LEARNING OBJECTIVES – PUMPS

Skill Objective
At the end of this training, the participant will be able to:
List the defining characteristics of a centrifugal pump.
Identify the major components of a centrifugal pump and give the purpose/function of each piece. Explain the underlying principles of centrifugal pump operation.
Visually inspect cavitation damage on an impeller and determine whether the root cause of cavitation is upstream or downstream of the pump. List at least five potential causes for pump cavitation.
Discuss different types of centrifugal pumps and state where each type might be applied.
Calculate water, brake, and motor horsepower.
Interprete a pump curve diagram.
Use the pump affinity laws to calculate the new flow output, discharge head, amp draw, and brake horsepower for a pump after either the impeller diameter or motor speed has changed.
Describe the different types of solids handling pumps (inclined screw, positive displacement, plunger, diaphragm, progressing cavity, rotary lobe, and peristaltic) and explain their basic operation.

LEARNING OBJECTIVES – LAGOONS AND FIXED FILM

Skill Objective
At the end of this training, the participant will be able to:
Describe the three main types of ponds (aerobic, facultative, and anaerobic), features of each, and the biological reactions taking place.
Explain why turnover happens in pond systems and how the AIPS process mitigates turnover effects.
Determine the most likely cause of various lagoon operational problems. (troubleshooting)
Identify major components of trickling filters and give the function of each.
Understand the importance of hydraulic wetting rate in biofilm formation and mitigation of predators.
List characteristics of various types of trickling filter media including rock, dump, vertical flow and cross-flow.
Discuss how air flows through a trickling filter using natural and forced air ventilation and the impact of air temperature on natural ventilation.
Classify trickling filters by treatment goals and loading rates.
Compare and contrast the differences and similarities between trickling filters and rotating biological contactors.

LEARNING OBJECTIVES – BASIC MATH

Follow the order of operations and rearrange mathematical formulas to calculate area, volume, detention time, velocity, loading rates, chemical feed rates, and horsepower.

LEARNING OBJECTIVES – DISINFECTION

Skill Objective
At the end of this training, the participant will be able to:
List the characteristics of chlorine gas and write the chemical formulas of the compounds formed when chlorine gas mixes with water.
Explain the purpose of a fusible plug and recite the melt temperature.
Describe the products formed when either sodium hypochlorite or calcium hypochlorite solution is mixed with water and the impact on alkalinity.
Discuss the breakpoint chlorination curve and describe in detail the chemical reactions taking place at each stage of the curve.
Explain regulatory requirements for chlorine leaks, how to detect a chlorine leak, and the three types of chlorine repair kits. Safely operate a chlorine disinfection system.

LEARNING OBJECTIVES – ACTIVATED SLUDGE

Skill Objective
At the end of this training, the participant will be able to:
Classify bacteria according to morphology, growth pattern, carbon source, and oxygen source. Define heterotroph, autotroph, facultative, and obligate aerobe.
Explain how faculative heterotropic bacteria and autotrophic bacteria will function in an anaerobic zone, anoxic zone, and aerated zone.
Discuss the impact of filaments on activated sludge settleability and the need to balance the growth of filament formers and floc formers.
Understand what may be controlled by manipulating the Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) pumping rates.
Select a target sludge age based on water temperature and nitrification requirements.
Demonstrate the relationships between sludge age (control variable) and its dependent process control variables of food to microorganism ratio, MLSS concentration, and MLVSS to MLSS ratio.
Calculate process control variables associated with secondary clarifiers including surface overflow rate, weir loading rate, and solids loading rate.
Conduct three types of settleometer tests and interpret results.
Predict the effect of increasing or decreasing sludge age on other process control variables including MLSS concentration, MLVSS concentration, F:M ratio, and wasting rate. Calculate process control variables from plant data.
Describe how hydraulic and solids loading parameters are calculated for secondary clarifiers and the relative importance of each.

LEARNING OBJECTIVES – NITROGEN REMOVAL

Identify sources and types of nitrogen species in the environment and domestic wastewater.
Identify the two main groups of bacteria responsible for ammonia removal and their requirements for growth.
Select a target mean cell residence time (MCRT) based on treatment goals and water temperature.
Explain why effluent ammonia concentrations can be several mg/L even when complete nitrification is taking place.
Discuss process variables that may affect nitrification including pH, alkalinity, and dissolved oxygen.
Understand denitrification stoichiometry and the requirements for denitrification to take place.
Apply knowledge of denitrification stoichiometry to prevent denitrification from occurring in clarifier blankets.
Adjust internal mixed liquor recycle ratios between aerobic and anoxic zones to maximize nitrification and denitrification.

LEARNING OBJECTIVES – PHOSPHORUS REMOVAL

Skill Objective
At the end of this training, the participant will be able to:
Understand the consequence of discharging excess phosphorus into the environment and the regulatory limitations being placed on phosphorus by EPA.
List sources of phosphorus in municipal wastewater. Convert between phosphorus as phosphate and phosphorus as P.
Explain the concept of luxury phosphorus uptake and how phosphate accumulating organisms utilize poly-phosphate for energy storage.
Evaluate influent data to determine if the carbon source to phosphorus ratios might support enhanced biological phosphorus removal.
Discuss the impact of various operating variables on enhanced biological phosphorus removal performance including dissolved oxygen, pH, temperature, and hydraulic and solids retention times.
Understand the basics of phosphorus precipitation chemistry and the concept of metal equivalent to P ratios to achieve certain effluent P goals.
List three novel techniques for phosphorus removal.

LEARNING OBJECTIVES – SOLIDS DIGESTION

Skill Objective
At the end of this training, the participant will be able to:
List the requirements for meeting Class A or Class B biosolids and vector attraction reduction requirements for land application of biosolids.
Compare aerobic digestion to the activated sludge process and list two common operational issues and their solutions.
Describe the major components of anaerobic digesters and the function of each.
Understand the importance of managing high-ammonia recycle streams from anaerobic digestion and dewatering processes with respect to maintaining stable nitrification on the liquid stream side of the WWTP and preventing bleed-through of high ammonia to the final effluent.
List typical gas production values for anaerobic digesters and give two reasons why digester gas has a lower heating value than natural gas.
Compare and contrast the chemical and biological reactions taking place in aerobic versus anaerobic digesters.
Describe anaerobic digester operation and the importance of various operating parameters including temperature and loading rate.
Review operating data, compare to standard operating conditions, and diagnose the most likely cause for an upset condition.

LEARNING OBJECTIVES – CENTRIFUGE DEWATERING

Skill Objective
At the end of this training, the participant will be able to:
Compare and contrast the separation of solids in a centrifuge to secondary clarifier operation. List the major components of the centrifuge and compare to the major components of a clarifier.
Describe the major components of a centrifuge and give the function of each component as well as describing ancillary equipment.
Explain typical startup and shutdown procedures for a centrifuge.
Explain the impact of process control variables including: pond setting, making seal, differential speed, load control, and differential speed control.
Troubleshoot common operational problems.
Perform common maintenance tasks for a typical centrifuge.
Calculate centrifuge loading rate and percent capture.

LEARNING OBJECTIVES – BELT FILTER PRESS DEWATERING

Skill Objective
At the end of this training, the participant will be able to:
List each of the dewatering zones in a belt filter press and give the expected solids concentration at the end of each zone.
Describe the major components of a belt filter press and give the function of each.
Understand the three major classifications of polymers and flocculants and the procedure for optimizing polymer dose.
Given an operational problem or operational data from a belt filter press, suggest the most likely cause and one other potential cause. (Troubleshooting)
Calculate process control parameters including: percent capture, total run time required, and quantity of finished cake produced.

LEARNING OBJECTIVES – LABORATORY TESTING METHODS

Skill Objective
At the end of this training, the participant will be able to:
Compare and contrast three methods for measuring total suspended solids: gravimetric analysis, TSS meter, and centrifuge spins. Comment on the relative accuracy of each method.
Correctly set up and execute the gravimetric total suspended solids procedure for analysis of wastewater samples including required QA/QC.
Calculate total suspended solids concentrations from raw laboratory data. Interpret QA/QC sample results and take corrective action.
Understand the historical and theoretical basis for the BOD test: a bulk estimate of organic content.
Correctly set up testing for biochemical oxygen demand including all required and recommended quality assurance and quality control samples. Explain why each step of the procedure is necessary.
Calculate BOD results from raw analytical data and evaluate results from QA/QC samples.
Correctly set up and execute a Winkler dissolved oxygen analysis. Describe the reagents required and correct order of addition.
Explain the difference between pH and alkalinity and why both measurements are needed when monitoring biological processes.
Correctly set up and execute an alkalinity titration including required QA/QC. Calculate alkalinity result as mg/L CaCO3 from raw laboratory data.
Correctly set up and execute a hardness titration. Calculate a hardness result as mg/L CaCO3 from raw laboratory data.
Discuss the limitations of spectrophotometers and the concept of a method detection limit.

Understand that the visible spectrum, colors of light, are dependent on their wavelength.
Explain Beer's Law and why samples must be diluted and reanalyzed when they are over the calibrated linear range.
Select appropriate quality assurance and quality control samples for a given analysis. Explain the purpose behind each type of QA/QC sample and the information gained by analyzing them.