANCE FUNDAMENTALS FOR OPERATORS Educational Point: One (1)

Training material: Industrial Training Corporation video-based programs. This training course consists of three (3) different topics. The Measuring Instruments Module is a comprehensive program covering the most commonly used measuring instruments such as a steel rule, vernier caliper, outside micrometer, telescoping gauges and dial indicator. Other modules include Bolting and Fastening, and Mechanical Print Reading.

208 - PUMP CONTROLS, TYPES, OPERATION AND MAINTENANCE (INTERMEDIATE) Educational Point: One (1)

This course is designed to teach students to identify the basic components of pumps and pump processes and to describe the purpose of pumps in the wastewater field. The course is divided into three parts. Part I covers: (a) basic components of the pump assembly; (b) basic types of motors, starters and enclosures; (c) motor controls; and (d) troubleshooting. Part II covers: (a) centrifugal pumps; (b) basic components of centrifugal pumps; and (c) control of centrifugal pumps. Part III covers: (a) positive displacement pumps; and (b) basic components of positive displacement pumps.

Prerequisite: Knowledge of Mechanical Maintenance.

209-ROTATING BIOLOGICAL CONTACTORS (RBC), TRICKLING FILTERS AND STABILIZATION PONDS Educational Point: One (1)

The Trickling Filters unit discusses waste stabilization ponds, and the treatment process that occurs in them. Topics include: (a) what happens in the waste stabilization pond; (b) indicate why the facultative pond most often is used; (c) describe what happens in the facultative pond; etc. The Trickling Filters unit discusses the treatment process that occurs in the trickling filter. Topics include: (a) describe how treatment occurs in the trickling filter; (b) recall the name of the growth that forms on the filter media; (c) describe the importance of the secondary filter; (d) recall the advantages of recirculating wastewater through the media bed; etc. the RBC unit deals with the equipment involved in the RBC treatment system and the treatment process and how the operator can control the RBC wastewater treatment system. Other topics in the RBC unit include: start-up and shut-down, components and equipment, equipment maintenance, factors affecting the RBC treatment process, trouble-shooting the RBC process, etc.

Prerequisite: Completion of Basic Course.

210-SLUDGE HANDLING: SLUDGE THICKENING. ANAEROBIC DIGESTION. AEROBIC DIGESTION AND DEWATERING (INTERMEDIATE)

Education Point: One (1)

This training program is designed for the operators of wastewater plants who are, or will become, involved in the processing of wastewater sludge. Topics to be discussed include: (a) creation of sludge; (b) the processing of sludge; (c) the thickening of sludge; (d) operational and control procedures in sludge dewatering; and (e) aerobic and anaerobic digestion. *Prerequisite: Completion of Basic Course 101.*

211 - TROUBLESHOOTING PUMPS: BASIC SKILLS Educational Point: One (1)

This course is designed for students to learn ways to investigate a problem, analyze information obtained concerning the problem, repair the problem, and prevent future problems from occurring. The students will learn the importance of understanding normal equipment operations and the equipment background. Specific equipment to be covered include; centrifugal pumps, positive displacement pumps, reciprocating air compressors and pumping principles. *Prerequisite: Completion of Course #208.*

212A - WASTEWATER FACILITY MANAGEMENT SKILL TRAINING COURSE (VOLUME I) Educational Points: Three (3)

This course is targeted to supervisors or superintendent of small to medium-sized systems. The training programs are designed for those persons who are or are soon to become supervisors. Each program deals with a specific content area, focusing on those administrative skills required of a supervisor for effective operation of his/her treatment facility. This course contains training programs on: (1) Basic Management Concepts, (2) Budgeting, (3) Personnel Administration, and (4) Public Relations. *Prerequisite: Basic understanding of wastewater treatment plant operation.*

212B - WASTEWATER FACILITY MANAGEMENT SKILL TRAINING COURSE (VOLUME II) Educational Points: Three (3)

This course is targeted to supervisors or superintendents of small to medium-sized systems. The training programs are designed for those persons who are or are soon to become supervisors. Each program deals with a specific content area, focusing on those administrative skills required of a supervisor for effective and efficient operation of his/her treatment facility. This Course contains training programs on five subject areas: (1) Emergency Planning. (2) Safety. (3) Preparing and Presenting Reports. (4) Operations and Maintenance, (5) Selection of New Equipment. *Prerequisite: Completion of Course #212A.*

214 - WASTE TREATMENT PROCESSES, COMMUNITY WASTEWATER SYSTEM, PRE-TREATMENT, AND CLARIFICATION (INTERMEDIATE)

Educational Point: One (1)

This course continues the instruction begun in the Basic Course. It begins with a recap of the composition of normal domestic wastewater, and the necessity and importance of treating it. Unit 1 - Introduction and Unit 2 - The Community Wastewater System will provide you with the overall picture of wastewater treatment so that you, the operator, know why your job is so important. Also, these first two units will help you remember the important information from the Basic Course. Unit 3 - Pretreatment discusses bar screens, grit removal, comminutor, prechlorination, flow measuring devices, etc. Unit 4 - Clarification discusses the purpose of clarifier, the clarification process, the two main purposes of clarifier, clarifier efficiencies, description of sludge and scum removal equipment, etc. Plus a water treatment videotape presentation of wastewater collection and primary treatment, intermediate and secondary treatment. *Prerequisite: Completion of Basic Course #101.*

215 - PLANT SCIENCES (PHYSICS) Educational Points: One (1)

This course consists of four major subject areas: Science Fundamentals, Properties of Matter, Heat and Process Dynamics.

Plant Science #1 - Science Fundamentals cover some basic scientific principles and their applications in a process facility are introduced here, along with units of measurement for length, time, mass, pressure, temperature, flow, and level. The relationship between force and motion, the laws that

apply to force and motion. the definition of work, and the relationship of work to energy are also covered. The mechanical advantages of the inclined plane and the lever illustrate a discussion of basic machines, including examples of where the mechanical advantages of these basic machines are used in process equipment. Plant Science #2 - Properties of Matter focuses on the properties of matter associated with solids, liquids, and gases, and demonstrates how these properties influence process system operation. The molecular structures and related characteristics of solids, liquids, and gases are also discussed. The unit defines and explains mass, weight, density, specific gravity, buoyancy, viscosity, elasticity, and other terms associated with the effects of stress, pressure, and temperature on the three states of matter. Plant Science #3 - Heat teaches the principles of heat transfer, the effects of heat. The relationship between temperature and thermal energy, and the effects of temperature difference on heat transfer. Sensible heat, latent boiling temperatures are covered. The unit also introduces the three modes of heat transfer and discusses the heat transfer process that takes place between two fluids separated by a solid boundary. Plant Science #4 - Process Dynamics introduce the principles and operating characteristics of liquid, gas, and vapor systems by describing the main parts of a fluid system and the effects of pressure related to static fluids and steady-state flowing fluids. Other topics covered include energy conversions that take place in fluid systems, the use of pumps to control flow, common devices to measure process variables, and the effects of resistance and capacitance on operating fluid systems. *Prerequisite: High school general science.*

216 - BASIC WASTEWATER OPERATOR MATH I Educational Point: One (1)

Target group covers both elementary and basic math for Wastewater OIT and Grade I operators. Four sections of the workbook cover basic area and volume calculations solving for the unknown. Chlorine dosage, demand and calculations are covered. Fractions, conversion exercises, cancellation of units, scientific notation, whole numbers and decimals are reviewed. *Prerequisite: High school math or good knowledge of math or Math 105*

217 - BASIC WASTEWATER OPERATOR MATH II Educational Point: One (1)

Target group Grades 1-3. This math workbook manual is designed to provide operators with a range of typical examination industrial treatment math problems similar to those found on certification examinations. Newly written, this manual contains 14 chapters that provide illustrated math problems in the following categories: areas and volumes, flow and detention time calculations, chemical feed rates, chlorination, removal rates and efficiencies, chemical reactions, chemical solutions, pH calculations, statistical concepts, miscellaneous calculations and a complete set of step-by-step solutions to the problems presented in the manual. *Prerequisite: Basic Wastewater Operator Math I 216 or Math 105*

218 - ADVANCED WASTEWATER OPERATOR MATH III Educational Point: (0.8)

Target group Grade 3 Wastewater Plant operators. Journeyman and senior level WTPO level process math work; summary of process formulas, conversions. Advanced problems; volumes, pounds formula, sedimentation and clarification, secondary wastewater process units, trickling filters and activated sludge, chemical solutions, tertiary filtration, hydraulics, velocity, waste sludge, effluent disinfection, effluent disposal, gravity thickeners, and digesters. Assorted problems from past state exams. *Prerequisite: Basic Wastewater Operator MATH II # 217*

219 - ADVANCED WASTEWATER OPERATOR MATH IV Educational Point: (0.8)

Target group Grade 4 Wastewater Plant operators. Journeyman and senior level WTPO level process math work; summary of process formulas, conversions. Advanced problems; volumes, pounds formula, sedimentation and clarification, secondary wastewater process units, trickling filters and activated sludge, chemical solutions, tertiary filtration, hydraulics, velocity, waste sludge, effluent disinfection, effluent disposal, gravity thickeners, and digesters. Assorted problems from past state exams. *Prerequisite: Basic Wastewater Operator MATH III # 218*

220 – ODOR CONTROL SYSTEMS Educational Point: Two (2)

The purpose of this course is to provide operators and maintenance personnel an introduction to the need for odor control, health and safety issues, public relations, generation and measurement of odors, source control and containment, treatment technologies, the need for a systematic odor control strategy, case histories and a site visit. The treatment technologies covered include chemical processes such as chemical addition, thermal oxidation, absorption scrubbers, adsorption with activated carbon, and biological processes such as activated sludge and trickling filters and bulk media biofiltration. Treatment process issues include mechanisms, designs, removals, operation, maintenance and troubleshooting.

230 – EFFLUENT FILTRATION Educational Point: Two (2)

The purpose of this course is to provide operators and maintenance personnel an introduction to the need for effluent filtration, reclaimed water requirements, chemical coagulation/flocculation, and various filtration technologies. The treatment technologies covered include gravity filters (sand), pressure filters, upflow deep-bed filters, surface filters (disk, cloth, sponge), and membrane filters. Treatment process issues include mechanisms, designs, removals, operation, maintenance and troubleshooting.

250 - MECHANICAL MAINTENANCE I: AIR COMPRESSORS AND BLOWERS Educational Point: One (1)

This course is designed to teach wastewater maintenance personnel and interested operators the procedures for disassembly inspection, and repair of reciprocating and rotary compressors. The program shows how typical maintenance operations are performed on these two types of machines.

Tape 1 covers: reciprocating air compressors. discharge valve removal and disassembly, and suction valve unloader removal and disassembly. Tape 2 covers: reciprocating air compressors disassembly, piston and piston rod removal, piston ring installation, piston and piston rod installation, and clearance adjustment. Tape 3 covers: rotary blower disassembly. removing the timing gears, removing the head plate and shafts, removing the bearings, installing the bearings, installing the timing gears, and adjusting the timing and reassembling the rotary blower. *Prerequisite: Knowledge of mechanical maintenance.*

251 - MECHANICAL MAINTENANCE II: BEARINGS AND LUBRICATION. AND PACKING AND SEALS Educational Point: One (1)

This course consists of five videotapes and textbooks. Videotape 1 (Bearings and Lubrication) covers: introduction to bearings, disassembling and inspecting a plain journal bearing, checking the oil clearance of a plain journal bearing using a micrometer, performing a bearing contact check, checking the oil clearance of a plain journal bearing using lead wire, and assembling a plain journal bearing. Videotape 2 (Bearings and Lubrication) covers: introduction to anti-friction journal bearings, maintenance of tapered roller bearings in a gear-type speed reducer. removing the top housing from a speed reducer, removing a shaft and bearing from a gear reducer. removing the bearing inner ring from the shaft, cleaning and inspecting an anti-friction bearing, replacing and assembling the anti-friction bearing, and using a bearing puller. Videotape 3 (Bearings and Lubrication) covers: introduction to thrust bearings, tilting pad, oil film thrust bearings, disassembling a tilting pad, disassembling and inspecting the thrust bearing assembly, final assembly of a tilting pad, and bearing lubrication. Videotapes 4 and 5 (Packing and Seals) cover: removing conventional valve packing,

installing conventional valve packing, removing preformed chevron packing, installing preformed Chevron packing, fabricating graphite ring packing, removing pump packing, installing pump packing, removing-disassembling and inspecting a mechanical seal, and types of mechanical seals.
Prerequisite: knowledge of Mechanical Maintenance.

252 - MECHANICAL MAINTENANCE III: GEAR BOXES, MECHANICAL DRIVES, COUPLINGS & ALIGNMENT Educational Point: One (1)

This program consists of four videotapes and textbooks. Videotape 1 (Gear Boxes) covers: gear boxes, component inspection, performing precision measurements, installing bearings and oil seals, reinstalling the bearing covers and checking shaft runout, checking backlash and tooth contact, and gear designs. Videotape 2 (Gear Boxes) covers: periodic checks, lubrication, removing and installing the oil seals, wormgearing design, worm shaft end worm gear end play and positioning, and gear box maintenance guidelines. Videotape 3 & 4 (Mechanical Drives, Couplings and Alignment) covers: couplings and alignment, disassembling couplings and detecting angular misalignment, detecting parallel (offset) misalignment, interpreting alignment measurements, correcting misalignment, assembling the coupling, and removing belts. *Prerequisite: Knowledge of Mechanical Maintenance.*

253 -- MECHANICAL MAINTENANCE IV: VALVES Educational Point: One (1)

This program consists of four videotapes and textbooks. Videotape 1 covers: gate valves construction, disassembling the gate valve, disassembling the gate valve bonnet assembly, inspecting gate valve components, lapping the gate valve disc, reassembling the gate valve bonnet assembly, checking contact between the gate valve disc and seats, and final assembly of the gate valve. Videotape 2 covers: globe valve construction, removing and disassembling the globe valve bonnet assembly, inspecting globe valve components, reassembling the globe valve bonnet assembly, lapping the globe valve disc, and reassembling the globe valve. Videotape 3 covers: control valve construction, disassembling the control valve, inspecting control valve components, reassembling the control valve and installing the control valve. Videotape 4 covers: diaphragm valve construction and disassembly, disassembling the diaphragm valve bonnet assembly, reassembling the diaphragm valve, butterfly valve construction, disassembling the butterfly valve, and inspecting and reassembling the butterfly valve.
Prerequisite: Knowledge of Mechanical Maintenance

254 - MECHANICAL MAINTENANCE V: MOTORIZED VALVE ACTUATORS AND RELIEF VALVES Educational Point: One (1)

This course consists of four videotapes and textbooks. Videotape 1 (Motorized Valve Actuators) covers: valve actuators, mechanical components, electrical components. removing a valve actuator from a valve. disassembling a motorized valve actuator, and reassembling a motorized valve actuator. Videotape 2 (Motorized Valve Actuators) covers: limit switch adjustment, torque switch adjustment, operational tests, limit and torque switch adjustment in another actuator design, mechanical troubleshooting, and electrical troubleshooting. Videotape 3 (Relief Valves) covers: safety valve operation, safety valve disassembly, removing the disc assembly, blue checking the seat and disc, performing a spindle runout, valve reassembly, completing valve assembly and installing and setting the safety valve. Videotape 4 (Relieve Valves) covers: relive valve operation, relief valve disassembly, removing the pilot valve, blue checking the pilot valve, making valve seat repairs, and valve reassembly and installation. *Prerequisite: Knowledge of Mechanical Maintenance.*

255 - MECHANICAL MAINTENANCE VI: VIBRATION ANALYSIS, SHAFT ALIGNMENT I SHAFT ALIGNMENT II Educational Point: One (1)

This course consists of three videotapes. Videotape 1 (Vibration analysis) covers: introduction to the hand-held vibration meter, using the hand-held vibration meter, storing the hand-held vibration meter, introduction to the vibration analyzer, taking unfiltered readings, taking filtered readings, and taking signature balancing. Videotape 2 (Shaft Alignment I) covers: alignment theory, measuring and correcting misalignment, preparing for alignment, introduction to rim and face alignment, rim and face alignment (measuring vertical plane misalignment), graphing and correcting plane misalignment, and rim and face alignment (horizontal plane misalignment). Videotape 3 (Shaft Alignment II) covers: introduction to reverse dial alignment, measuring and correcting vertical plane misalignment, measuring and correcting horizontal plane misalignment, aligning vertically mounted equipment, and other alignment methods. *Prerequisite: Knowledge of Mechanical Maintenance.*

256 - MECHANICAL MAINTENANCE VII: BOILERS AND BOILER EQUIPMENT, AND AUXILIARY STEAM TURBINES Educational Pt: One (1)

This course consists of five videotapes and textbooks. Videotape 1 - Boiler Fundamentals covers principles of operation, types of boilers, fuels and burners, heat transfer, water and fuel flow. and water and steam flow. Videotape #2 - Basic Boiler Systems covers fuel systems, condensate and feedwater systems. control systems, and instrumentation. Videotape #3- Boiler Maintenance covers types of boilers, interior furnace components, hot gas path components, the outside of the boiler, and waterside components. Videotape #4 - Boiler Inspection and Cleaning Unit 1 covers waterwall inspection, techniques, superheater inspection, inspection of baffles, economizers, and ash hoppers, and exterior boiler inspection. Videotape #5 - Boiler Inspection and Cleaning Unit 2 covers drum and moisture separator inspection, header and tube inspection, waterside cleaning, and fireside cleaning and boiler closure. *Prerequisite: Knowledge of Mechanical Maintenance.*

257 - MECHANICAL MAINTENANCE VIII: COAL AND ASH HANDLING EQUIPMENT, AND HYDRAULIC EQUIPMENT Educational Point: One (1)

This course consists of four videotapes and test books. Videotape 1 (Coal and Ash Handling Equipment) covers: preparing a conveyor belt for maintenance, cutting a conveyor belt, punching holes in the belt for a bolted fastener, assembling and installing metal fasteners, completing the bolted metal splice, preparing a belt for splicing with riveted solid metal fasteners, completing the riveted solid metal splice, and installing a riveted hinged splice and aligning the belt. Videotape 2 (Coal and Ash Handling Equipment) covers: re-blading and balancing a pulverizer exhauster, disassembling a control valve, removing the seat and disc, reassembling the control valve, disassembling and inspecting an air piston operator, reassembling an air piston operator, water jet exhauster operation and inspection, and assembling a water jet exhauster. Videotape 3 (Hydraulic Equipment) covers: basic hydraulic systems, hydraulic cylinder disassembly, shaft runout, cylinder reassembly, control valve disassembly, and control valve inspection and reassembly.

258 - PIPING Educational Point: One (1)

Videotape 1 covers: preparing for tubing system repair, flaring tubing, bending and cutting tubing, tubing connections, pipe cutting, threading pipe, pipe assembly, and union replacement. Videotape 2 covers: general maintenance and insulation removal, elbow removal, elbow installation, selecting and installing insulation on an elbow, insulating a flange and applying cloth, and plastic-lined piping. Videotape 3 covers: inverted bucket trap, disassembly and reassembly, float and bellows trap disassembly, float and bellow trap reassembly, impulse steam trap (piston type), impulse steam trap (disc type), the duplex strainer, and the edge type strainer. Videotape 4 covers; cleaning steam condenser tubes, inspecting and plugging steam condenser tubes, cutting a tube for removal, collapsing a tube for removal, replacing a tube, and gauge glass replacement. *Prerequisite: Knowledge of Mechanical Maintenance.*

259 - ADVANCED PIPE FITTING Educational Point: One (1)

This course consists of four videotapes and textbooks. Videotape 1 covers: introduction to pipe fitting, blueprints, piping materials, material list and field checks, determining pipe length, fitting measurements, marking a pipe, and cutting methods. Videotape 2 covers: torch cutting, using an automatic cutting torch, end preparation tool, alignment, checking alignment and tack-welding, installation, and support. Videotape 3 covers: fabricated joints, mitre joints, riser joints, centering heads, contour markers, field marking and hole projection markers. Videotape 4 covers: introduction to plastic pipe and cutting, end preparation, end cleaning, joining, plastic welding, fiberglass reinforced plastic pipe cutting and end preparation, making a butt and wrap joint, and program review.

260-HYDRAULIC SYSTEMS I: INTRODUCTION TO HYDRAULIC SYSTEMS, PRESSURE CONTROLS, AND DIRECTIONAL AND FLOW CONTROLS Educational Point: One (1)

This course consists of three videotapes and textbooks. Videotape 1 (Introduction to Hydraulic Systems) Covers: properties of liquids, hydraulic system components, hydraulic schematic symbols, pressure and flow, system flow and pressure, hydraulic power transmission, hydraulic system efficiency, and hydraulic system safety. Videotape 2 (Pressure Controls) covers: introduction to pressure control valves, unloading and counterbalance valves, sequence and pressure reducing valves, direct-acting and pilot-operated pressure control valves, external control of pilot-operated valves, spool-type pressure control valves, and pressure reducing valve operation. Videotape 3 (Directional and Flow Controls) covers:

directional control valves, centering conditions, actuating directional control valves, piloting and draining, packed spool valves, flow control valves, flow control valve designs, and flow control applications. *Prerequisite: Knowledge of Mechanical Maintenance.*

261 - HYDRAULIC SYSTEMS II: FLUIDS, FILTERS, AND RESERVOIRS; HYDRAULIC PUMPS, PUMPING PRINCIPLES, AND ACCUMULATORS; AND VARIABLE VOLUME HYDRAULIC PUMPS Educational Point: One (1)

This course consists of three videotapes and textbooks. Videotape 1 (Fluids, Filters and Reservoirs) covers: functions of hydraulic fluid, characteristics of hydraulic fluid, fluid conditioning in the reservoir, draining and replacing fluid, reducing external contamination filters, filters, and filter maintenance. Videotape 2 (Hydraulic Pumps, Pumping Principles, and Accumulators) covers: hydraulic power, hydraulic pumps vane pumps, piston pumps, monitoring pump operation, hydraulic accumulators, accumulators maintenance, and precharging an accumulator. Videotape 3 (Variable Volume Hydraulic Pumps) covers: fixed volume and variable volume pumps, horsepower reduction, variable volume vane pumps, variable volume piston pumps, volumetric efficiency, case drain flow, electrical checks, and reversible pumps. *Prerequisite: Completion of Course #260 Hydraulic Systems I.*

262 - HYDRAULIC SYSTEMS III: ACTUATORS, HYDRAULIC SYSTEM TROUBLESHOOTING. AND ELECTROHYDRAULIC SERVO SYSTEMS Educational Point: One (1)

This course consists of three videotapes and textbooks. Videotape 1 (Actuators) covers: hydraulic cylinders, cylinder regulation, cylinder repair, hydraulic motors, motor regulation, and motor repair. Videotape 2 (Hydraulic System Troubleshooting) covers: introduction to troubleshooting, using schematic diagrams, flow-related problems, cylinder malfunction, edge guide circuit malfunction, downender malfunction, and traversing circuit malfunction. Videotape 3 (Electrohydraulic Servo Systems) covers: signal transmission, servo system schematic symbols, spool servo valves, jet pipe servo valves, flapper servo valves, and frequency response tests. *Prerequisite: Completion of Course #261 Hydraulic Systems II.*

263 - LIFTING AND RIGGING Educational Point: One (1)

Rigging and Lifting Module is a comprehensive videotape and text training program. It teaches the procedures for using: hand-operated chain hoists, overhead traveling cranes, forklifts, mobile cranes, scaffolding, and ladders. The program shows the various maintenance activities being performed on actual plant equipment. Videotape 1 includes hand-operated hoists, planning and equipment selection, hoist inspection, shackle and trolley inspection, etc. Videotapes 2 includes introduction to overhead traveling cranes, performing an operational inspection on an overhead traveling crane, using a spreader bar, etc. Videotape 3 includes inspecting a mobile crane, test driving a mobile crane, static and operational inspection of a forklift, removing a pallet from a truck, etc. Videotape 4 includes components of ladders and ladder selection, climbing and lowering an extension ladder, erecting a fixed scaffold, etc.

265 - MECHANICAL MAINTENANCE X: (FUNDAMENTALS OF INSTRUMENTATION AND CONTROLS) LIQUID LEVEL MEASUREMENTS AND PRESSURE GAUGE AND CALIBRATION Educational Point: One (1)

Videotape 1 - Liquid Level Measurement focuses on the operating principles of simple level measuring instruments, float-actuated instruments, displacers, magnetic float devices and sonic instruments. Videotape 2 - Liquid level Measurements 2 teaches trainee how to convert pressure measurements into equivalent liquid level measurements. After completing this unit, trainees should understand how indirect level measuring instruments can be used in open tanks, what differential pressure is, how differential pressure is measured, and how D/P devices are connected to open and closed tanks. Videotape 3 - Pressure Gauges and Calibration 1 demonstrates how to read pressure gauges, remove gauges, and return gauges to service. With sufficient practice, trainees should be able to assemble and disassemble adjustable pointer mechanisms and calibrate rotary-gear pressure gauges containing Bourdon tube or bellows pressure elements. Videotape 4 - Pressure Gauges and Calibration 2 teaches trainees to calibrate a variety of pressure gauges, including retard gauges, absolute gauges, and compound gauges. Trainees also learn to compensate correctly for static pressures when the level of the gauge is different from the level of the pressure being monitored and to select and install devices to protect a gauge from process it monitors. *Prerequisite: Completion of Course 206.*

266 - MECHANICAL MAINTENANCE XI: (FUNDAMENTALS OF INSTRUMENTATION AND CONTROL: RECORDERS, TEMPERATURE AND TEMPERATURE MEASUREMENT 2, AND INSTRUMENTATION TROUBLESHOOTING AND REPAIR Educational Point: One (1)

Videotape 1 - Recorders covers the construction and operation of typical circular chart and strip chart recorders and shows the variety of designs and types of available recorders, types of inputs, print drive and chart drive sections, and recorder printers. The unit also demonstrates simple maintenance, troubleshooting, and calibration procedures on both pneumatic and electronic recorders. Videotape 2 - Temperature and Temperature Measurement #2 explains how thermocouples, (RTDs), thermistors, and infrared temperature sensors operate, and how certain electrical properties and temperature are related and applied in electrical temperature-measuring instruments. Trainees are shown how to obtain a temperature reading with each of the devices covered and how to convert a reading in volts or ohms to degrees. Trainees are also shown how to identify thermocouple types and thermocouple lead wires, how to determine polarity in each of the electrical circuits covered, and how to remove and install the instruments safely. Appropriate electronic test equipment is used to check or troubleshoot electrical temperature-measuring instruments. Videotape 3 - Instrumentation Troubleshooting and Repair introduces the types of diagrams and manuals used in instrumentation troubleshooting and the test equipment used for simulating inputs and measuring outputs. After completing this unit, trainees should be able to identify the problem components in a malfunctioning control loop, given the necessary reference materials. Trainees should also be able to demonstrate good practices for removal, replacement, and repair of process control instruments. *Prerequisite: Completion of Course #265.*

267 - MECHANICAL MAINTENANCE XII: PNEUMATIC SYSTEMS AND EQUIPMENT Educational Point: One (1)

Videotape 1 - Pneumatic Actuators and Positioners examine the main parts of a diaphragm actuator, a piston actuator, a force balance positioner, and a motion balance positioner. Also covered are how each of these instruments work. how a force balance positioner is adjusted, and how a diaphragm actuator and a valve are stroked. Videotape 2 - Pneumatic Control Equipment #2 focuses on the operating principles underlying common types of force balance instruments and motion balance instruments. Trainees are shown how to locate the zero and span or range adjustments on these instruments and how various types of pneumatic relays operate. Videotape 3 - Pneumatic Control Equipment #3 focuses on the function, purpose, and operation of five pneumatic control instruments: transmitters, recorders, converters, indicators, and hand-auto control stations. This unit explains how to identify correct output conditions, given instrument input conditions, and how to calibrate the instruments. *Prerequisites: Completion of Course #206.*

268 - MECHANICAL MAINTENANCE XIII: (PNEUMATIC SYSTEMS AND EQUIPMENT) Educational Point: One (1)

Videotape 1 - Multi-element Pneumatic Control Systems discusses the operating principles of ratio control systems, cascade control systems, auctioneering control systems, and three-element feedwater control systems. Trainees learn to trace the associated signal paths and explain the symbols used on simplified logic diagrams. Videotape 2 - Tuning Pneumatic Control Systems. After completing this unit, trainees should be able to tune a controller with the guidance and assistance of an experience supervisor or instrument technician. Correct tuning of systems should be prerequisite to successful completion of this training sequence. Tuning, in the context of this unit, involves identifying process and system characteristics, determining how those characteristics affect the tuning process, interpreting process reaction curves correctly, and adjusting the controller properly. Videotape 3 - Troubleshooting Pneumatic Instrument Systems. This unit presents the basics of troubleshooting pneumatic instrument systems. After completing this unit, trainees should be able to demonstrate the correct procedure for troubleshooting pneumatic instrument systems when given specific troubleshooting tasks. *Prerequisite: Completion of Course #267 - Pneumatic Systems and Equipment.*

269 - ELECTRICAL MAINTENANCE I Educational Point: One (1)

Videotape 1 - Reading Electrical Diagrams. 2. Connection and Interconnection diagrams, raceway diagrams, and logic diagrams are covered in this unit. Trainees learn how to read a "Raceway Schedule"; a Raceway Notes, Symbols, and Detail book; and truth tables. Videotape 2 - Troubleshooting and Emergency Repair of AC Systems and Equipment. This unit examines examines AC systems and equipment troubleshooting, with particular emphasis on industrial AC systems, subsystems, units, and components commonly in use. Trainees are taught how to identify and locate grounds, shorts, and opens; how to make simple emergency repairs to AC equipment; and how to be aware of the limitations and safety concerns associated with emergency repairs. Videotape 3 - Power Supplies. It explains the operation of transformers, rectifiers, filters. regulators, voltage multipliers, and voltage dividers and shows trainees how to identify these devices and circuits on a schematic. *Prerequisite: Completion of Course #102, Basic Electricity Review and Reading Electrical Diagrams.*

270 - ELECTRICAL MAINTENANCE II: (MOTORS AND MOTOR CONTROLLERS) Educational Point: One (1)

Videotape 1 - Three-Phase AC Induction Motor Maintenance. This unit focuses on the basics of three-phase AC induction motor maintenance: how three-phase motors are constructed; how they operate; and how they are tested, maintained, disassembled, inspected, and reassembled. Videotape 2 - AC Motor Controller Maintenance. This unit shows trainees how to locate controller components using a schematic diagram and a wiring diagram; how to apply the basic steps of troubleshooting; how to perform preventive maintenance procedures; how to test an energized controller for opens; and how to test a de-energized controller for grounds, opens and shorts. Videotape 3 - Maintenance of High-Voltage Circuit Breakers and Switchgear (4KV and Over). This unit describes the principles of operation of high-voltage breakers and switchgears; how circuit breakers extinguish an arc and how protective systems work in conjunction with the breakers. After completing the unit, trainees should be able to assist an experienced electrician

in performing routine maintenance on air circuit breakers and oil circuit breakers, and in performing certain electrical tests on breakers. *Prerequisite: Completion of Course #269.*

271 - ELECTRONIC SYSTEMS AND EQUIPMENT AMPLIFIERS Educational Point: One (1)

Videotape 1 - Operational Amplifiers #1. After completing this unit, trainees should be able to use schematic diagrams to recognize the following basic operational amplifier circuit configurations: voltage followers, reinverted voltage followers, inverting amplifiers, non-inverting amplifiers, differential amplifiers, and instrumentation amplifiers. Given input conditions for these amplifiers circuits, trainees should be able to identify correct circuit output conditions, the basic characteristics of operational amplifiers, and the functions of each of the components within the circuits. They should also be able to recognize the four common operational amplifier package styles. Videotape 2 - Operational Amplifiers 2. This unit shows trainees how to use schematic diagrams to recognize basic operational amplifiers summing amplifiers, comparator, integrator, and differentiator circuits. It teaches trainees to identify correct circuit output conditions, given input conditions for these amplifiers circuits, and to perform common routine maintenance and troubleshooting tasks on equipment involving basic operational amplifiers circuits. Videotape 3 - Using Electronic Test Equipment. This unit on electronic test equipment describes the operation of a Wheatstone Bridge circuit and explains how this circuit relates to the use of resistance decade box, which checks an RTD monitoring system. After completing this unit, trainees should know how to use signal generator, an AC/DC power supply, a vacuum tube tester, and a millivolt potentiometer in common plant applications. *Prerequisite: A general knowledge of electronic systems. Completion of Course 270 is recommended.*

272- ELECTRONIC SYSTEMS AND EQUIPMENT TRANSISTORS. Educational Point: One (1)

Videotape 1 - Transistor Principles. This unit familiarizes trainees with the construction of N-P-N and P-N-P bipolar transistors and explains how a transistor is properly sized, how current flows through a properly biased transistor, and how current flow through a properly biased transistor can be controlled. This unit also covers the construction of a common emitter circuit and explains how this circuit amplifies an electrical signal. After completing the unit, trainees should be able to identify the leads of transistors by their appearance and through the use of a transistor manufacturer's data book. Trainees should also be able to use the data book to select a replacement transistor, and they should be familiar with several types of transistor test equipment. In addition, they should be able to use a digital multimeter to conduct resistance checks on transistors to determine if they are good or bad. Videotape 2 - Transistor Amplifiers. This unit explains how transistor amplifier circuit configurations are used as examples to teach trainees about construction, bias, and amplification characteristics. In addition, trainees are shown how to identify the three basic methods of transistor amplifier coupling and how a multistage amplifier operates. A typical procedure for troubleshooting a faulty amplifier circuit, including initial in-unit testing, visual inspection, and signal checks, is demonstrated. Videotape 3 - Transistor Oscillators. This unit covers basic operating principles of oscillators and how these principles specifically apply to different oscillators. Included are the Armstrong oscillators, the Hartley oscillators, and multivibrators. After completing this unit, trainees should be able to perform simple troubleshooting procedures on a transistor oscillator by applying the techniques discussed in this unit for Armstrong oscillators and astable oscillators. *Prerequisite: Completion of Course #271.*

273 COLLECTION SYSTEM MAINTENANCE Educational Points: one (1)

This course covers various collection system operation and maintenance to include: Basic system designs, collection system inspection, system testing, pipe cleaning and repair, underground repairs and safety procedures. Backhoe operation and safety videos. Basic open trench and trenching procedures and safety are covered as well.

Prerequisite: basic collection system knowledge

275A MECHANICAL MAINTENANCE: INDUSTRIAL GEARING, GEAR REDUCERS, CENTRIFUGAL PUMPS Educational Point: One (1)

This training program from Tel-A-Train, Inc., covers mechanical maintenance in three sections: A, B, and C. Part A uses six videos and associated readings and class discussions to cover:

- (1) Basic Terms of Maintenance
- (2) Maintaining and Troubleshooting Industrial Gearing
- (3) Maintaining and Troubleshooting Gear Reducers
- (4) Maintaining Centrifugal Pumps
- (5) Monitoring Centrifugal Pumps
- (6) Troubleshooting Centrifugal Pumps

Prerequisite: Knowledge of Mechanical Maintenance.

275B MECHANICAL MAINTENANCE: VALVES, FLEXIBLE DRIVES (BELTS & CHAINS), BRAKES AND CLUTCHES Educational Point: One (1)

This training program from Tel-A-Train, Inc., covers mechanical maintenance in three sections: A, B, and C. Part B uses six videos and associated readings and class discussions to cover:

- (7) Maintaining Valves
- (8) Maintaining V-Belts
- (9) Maintaining and Troubleshooting Brakes and Clutches
- (10) Maintaining Flexible Drives: Roller Chain and Silent Chain
- (11) Maintaining Flexible Drives: Flat Belts, V-Belts and Timing Belts
- (12) Maintaining Flexible Drives: Chain other than Roller Chain

Prerequisite: Knowledge of Mechanical Maintenance.

75C MECHANICAL MAINTENANCE: LUBRICATION, BEARINGS, COUPLINGS, AND LASER ALIGNMENT Educational Pt: One (1)

This training program from Tel-A-Train, Inc., covers mechanical maintenance in three sections: A, B, and C. Part C uses six videos and associated readings and class discussions to cover:

- (13) Lubrication Techniques
- (14) Bearing Installation
- (15) Bearing Maintenance
- (16) Couplings

(17) Coupling Alignment Techniques

(18) Laser Alignment

Prerequisite: Knowledge of Mechanical Maintenance.

276 TRICKLING FILTER SOLIDS CONTACT Educational Point: One (1)

This training program deals with the process control in a trickling filter solids contact (TF/SC) process. TF/SC is an aerobic combined suspended growth/attached growth process which combines a trickling filter with an activated sludge process. As a plant operator, you know that the success of the treatment system is measured by the quality of the effluent. So, your main concern is to make sure that your effluent meets your regulatory agencies requirement. In many cases the required values for the biochemical oxygen demand (BOD) and suspended solids (SS) are less than 30 mg/l. To maintain these levels and, thus have an effective operation, you must: (a) maintain an adequate number of microorganisms; (b) maintain good settling properties; (c) supply adequate air to the aeration tank; and (d) remove sludge from the clarifier before septic conditions or de nitrification problems occur. Other objectives include: (a) identify the components of biotower, aeration, reaeration, and clarification methods; (b) describe the purpose, operation, and maintenance requirements of major components; (c) use checklist to start-up, shut down and troubleshoot a system; and (d) demonstrate knowledge of F/M ratio, respiration rate, and mean cell retention time for analyzing plant data. *Prerequisite: Successful completion of the Basic Course #101.*

278A INDUSTRIAL HYDRAULIC TECHNOLOGY Educational Point: One (1)

This training program from Tel-A-Train covers industrial hydraulics in two sections: A and B. Part A uses seven videos and an instructional text to cover:

- (1) The Physical World of a Machine
- (2) Hydraulic Transmission of Force and Energy
- (3) Petroleum Base Hydraulic Fluids
- (4) Fire Resistant Hydraulic Fluids
- (5) Operation at the Suction Side of a Pump
- (6) Hydraulic Actuators
- (7) Control of Hydraulic Energy

Prerequisite: Knowledge of Mechanical Maintenance.

278B INDUSTRIAL HYDRAULIC TECHNOLOGY Educational Point: One

This training program from Tel-A-Train covers industrial hydraulics in two sections: A and B. Part B uses seven videos and an instructional text and class discussions to cover:

- (1) Accumulators and Cylinders
- (2) Flow Control Valves

- (3) Directional Control Valves
- (4) Pressure Control Valves
- (5) Pilot Operated Pressure Control Valves
- (6) Hydraulic Pumps
- (7) Hydraulic Motors
- (8) Reservoirs, Coolers and Filters

Prerequisite: Knowledge of Mechanical Maintenance.

ADVANCED COURSES

(300 Level)

301 - ACTIVATED SLUDGE SKILLS TRAINING COURSE (ADVANCED) Educational Point: One (1) CEU for the two-day course. Two (2) CEUs for the 2 1/2-day course.

This training program deals with the process control in an activated sludge system. As a plant operator, you know that the success of the treatment system is measured by the quality of the effluent. So, your main concern is to make sure that your effluent meets your regulatory agencies requirement. In many cases the required values for the biochemical oxygen demand (BOD) and suspended solids (SS) are less than 30 mg/l and that for the chemical oxygen demand (COD) is less than 100 mg/l. To maintain these levels and, thus have effective operation, you must maintain an adequate number of microorganisms; maintain good settling properties; supply adequate air to the aeration tank; and remove sludge from the clarifier before septic conditions or denitrification problems occur. Other objectives include identifying the components of aeration and clarification methods; describing the purpose, operation, and maintenance requirements of major components; use checklists to start-up, shut down and troubleshoot a system; and demonstrating knowledge of F/M ratio, respiration rate, and the mean cell retention time for analyzing plant data. Advance activated mathematic problems will also be covered. *Prerequisite: Successful completion of Course #201 or completion of Volume I - Ken Kerri's correspondence course of the California State University, Sacramento.*

302 - ANAEROBIC DIGESTION SKILLS TRAINING COURSE (ADVANCED) Educational Point: One (1)

This training course is divided into three parts. Chapter One, you will work through an overview of both the actual digestion process and the equipment that is used in the system. This includes learning about the two stages of digestion, where and how they occur, and about the most important pieces of equipment like digesters, heat exchanger, gas lines and sludge lines. Chapter Two deals with the equipment in more detail. You will learn to identify the components of the various pieces of equipment used in this process. Also, you will learn the part each piece of equipment plays in the digestion process. Chapter Three discusses normal operating procedures and process control; all you need to know to keep the digestion system working effectively. You will have an opportunity to practice the calculations that will provide information for process control. *Prerequisite: Successfully completed the Basic Course and Course #210 or completion of Volume I - Ken Kerri's Course.*

303 - CHLORINATION SKILLS TRAINING COURSE (ADVANCED) Educational Point: One (1)

This training course consists of two parts. Part A contains information on the uses, properties and hazards of chlorine; dosage, residual and feed rate calculation; and feed rate calculation; and identification and function of gas chlorination components. Part B contains a guide for hands-on training that should be conducted in a gas chlorination workshop (if possible). *Prerequisite: Completion of Course #101 or Volume I - Ken Kerri's Course.*

304 - ELECTRICAL MAINTENANCE COURSE: LOW AND MEDIUM VOLTAGE MOTOR CONTROLS AND STARTERS. BY MULTI-AMP INSTITUTE OF DALLAS, TEXAS Educational Point: One (1)

This training course consists of circuit layout, connections and symbols; control pilot devices; basic control circuits; AC reduced voltage starters; three-phase, multispeed controllers; wound rotor (slip ring) motor controllers; synchronous motor controls; direct-current controllers; methods of deceleration; and motor drives.

306 - PROCESS CONTROL LABORATORY COURSE Educational Points: Two (2)

This training course is ideally suited to prepare operators with the necessary training to perform laboratory sampling and testing. Laboratory procedures covered include: measurement of pH (colorimetric and electrometric method); thirty minute settling test; test solids (TS) measurement, total volatile solids (TVS) measurement; total dissolved solids (TDS) measurement; total residual chlorine measurement; dissolved oxygen (DO) test; sampling mixed liquor for the DO test; determining biochemical oxygen demand; determining alkalinity; and volatile acids measurements.

307 - SLUDGE CONDITIONING, THICKENING AND DEWATERING SKILL TRAINING COURSE (ADVANCED) Educational Points: Three (3)

This training course is designed for the operators of wastewater treatment plants who are, or will become, involved in the processing of wastewater sludge. Volume A, Part I covers the quality and quantity of sludge produced. Topics include primary sludge, secondary biological sludge, chemical sludge, and miscellaneous wastewater sludge. Part 2 covers chemical conditioning of sludge. Topics include storage and handling, chemical feeders and processes control for chemical sludge conditioning. Volume B covers sludge dewatering. Topics include drying beds, centrifuges, vacuum filters, belt filter presses, and pressure filters. *Prerequisite: Completion of Course #210 or Volume I - Ken Kerri's course.*

308 - WASTEWATER STABILIZATION PONDS (ADVANCED) Educational Point: One (1)

The general objectives of this course are to increase the ability of the student to recognize and understand the function and operation of a facultative waste stabilization pond. Several points to be discussed include: locate and describe components and, where necessary, explain how they work; distinguish between the various types of ponds; distinguish between the responsibilities of the operator and those of the owner; describe how bacteria and algae cycle works; explain the advantages and disadvantages of parallel and series operation in terms of BOD, SS and fecal coliform removal. *Prerequisite: Completion of Course #209 or Volume I - Ken Kerri's course.*

310 – ACTIVATED SLUDGE MICROBIOLOGY Educational Point: One Half (0.5)

This course covers the basic functions of various microbes. Discusses the relationship between relative predominance of organisms and condition of activated sludge. Students are encouraged to bring sludge sample from their facilities for use during course case studies.

Prerequisite: Completion of Course #209 or Volume I - Ken Kerri's course.

312 - ADVANCED LABORATORY COURSE Educational Points: Two (2)

This course is designed to supplement Course #306 - Process Control Laboratory Course as well as to introduce advanced topics in wastewater chemistry, biomonitoring and toxicity testing, etc. Course objectives are: to learn and apply advanced analytical techniques and good laboratory practices; to apply knowledge and skills learned in previous laboratory course; to know how to properly collect and handle analytical samples; to know how to validate analytical data; to know how to write standard operating procedures; to understand quality assurance and quality control; and to recognize unsafe laboratory practices. *Prerequisite: Completion of Course #306.* NOTE: Course #312 replaces Courses #309 and #311. Anyone who has previously completed Courses #309 and #311 should not register for Course #312 as the instruction would duplicate training already received.

314 - LAB SKILLS TRAINING FOR SUPERVISORS AND MANAGERS Educational Point: One (1)

This two-day course for supervisory personnel in wastewater treatment operations focuses on the process control laboratory. The increasing emphasis on treatment upgrades, effluent re-use, and managing costs through treatment optimization are factors driving the need for reliable data from the laboratory. Students will receive classroom instruction in lab test methods and operations, then apply these skills in a laboratory setting. The training topics will stress quality control in sample collection and handling, analytical testing, data evaluation and reporting, and basic lab management.

Prerequisite: Completion of Course #312 (#309 & #311).

315 - BIOLOGICAL NUTRIENT REMOVAL Educational Point: One (1)

This training program is designed to prepare operators to operate biological nutrient removal treatment systems. In Part 1, the processes of nitrification and denitrification will be covered for both suspended growth and attached growth reactors. In Part 2, biological phosphorus removal will be covered in terms of basic principles of luxury uptake of phosphorus, start-up, operation, and maintenance of different types of systems. In Part 3, biological dual nutrient removal three-zone and five-zone treatment systems will be covered.

316 – CLARIFIER OPTIMIZATION Educational Point: Half (0.5)

This one-day course is designed to provide an advanced look at secondary clarifiers for activated sludge systems. The course covers the details of all the individual clarifier components and their purpose/function. It then covers the clarifier process objectives in concert with the activated sludge process including operating parameters such as retention time, surface overflow rate, solids loading rate, and weir loading rate. Then operating strategies and optimization thereof are discussed. Measurements for daily operation and optimization are described in detail including settleometer, DO, RAS, WAS, MLSS. Case studies are described and then troubleshooting and optimization for these cases are discussed. *Prerequisite: #301.*

317 – FUNDAMENTALS OF BIOLOGY AND CHEMISTRY Educational Point: One (1)

This training program is designed to prepare operators to understand the chemical and biological basis of various treatment processes such as chemical addition, disinfection, chemical odor control, activated sludge, biological nutrient removal, and aerobic/anaerobic digestion. Part 1 covers the fundamentals of chemistry such as stoichiometry, pH, chemical equilibrium, Henry's Law, coagulation, precipitation and neutralization. Part 2 covers the fundamentals of biology such as types of microorganisms, cell composition, molecular tools, metabolism, nutrient requirements, bacteria yield, stoichiometry, growth kinetics, and aerobic/anoxic/anaerobic reactions. biological phosphorus removal will be covered in terms of basic principles of luxury uptake of phosphorus, start-up, operation, and maintenance of different types of systems. Part 3 is a brief overview of chemical and biological treatment processes in wastewater treatment plants.

319 – NEW AND EMERGING SECONDARY TREATMENT TECHNOLOGIES Educational Point: One (1)

Day 1 will cover new technologies for old processes to both stretch capacity and optimize efficiency. Students will learn about modernizing techniques using compartmentalized biological selectors and how to turndown aeration equipment for energy conservation. Hybrid processes covered include selector activated sludge, cannibal activated sludge and vertical loop reactors. Modernization of conventional fixed film systems includes the use of moving bed media and flushing techniques to slough biosolids from biotowers.

Day 2 will cover emerging processes with new technologies. Emerging technologies like submerged biological filters (SBFs) and membrane bioreactors (MBRs) do not require secondary clarifiers and eliminate the need for conventional filters to produce R-1 water. Operators will learn if these emerging processes have application at their facility. Lessons learned and case history discussions will help participants judge if emerging technologies have been adequately developed. Energy savings techniques using new aeration equipment and high speed blowers are also covered.

320 – MEMBRANE BIOREACTORS Educational Point: Two (2)

This 2.5 day course covers operation and control of membrane bioreactor activated sludge systems (MBRs) and includes site visit to a working MBR. The course will cover describe theory and mechanisms, show designs and design parameters, give expected performance removals, work sample calculations, describe system start-up, operation, maintenance, and troubleshooting. The course will be part discussion about how processes work and relative advantages/disadvantages of different systems, and part visual observation of all the components of an operating MBR treatment system. The tour will include observation of fine screens, anoxic tanks, aeration tanks, membrane units, pumping and aeration systems, PLCs and user interface along with emphasis on process inputs, start-up, normal operations, process upsets and troubleshooting, maintenance cleaning and recovery cleaning of membranes. *Prerequisite: Completion of Course #210 or Vol I of Ken Kerri's course.*

321 – DIRECT RESPONSIBLE CHARGE Educational Point: Half (0.5)

The purpose of this course is to provide operators seeking and/or holding Direct Responsible Charge (DRC) positions practical information on the role of the DRC, the regulations, code of ethics, and the responsibilities of the designation. Responsibilities to be covered include HAR 11-61 and 11-62, the code of ethics, DOH monitoring reporting forms, signing BOC exam forms, training and mentoring of temporary certificate holders. The course includes presentations, discussion, question/answer, best practices.