Wyeth Biotech, Andover, Massachusetts
pH Neutralization System
System Description

October 2007

System Description:

(Refer to attached drawing KE-141 B "Piping and Instrumentation Diagram pH Adjustment System)

Overview

The main pH system at the site consists of 3, 10,000-gallon tanks through which all wastewater flows in a sequential manner. All wastewater from all of the manufacturing suites on site, as well as from all laboratories and the cage wash area from the bioresources (i.e., animal) areas are also directed to the pH system. Wastewater from suites A,B, the ADF, E, F, I, II, III, and IV flow directly into the 1st 10,000-gallon tank (Tank T1A). Wastewater from building G labs is first directed to a dedicated sump in that building and then pumped from the 11'6" x 15'0" x 10'6" deep sump by one of two waste water pumps, each rated at 300 gallons per minute (gpm), into this first tank as well. Wastewater from building A laboratories is directed to a sump located underground by the pH system and from here is pumped to the initial 10,000 gallon tank. Two pumps, each rated at 30 gpm provide for this wastewater transfer. Under normal operation, Tank T1A is only used for mixing and no chemical addition is provided. However, when one of the two downstream tanks is out of service, tank T1A can provide for coarse pH adjustment through the addition of 50% sodium hydroxide solution or 50% sulfuric acid.

Wastewater from tank T1A is pumped into the second 10,000-gallon tank by two neutralization feed pumps, each rated at a maximum of 200 gpm. This second tank (T-2001) is used for coarse pH adjustment and is provided with caustic/acid delivery lines from the chemical storage shed located adjacent to the tank.

Wastewater from Tank T-2001 flows by gravity in to the last tank, Tank 2-2000. This tank is used for fine pH adjustment, prior to discharging the treated wastewater, by gravity, to the main site lift station and ultimately to the Greater Lawrence Sanitary System.

Detailed Process Description

Under normal operating conditions, all waste streams are initially sent to a 10,000 gallon waste neutralization surge tank, pH-T1A. Waste from this surge tank is pumped to the 10,000 gallon first stage neutralization tank, T-2001, where acid or base is added from the acid/base system for coarse pH adjustment. The waste from Surge Tank pH-T1A is pumped in proportion to a level set point via a PID controller with in the Local PLC. The

PID Controller output is wired to each Variable Frequency Drive (VFD) Motor controller to provide speed regulation and response to changes in Tank pH-T1A level. The set point is set such that the VFD will run at minimum speed until a preset level is exceeded at which time the VFD speed will increase to reduce the level in the tank to its setpoint. The ramp time for the change in VFD speed is adjustable to allow the motor speed to ramp up and down slowly to provide continual predictable level changes in tanks T-2001 & T-2000 to minimize upsets in the pH level in either of the tanks. At the end of a pumping cycle if pump pH-P1A is running and the level falls to the stop level, pH-P1A will stop and the logic will alternate to put pH-P2A in the lead where it will run as required to maintain level in Tank PH-T1A. The alternator is selectable for automatic or manual operation so a single pump can be selected to run continuously in the event of a VFD Failure. In the event of a failure of either pump, the lag pump will be called to run and an alarm will be sent to annunciate the alarm condition. The treated process waste from the first neutralization tank then overflows into the 10,000 gallon second stage neutralization tank, T-2000, where acid or base is again added from the acid/base system for fine pH adjustment. Overflow from T-2000 discharges to the waste flume.

Abnormal conditions occur when one of the three tanks is removed from service for maintenance purposes. The two remaining tanks will operate as the coarse and fine neutralization tanks. Overflow from the Fine neutralization tank will discharge to the waste flume.

Under normal operating conditions (i.e. three tank system), the pH Adjustment System for Tank T-2001 will condition all wastewater released to Tank T-2000 to be not lower than 5.75 pH or higher than 10.00 pH. The pH Adjustment System for Tank T-2000 will condition all effluent wastewater released to the Sewage Lift Station to be not lower than 5.75 pH or higher than 10.00 pH. Tank T-2000's pH, effluent pH and Effluent Water Flow Control Valve will be recorded by a six pen chart recorder. Tank T-2001's pH, effluent pH and Effluent Water Flow Control Valve will be recorded by the same six pen chart recorder. Tank T-2000's redundant pH transmitter will be recorded on a 10-pen chart recorder. Tank T-2001's redundant pH transmitter will be recorded on the 10-pen chart recorder. Tank pH-T1A's redundant pH transmitters will be recorded on the 10-pen chart recorder. Three Discrete Inputs to the 10-pen chart recorder will be used to determine which of the redundant pH probes for each of the three Tanks will be "Active". The effluent water control valve shall be open, allowing water to be released to the Sewage Lift Station when Tank T-2000's pH is between 5.75 and 10.00. The Caustic Metering Pump for each pH Adjustment System shall be controlled by an Allen Bradley SLC (SLC 5/04), utilizing a direct acting PID Loop, and will hold a setpoint of between 6.0 and 6.8 tank pH. The Acid Metering Pump for each pH Adjustment System shall be controlled by this same Allen Bradley SLC (SLC 5/04), utilizing a reverse acting PID Loop, and will hold a setpoint of between 7.5 and 8.0 tank pH.

Under abnormal operating conditions (i.e., two tank system), the pH Adjustment Systems will need to be routed to the appropriately configured tanks. When tank pH-T1A is disabled, tank T-2001 will be the Coarse Tank and T-2000 the Fine Tank. When tank T-2001 is disabled, tank pH-T1A will be the Coarse Tank and T-2000 the Fine Tank. When

tank T-2000 is disabled, tank pH-T1A will be the Coarse Tank and T-2001 the Fine Tank. The pH Adjustment System for the Coarse Tank will condition all wastewater released to the Fine Tank to be not lower than 5.75 pH or higher than 9.25 pH. The pH Adjustment System for the Fine Tank will condition all effluent wastewater released to the Sewage Lift Station to be not lower than 5.75 pH or higher than 10.00 pH. The effluent water control valve shall be open, allowing water to be released to the Sewage Lift Station when the Fine Tank's pH is between 5.75 and 9.25. The Caustic Metering Pump for each pH Adjustment System shall be controlled by an Allen Bradley SLC (SLC 5/04), utilizing a direct acting PID Loop, and will hold a setpoint of between 6.0 and 6.8 tank pH. The Acid Metering Pump for each pH Adjustment System shall be controlled by this same Allen Bradley SLC (SLC 5/04), utilizing a reverse acting PID Loop, and will hold a setpoint of between 7.5 and 8.0 tank pH.

The pH Adjustment System's Sump Pit Pumps shall operate as an alternating LEAD / LAG system. Pump "A" shall turn on when the sump reaches 65% capacity, and sump pump "B" will turn on if the sump level reaches 80% capacity. The sump pump sequencing will alternate upon each ON / OFF cycle. Lead Pump "A", or Pump "B" (and lagging Pump "B" or Pump "A" when required) will turn off when the sump reaches 20% of its capacity. Both sump pumps shall shut off if either Tank pH-T1A or Tank 2001 go into a **"HIGH HIGH** Level" Alarm Condition.

Surge Tank pH-T1A's Sump Pump (pH-P5A) will be located in the diked area containing the Surge Tank. This pump will transfer any accumulated liquid from this area into the Surge Tank. There will be no automatic control of this pump.

Under normal operation (i.e. three tank system), neutralization feed pumps, pH-P1A and pH-P2A, shall operate as an alternating LEAD / LAG system. Pump pH-P1A shall turn on when level in the Surge Tank pH-T1A reaches 40% capacity, and pump pH-P2A will turn on when Tank pH-T1A reaches 70% capacity. The pump sequencing will alternate upon each ON / OFF cycle. Lag Pump pH-P2A, or Pump pH-P1A, will turn off when level in the Surge Tank pH-T1A reaches 60% capacity. Lead Pump pH-P1A, or Pump pH-P2A, will turn off when level in the Surge Tank pH-T1A drops below sixty four (64) inches. Both pumps shall shut off if Tank 2001 goes into a **HIGH HIGH** Level" Alarm Condition.

Under abnormal operation (i.e. two tank system), neutralization feed pumps, pH-P1A and pH-P2A, shall operate as an alternating LEAD / LAG system only when tank pH-T1A (acting as the Coarse Tank) is enabled. Pump pH-P1A shall turn on when level in the Surge Tank pH-T1A reaches 50% capacity, and pump pH-P2A will turn on when Tank pH-T1A reaches 60% capacity. This is to prevent overflow of tank pH-T1A when an unexpected downstream transfer occurs. The pump sequencing will alternate upon each ON / OFF cycle. Lag Pump pH-P2A, or Pump pH-P1A, will turn off when level in the Surge Tank pH-T1A reaches 40% capacity. Lead Pump pH-P1A, or Pump pH-P2A, will turn off when level in the Coarse Tank pH-T1A drops below sixty four (64) inches. Both pumps shall shut off if the Fine Tank goes into a **HIGH HIGH** Level" Alarm Condition.

Tanks 2000 and 2001 agitator shall remain on at all times, unless the agitator's appropriate tank is in a "LOW Level" Alarm Condition (approximately sixty five inches from Tank T-2000's bottom and sixty one inches from Tank T-2001's bottom).
Tank pH-T1A's agitator shall remain on at all times, unless the tank level reaches approximately sixty one inches (61) from the tank bottom.

Tanks 2000, 2001 and pH-T1A each have redundant pH sensors / transmitters. These will work in an "Active" and "Non-active" setup. The operator will choose the "Active" pH meter from the Panel View Operator Interface for each of the tanks. The "Active" pH sensor will be used in all pH calculations. In the SLC 5/04, the values of the "Active" and "Non-active" pH meters will be compared to each other. If the values between the meter readings differ by greater than 0.5 pH, an alarm will be sent to the UMS indicating a possible meter malfunction. The operator will have the ability to change the "Active" and "Non-active" status of the meters at the Panel View.