Welcome

BURT | PROCESS EQUIPMENT

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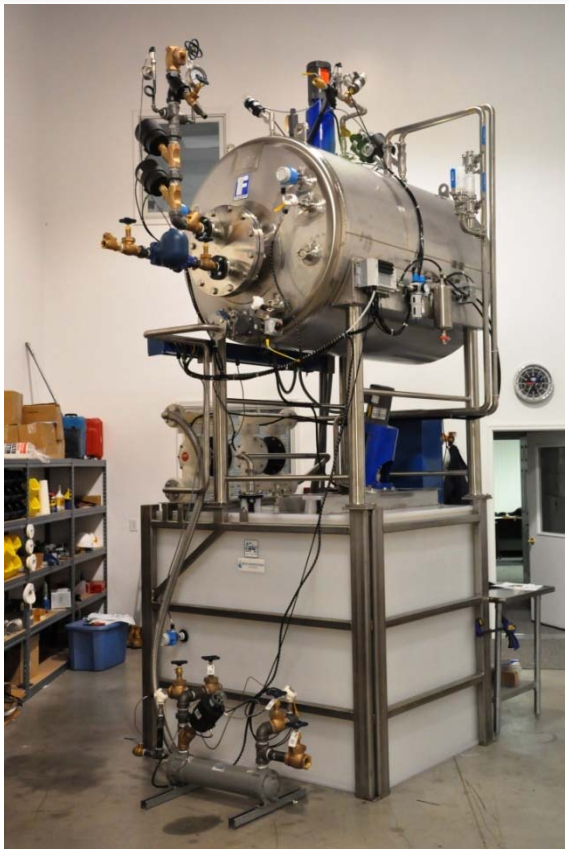
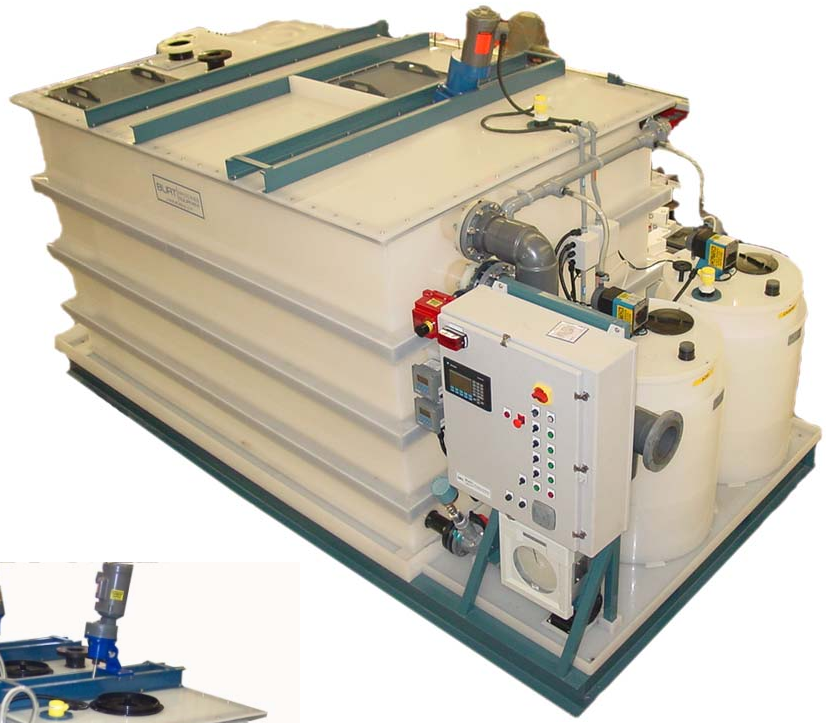
Active Waste Treatment Systems





BPE

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What is an Active Waste Treatment System?

An active waste system is a system that treats waste based on real time pH feed back via the controlled inject of acid and caustic reagents.

Typical Applications

- Power Industry
- Semiconductors
- Pharmaceuticals
- Clean Room
- Food and Beverage
- Research Labs
- Schools and Academia
- Municipal

pH Theory

pH Scale

Lemon Juice *Orange Juice* *Soap* *Bleach*

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Acidic Waste

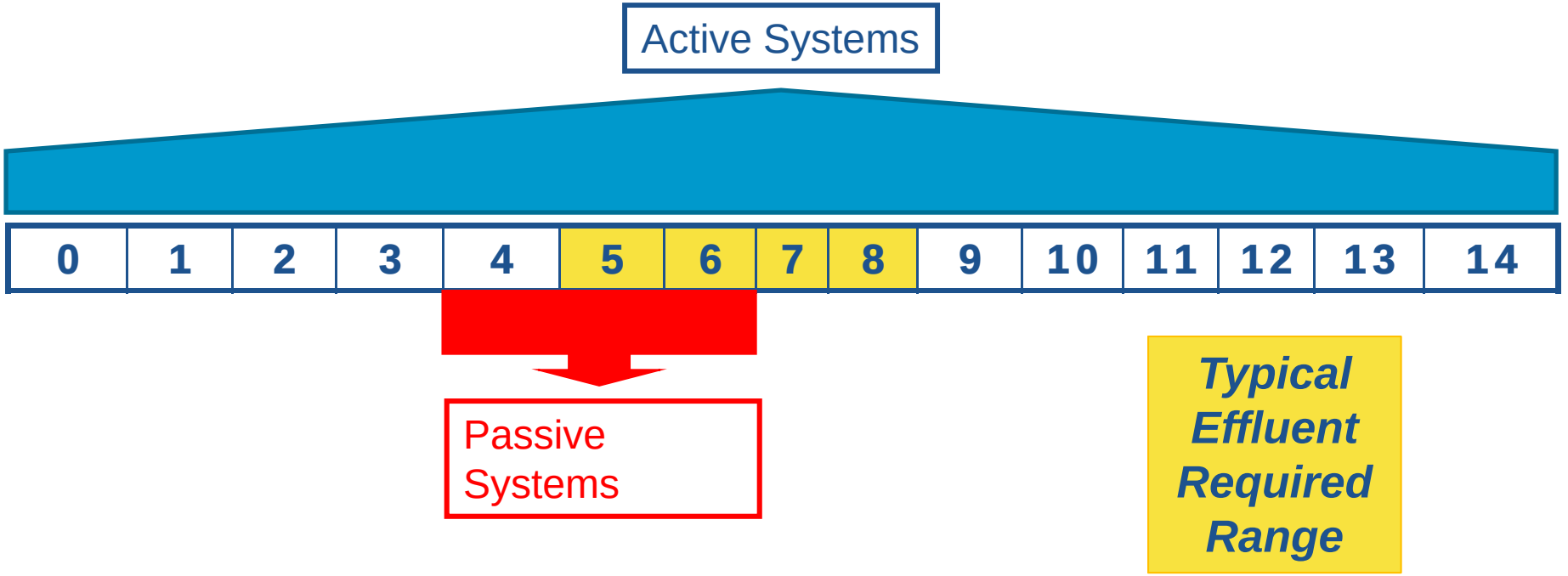
Basic Waste

pH is logarithmic by nature

10^{7}	10^{6}	10^{5}	10^{4}	10^{3}	10^{2}	10^{1}	0	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}

Active vs. Passive Systems

pH Range



Passive Systems

- Single direction treatment
- Unable to treat strong waste steams

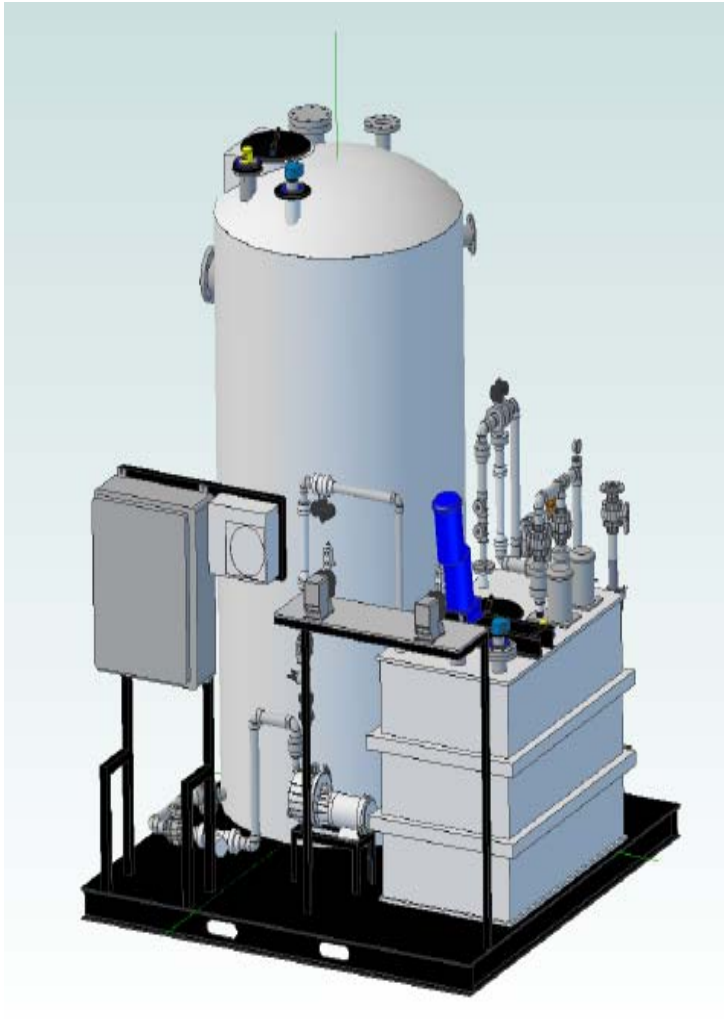
Active Systems

- Can Treat in both directions
- Can treat waste of any strength

pH System Designs

There are three main styles of pH adjustment systems

- Flow through systems
- Batch treatment systems
- Hybrid flow/batch systems

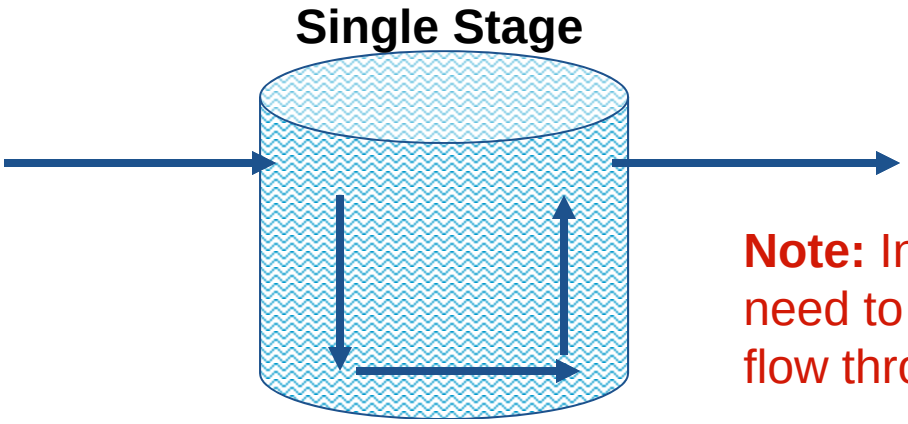


pH System Design Flow Through Systems

Flow through systems are designed to treat the waste on a continuous basis over a number of stages. They are designed based on the residence time determined for the given flow rate and influent pH.

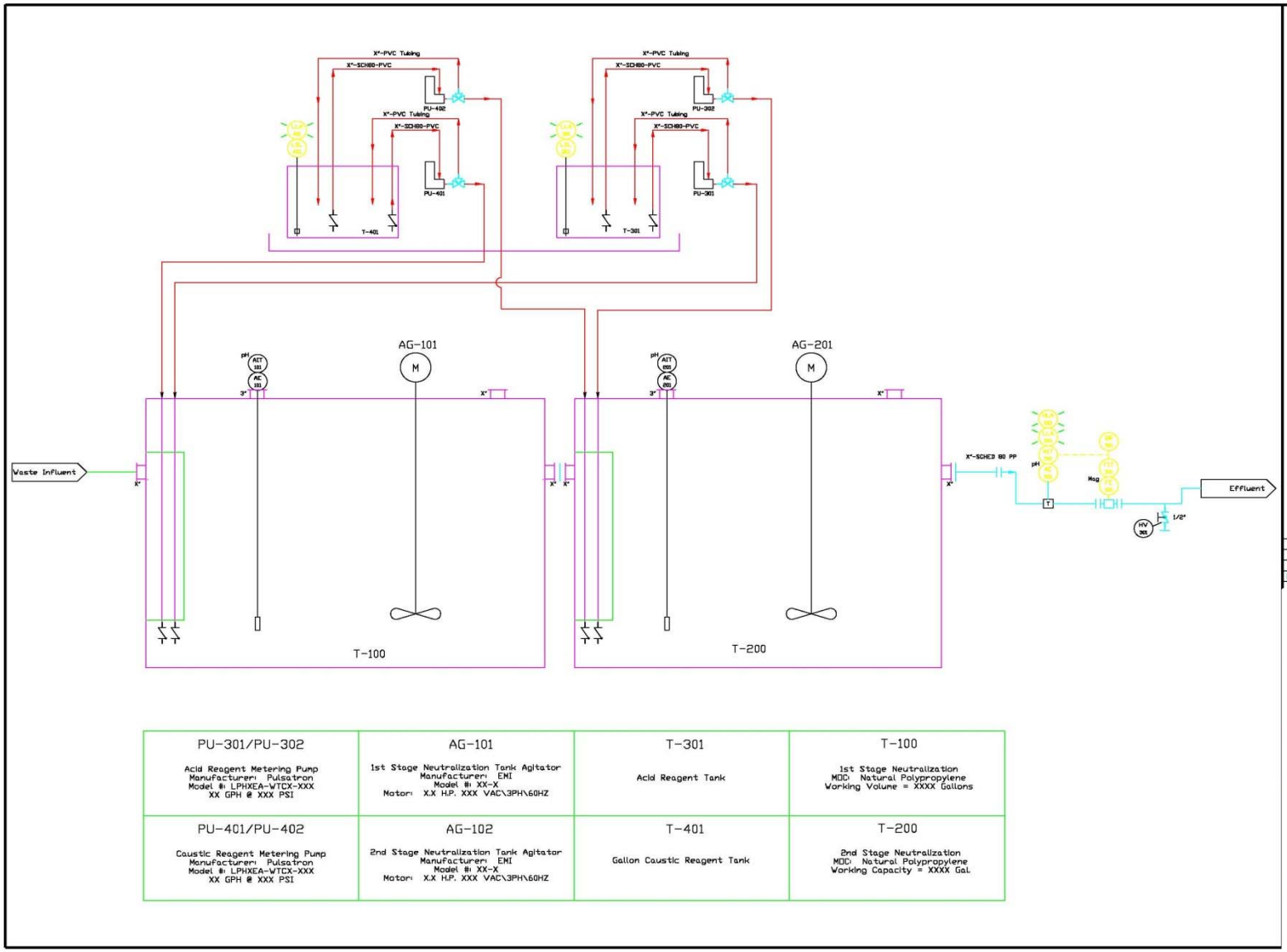
- Residence time is the theoretical measurement of the average amount of time the waste will be treated in the treatment tank. Larger flow rates and more acidic/basic waste streams will require a higher residence time. Average residence time is 20 minutes.
- The number of stages is the number of in-series treatment tanks. The number of stages is based on the flow and nature of the pH.

Flow Pattern: determines residence time



Note: Influent flow does not need to be continuous in a flow through system.

pH System Design Flow Through

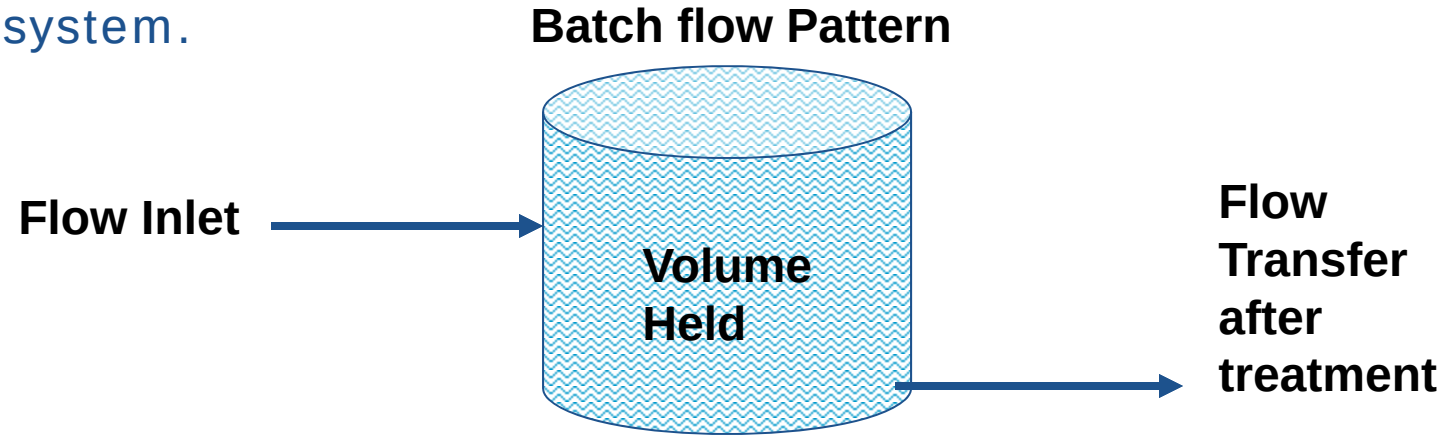


PU-301/PU-302 Acid Reagent Metering Pump Manufacturer: Pulsatron Model #: LPHXEA-WTCX-XXX XX GPH @ XXX PSI	AG-101 1st Stage Neutralization Tank Agitator Manufacturer: EMI Model #: XX-X Motor: X.X H.P. XXX VAC\3PH\60HZ	T-301 Acid Reagent Tank	T-100 1st Stage Neutralization MOC: Natural Polypropylene Working Volume = XXXX Gallons
PU-401/PU-402 Caustic Reagent Metering Pump Manufacturer: Pulsatron Model #: LPHXEA-WTCX-XXX XX GPH @ XXX PSI	AG-102 2nd Stage Neutralization Tank Agitator Manufacturer: EMI Model #: XX-X Motor: X.X H.P. XXX VAC\3PH\60HZ	T-401 Gallon Caustic Reagent Tank	T-200 2nd Stage Neutralization MOC: Natural Polypropylene Working Capacity = XXXX Gal

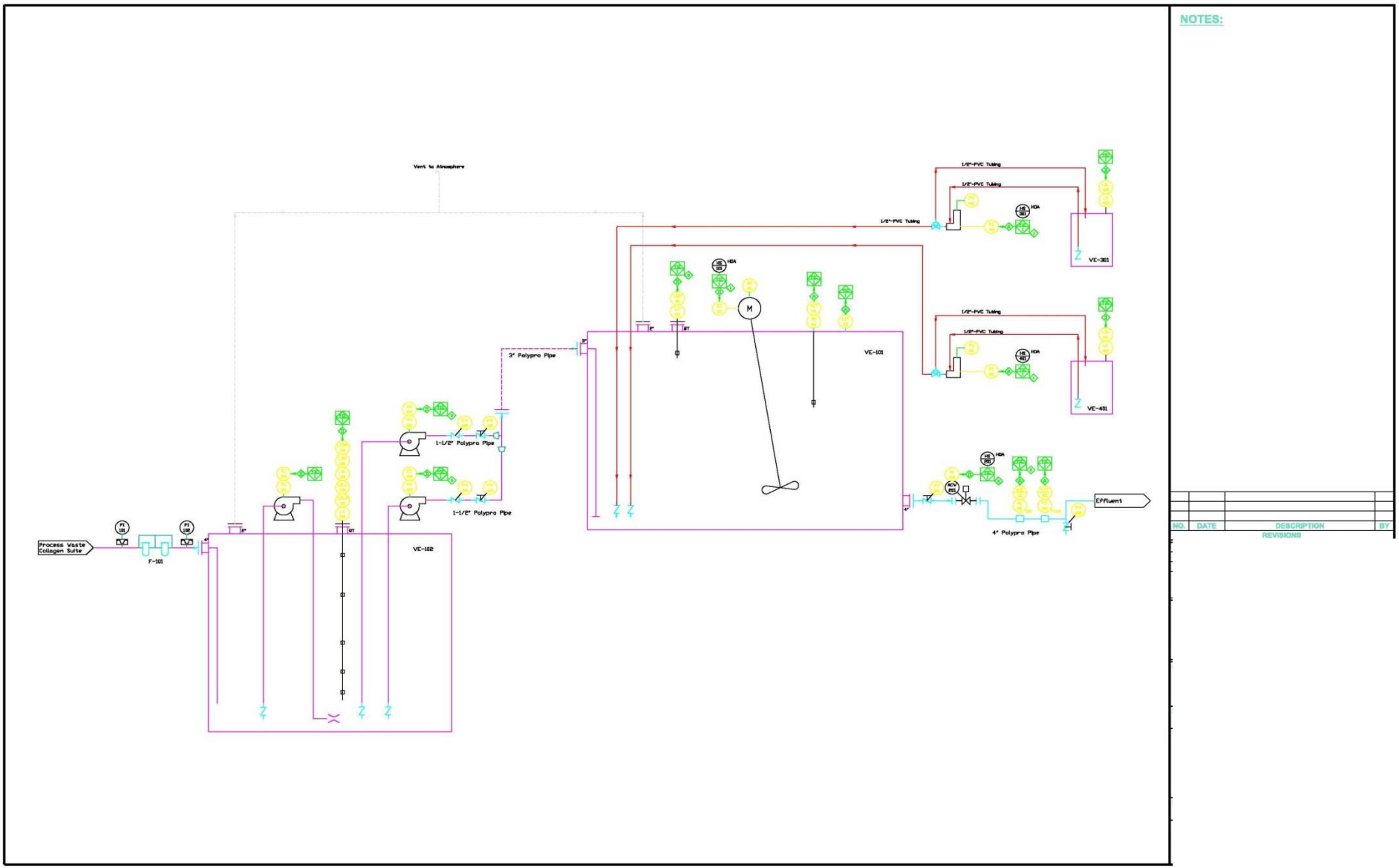
pH System Design Batch Systems

Batch systems are designed to treat a volume of waste until neutralized at which point the current batch is discharged and another batch volume is added to the system. Residence time is not a factor as the bath system treats the waste for as along as necessary.

- Batch systems have the advantage of being able to handle waste of essentially any pH. They also have no risk of producing out of compliance waste.
- Their primary disadvantage is they reduce throughput of the system.



pH System Design Batch

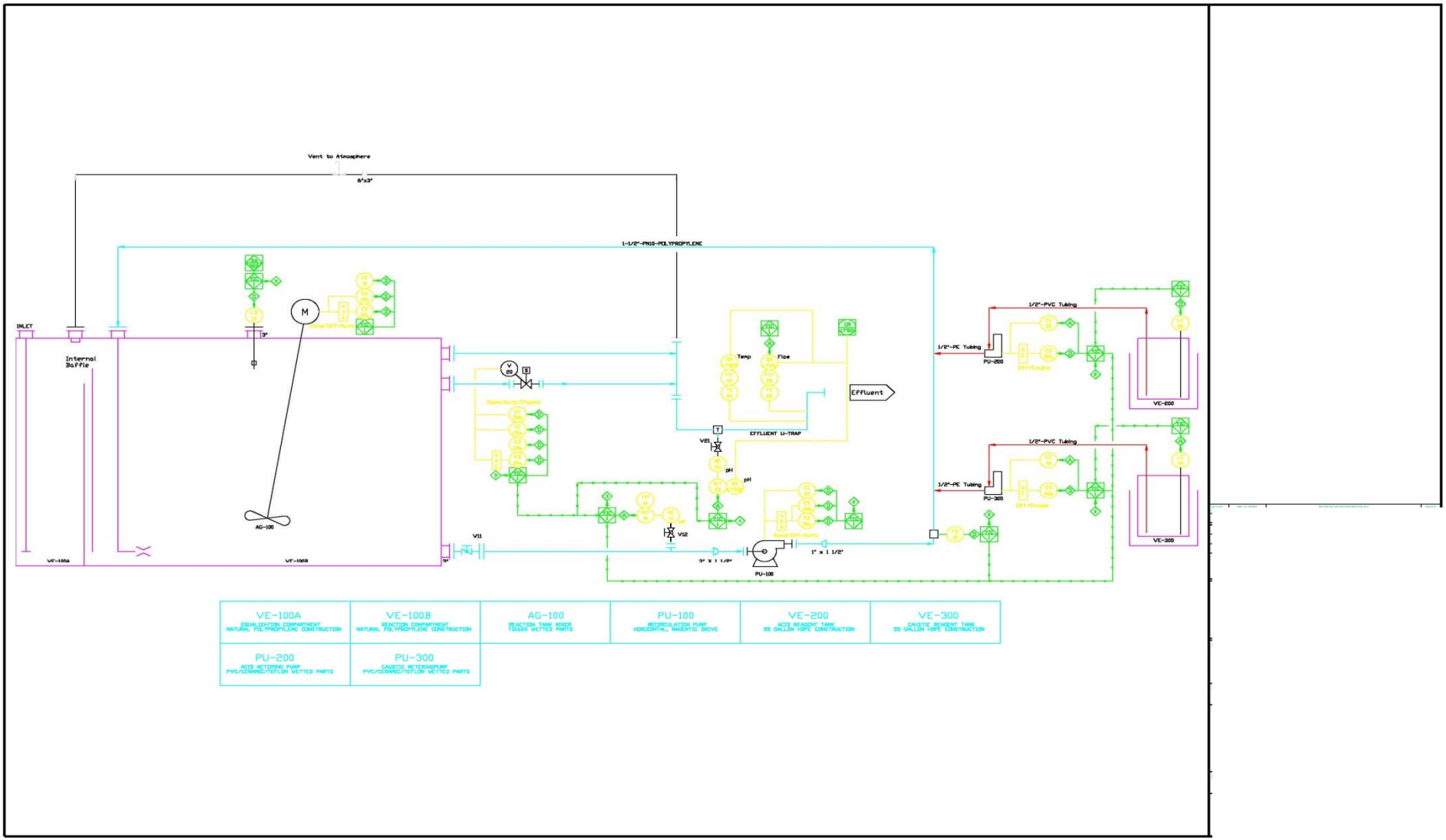


pH System Design Hybrid Systems (ACS)

Hybrid systems employ the benefits of the throughput capability of the flow through systems with the additional residence time and compliance control of batch systems. This is referred to as the Assured Compliance System (ACS).

The ACS provides an actuated valve on the discharge of the system. This valve will close if the effluent pH nears the discharge limits. The tank normally only runs at partial capacity so when the discharge valve closes, it allows the system to operate for five minutes in a batch mode. Once the pH returns to a normal range, the discharge valve will re-open and the system will continue to operate as a continuous flow through system. Should the pH not return to the desired range in time, an overflow at the top of the tank will bypass to drain or an optional recirculation or collection tank to prevent flooding of the system.

pH System Design Hybrid Systems (ACS)



pH Adjustment System Basic Components

- Treatment Tank
- Equalization Tank
- Reagent Injection
- Temperature Control
- Agitation
- Recirculation Pump(s)
- Control Instrumentation
- Effluent Monitoring

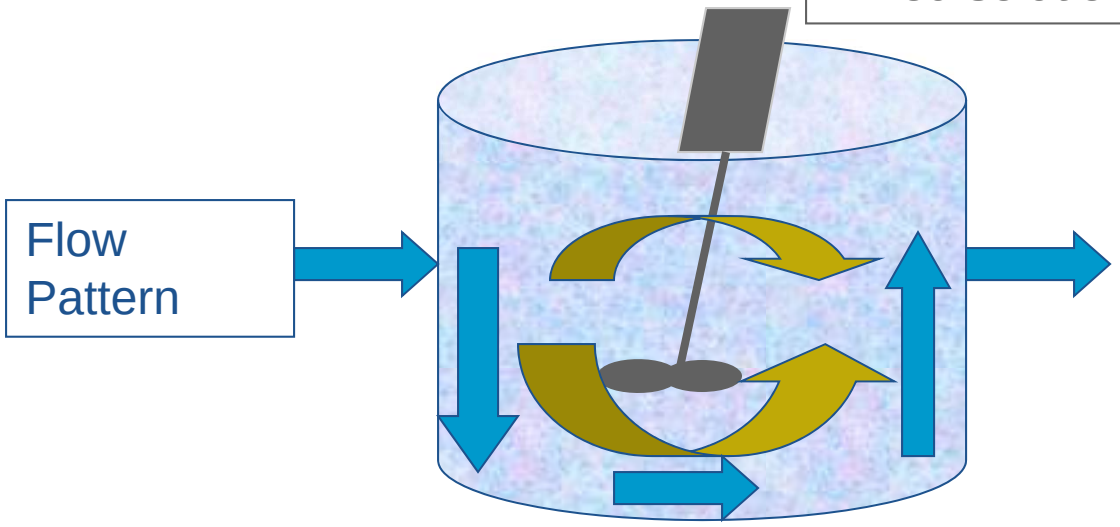
pH Adjustment System Components
Treatment Tanks / Agitation

The treatment tanks in a pH adjustment system are designed as **continuously stirred-tank reactors (CSTR).** They are sized and agitated to create ideal mixing so the pH in the tank is equivalent to the pH leaving the tank.

Important Considerations

- Residence time
- Rate of mixing
- Material Compatibility

Rate of Mixing: 1.5 x tank volume pumping rate required for well mixed solution



Due to the ideal model of the CSTR, multiple stages are more efficient then one large stage

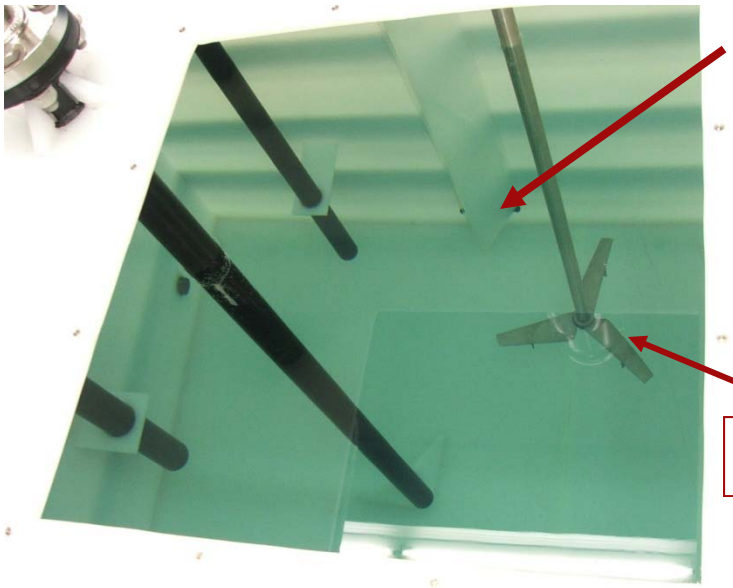
pH Adjustment System Components, chemical injection

Since a CSTR model allows for uniform pH across the treatment tank, reagent injection must be properly injected into the mixer wash and controlled to avoid swings in pH. The most common reagents for pH adjustment are sulfuric acid and sodium hydroxide. Additionally, carbon dioxide gas can be used.

Important Considerations

- Turn down for reagent injection proportional to logarithmic pH scale
- Careful not to oversize to avoid instability in controlling pH.

Standard Reagent assembly

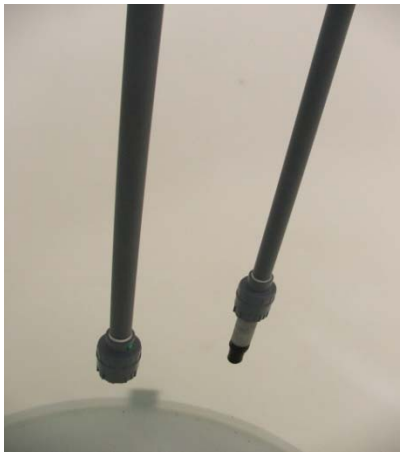


pH Adjustment System Components, Instrumentation and Controls

pH System is controlled by the pH probe located in the tank or inline recirculation loop.

- pH probe probes can be immersion style or retractable
- pH probes options include
  - Memory sense technology to save calibration data
  - Can be custom rigged with self-cleaning spray technology
  - Probes are available for specific waste streams (High Purity, Hydrofluoric acid etc.)

Retraction Style



Immersion Style

pH Adjustment System Components, Equalization Tanks

Equalization tanks are an option that can be added to treatment systems. Equalization storage serves two main purposes:

- Equalize flows and allow for specific volume transfer
  - This is an important feature in establishing a proper CSTR design or batch size.
- Can allow for some self neutralization.

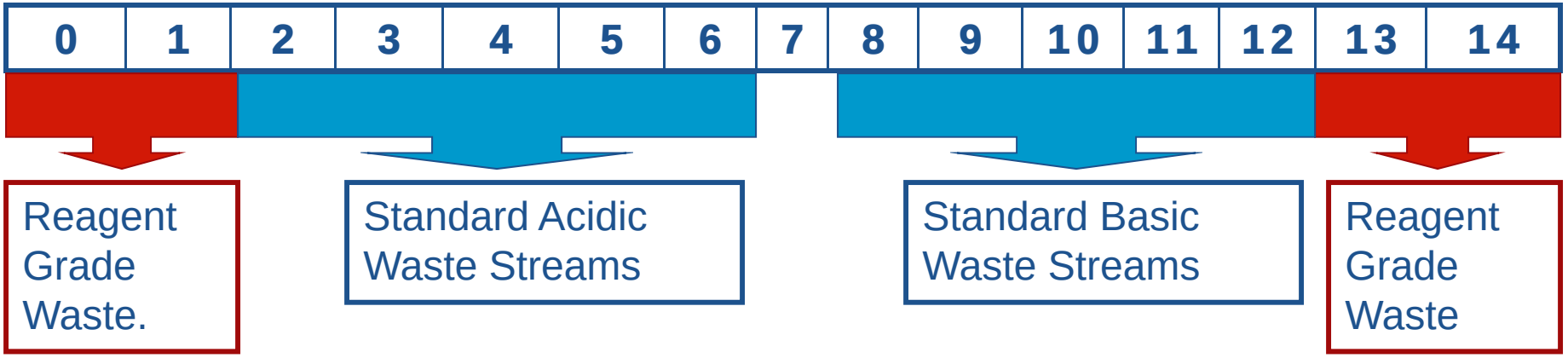
pH Adjustment System Components, Recirculation Pumps

Recirculation pumps are an option that can be added to treatment systems. Recirculation pumps serve three main purposes:

- They allow for use of retraction style pH probes which can be mounted at a more ergonomic level.
- The reagents can be injected inline, allowing for dilution and direct mixing into the mixer backwash.
- They can supplement mixing (but cannot be used in place of a mixer).

pH Design Considerations
Influent pH

Influent pH dictates the number of stages for flow through systems and batch times for batch systems.



Reagent Grade Waste

- Waste Stream 1%+ acid/caustic
- Generally batch treatment only
- Requires in process temperature control to mitigate heat from neutralization reaction
- Treatment time is very long, residence time not applicable. Limiting temperature build-up dictates treatment time.

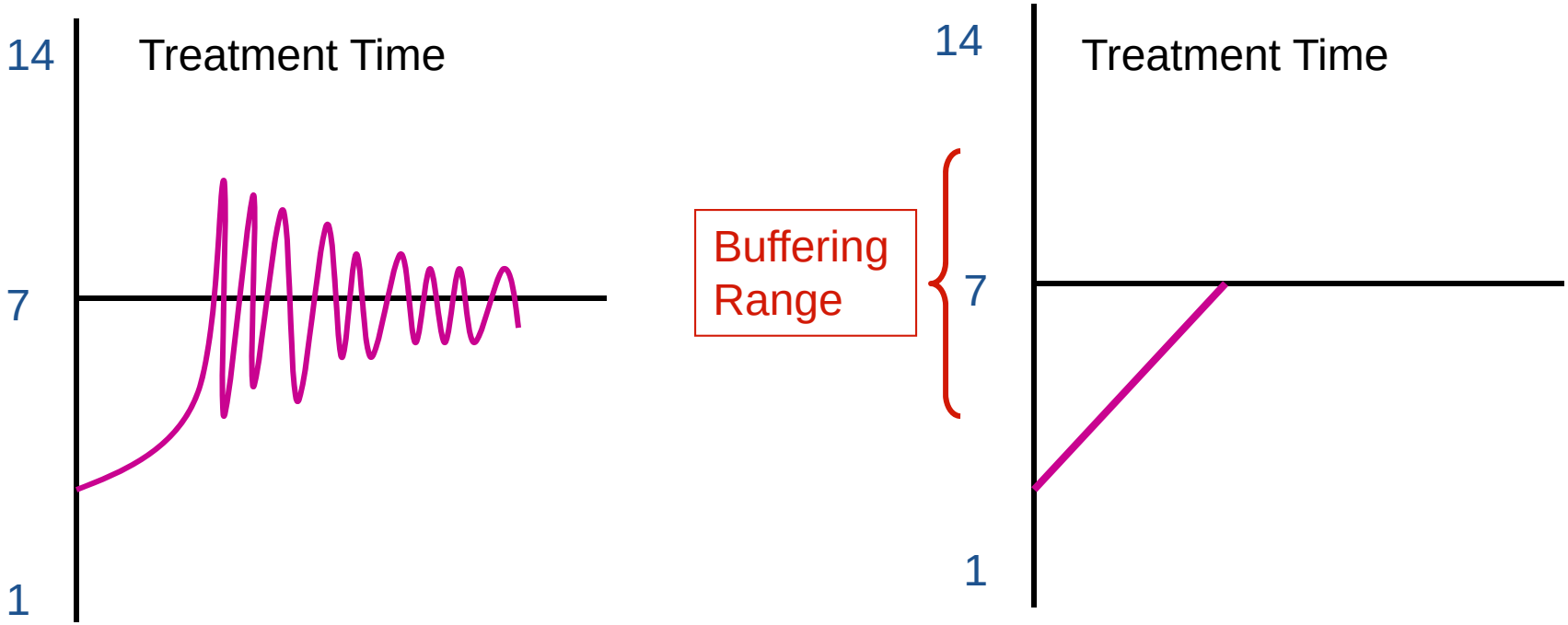
Standard Grade Waste

- Waste Stream 2-6 pH range
- Flow through, batch and hybrid systems applicable
- Residence time and number of stages based on flow rate and pH

pH Design Considerations Alkalinity

Alkalinity is a measure of buffering capability or the ability to neutralize acid and bases in a solution.

- Alkalinity is a major problem in high purity waste water (WFI, RODI etc.)
- Buffer injection will cut down on chemical use and treatment time

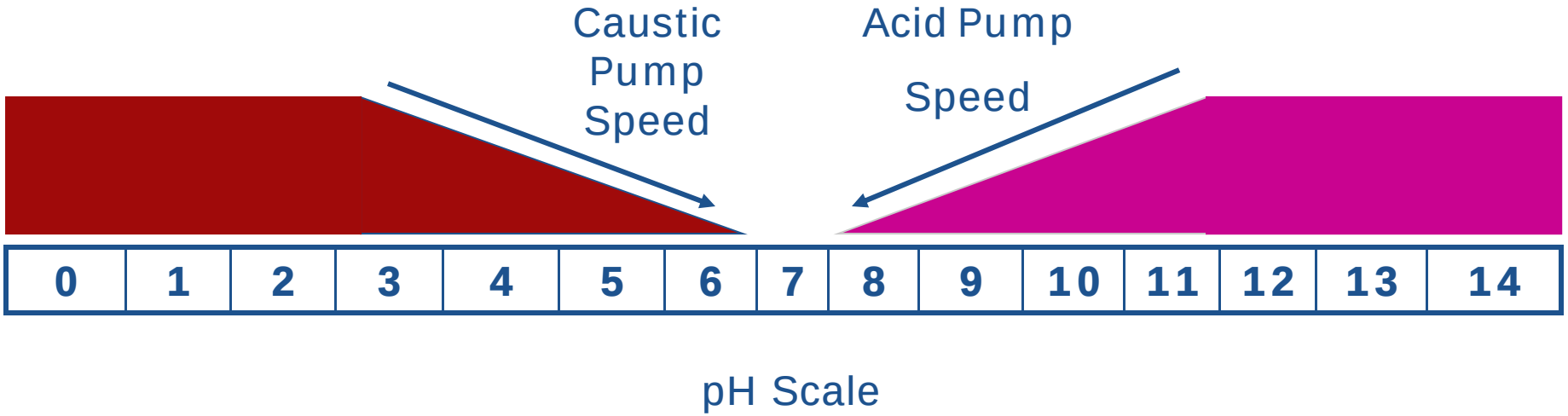


pH System Control Schemes

There are two types of control schemes used in pH systems:

- Proportional control
- Titration based control

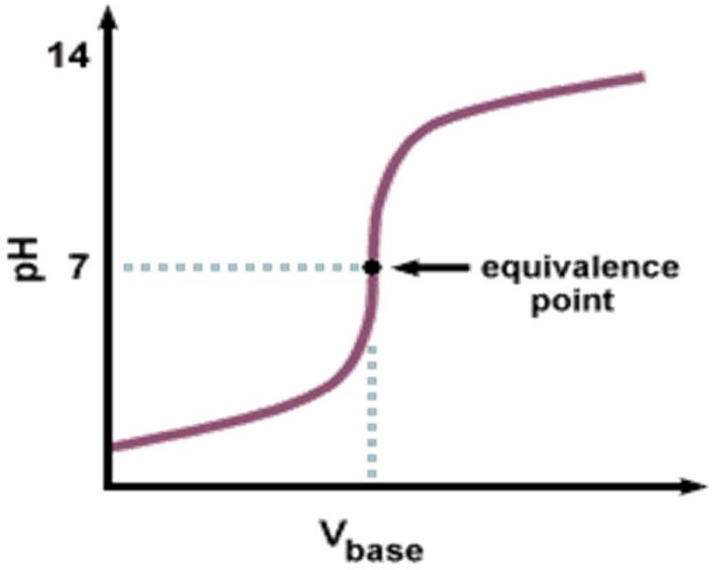
Proportional control is the more versatile of the control schemes. It is based on the logarithmic nature of pH and adjusts the chemical addition proportionally to the pH reading.



pH System Control Schemes Continued

Titration Curve Control involves injecting chemistry based on an experimentally determined neutralization curve for the specific waste entering the system.

- It is useful if the waste always has the same characteristics.
- It is NOT practical for most treatment applications as the waste characteristics are constantly fluctuating based on the process.



pH System Sizing Flow through Systems

Assumptions:

Lab Sink = 1 GPM

Cup Sink = 0.5 GPM

Fume Hood = 0.25 GPM

Actual Usage is 20% to 30% (Diversity)

Cage Washer, Autoclaves, and Dishwashers are assumed to operate at there maximum flow rates and are outside of normal diversity factors.

15 to 20 Minute Retention Time (in some cases more time is required).

pH System Sizing Flow through Systems Continued

Sample Calculation:

50 Lab Sinks X 1.0 GPM = 50 GPM

50 Cup Sinks X 0.5GPM = 25 GPM

20 Fume Hoods X 0.25 = 5 GPM

80 Total GPM X 25% Actual Usage = 20 GPM

2 Cage Washers at 10 GPM each. The diversity would assume only one is in operation at a time.

TOTAL System Flow: 30 GPM

30 GPM X 20 Minute Retention Time = 600 Treatment Tank ((2) 300 gal. Tanks) Required.

Case Study 1

Type: pH Adjustment System for College Biology Building.

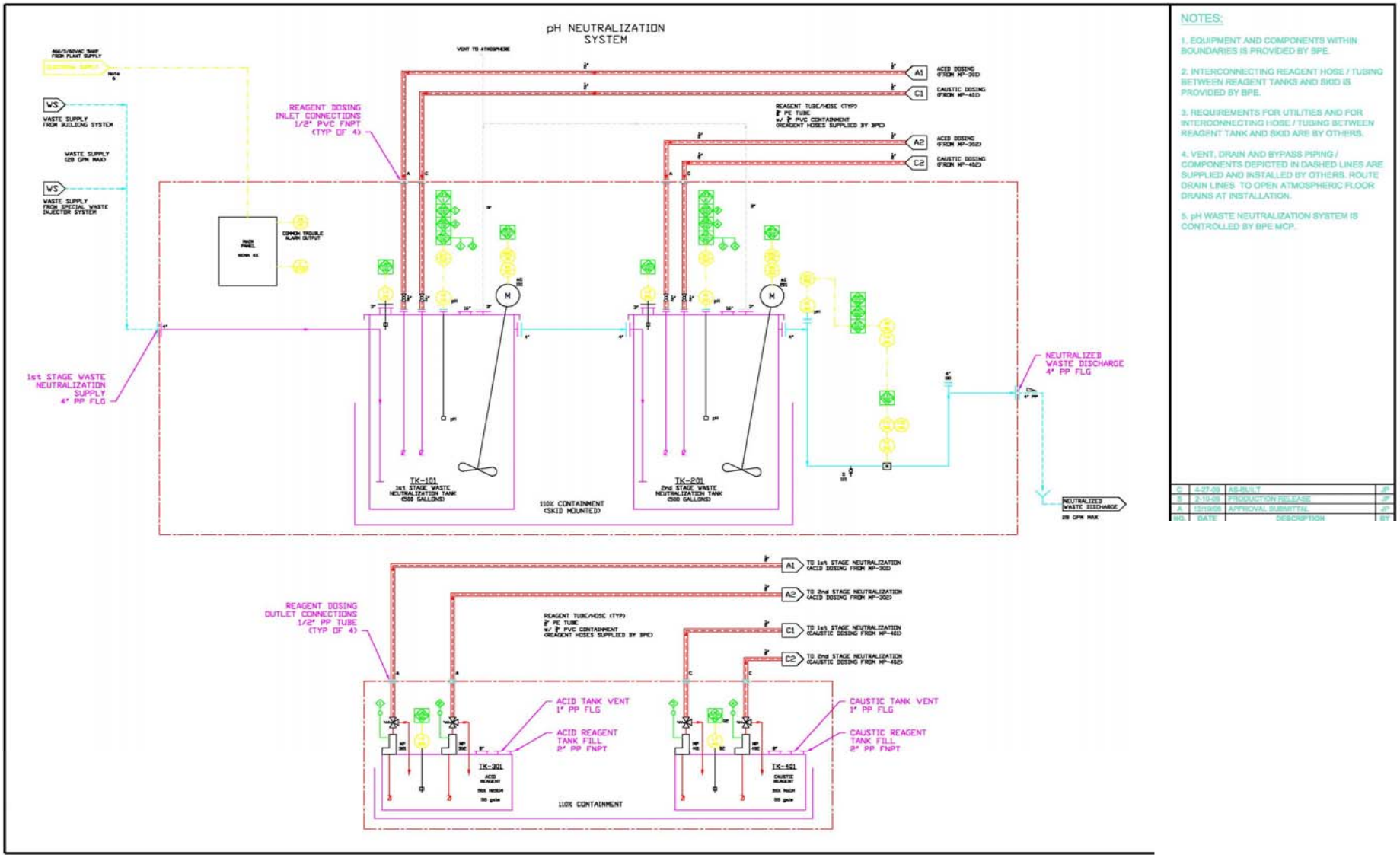
Details:

The system accepts waste from a 7 floor lab building. Total number of sinks and fume hoods are 105 and 20 respectively and (2) cage washers. The System is designed to treat 40gpm.

Unit Features:

1. Dual stage pH system to account for aggressive waste streams.
2. Two way pH control to treat both acid and alkaline waste.
3. Effluent flow and pH monitoring.

Case Study 1


pH NEUTRALIZATION SYSTEM
VENT TO ATMOSPHERE
WS
WASTE SUPPLY FROM BUILDING SYSTEM
WASTE SUPPLY (20 GPM MAX)
WS
WASTE SUPPLY FROM SPECIAL WASTE INJECTOR SYSTEM
REAGENT DOSING INLET CONNECTIONS 1/2" PVC FNPT (TYP OF 4)
A1
ACID DOSING (FROM MP-301)
C1
CAUSTIC DOSING (FROM MP-401)
REAGENT TUBE/HOSE (TYP) 3/8" PE TUBE w/ 1" PVC CONTAINMENT (REAGENT HOSES SUPPLIED BY BPE)
A2
ACID DOSING (FROM MP-302)
C2
CAUSTIC DOSING (FROM MP-402)
COMMON TROUBLE ALARM OUTPUT
1st STAGE WASTE NEUTRALIZATION SUPPLY 4" PP FLG
TK-101 1st STAGE WASTE NEUTRALIZATION TANK (500 GALLONS)
TK-201 2nd STAGE WASTE NEUTRALIZATION TANK (500 GALLONS)
110% CONTAINMENT (SKID MOUNTED)
NEUTRALIZED WASTE DISCHARGE 4" PP FLG
NEUTRALIZED WASTE DISCHARGE
(20 GPM MAX)
REAGENT DOSING OUTLET CONNECTIONS 1/2" PP TUBE (TYP OF 4)
A1
TO 1st STAGE NEUTRALIZATION (ACID DOSING FROM MP-301)
A2
TO 2nd STAGE NEUTRALIZATION (ACID DOSING FROM MP-302)
REAGENT TUBE/HOSE (TYP) 3/8" PE TUBE w/ 1" PVC CONTAINMENT (REAGENT HOSES SUPPLIED BY BPE)
C1
TO 1st STAGE NEUTRALIZATION (CAUSTIC DOSING FROM MP-401)
C2
TO 2nd STAGE NEUTRALIZATION (CAUSTIC DOSING FROM MP-402)
ACID TANK VENT 1" PP FLG
ACID REAGENT TANK FILL 2" PP FNPT
CAUSTIC TANK VENT 1" PP FLG
CAUSTIC REAGENT TANK FILL 2" PP FNPT
TK-301 ACID REAGENT
TK-401 CAUSTIC REAGENT
110% CONTAINMENT
NOTES:
1. EQUIPMENT AND COMPONENTS WITHIN BOUNDARIES IS PROVIDED BY BPE.
2. INTERCONNECTING REAGENT HOSE / TUBING BETWEEN REAGENT TANKS AND SKID IS PROVIDED BY BPE.
3. REQUIREMENTS FOR UTILITIES AND FOR INTERCONNECTING HOSE / TUBING BETWEEN REAGENT TANK AND SKID ARE BY OTHERS.
4. VENT, DRAIN AND BYPASS PIPING / COMPONENTS DEPICTED IN DASHED LINES ARE SUPPLIED AND INSTALLED BY OTHERS. ROUTE DRAIN LINES TO OPEN ATMOSPHERIC FLOOR DRAINS AT INSTALLATION.
5. pH WASTE NEUTRALIZATION SYSTEM IS CONTROLLED BY BPE MCP.
NO. | DATE | DESCRIPTION | BY
C | 4-27-09 | AS-BUILT | JP
B | 2-10-09 | PRODUCTION RELEASE | JP
A | 12/19/08 | APPROVAL SUBMITTAL | JP

Case Study 2

Type: pH Adjustment System for Criminology Lab.

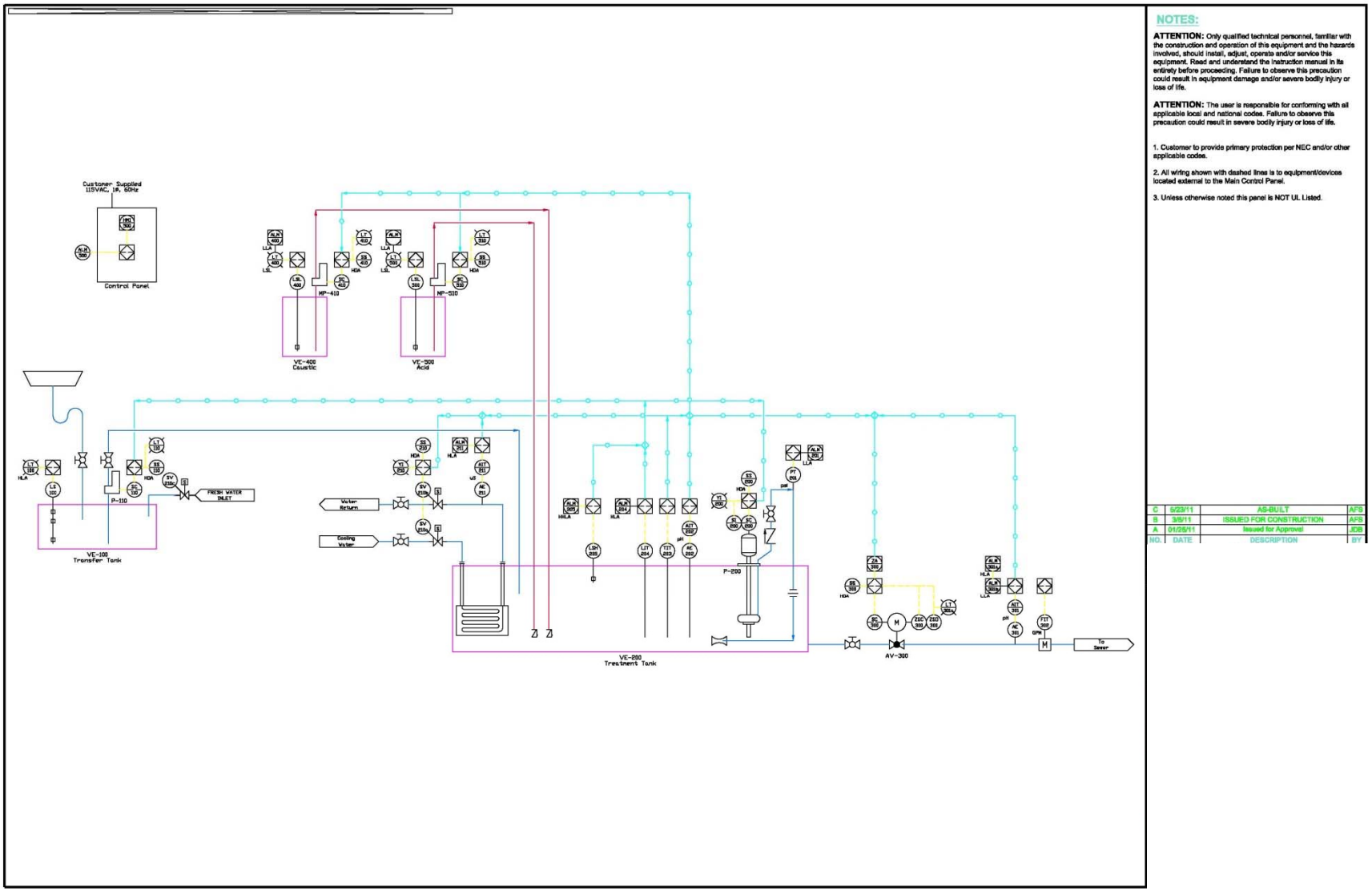
Details:

The system accepts waste directly from the lab processes. Waste constituents include 30% nitric acid, 10% hydrochloric acid, and 10% hydrofluoric acid. The system is designed for safe treatment of these chemistries using caustic reagent control and temperature control with safety interlocks. The system is completely automated and user adjustable.

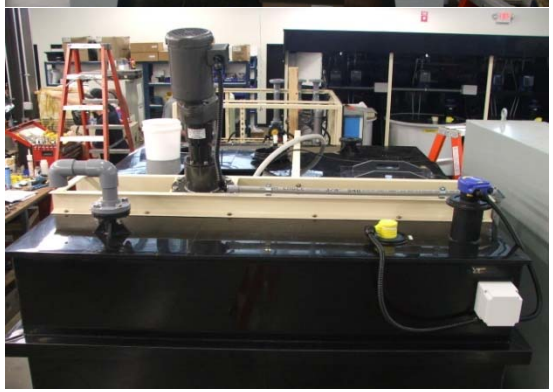
The unit features:

1. All PVDF and PTFE wetted materials including adjustment tank and mixer coating
2. Memory programmed pH holders that store calibration data between probe replacements
3. Temperature safety interlocks
4. Full PLC control with owner remote access and monitoring

Case Study 2


NOTES:
ATTENTION: Only qualified technical personnel, familiar with the construction and operation of this equipment and the hazards involved, should install, adjust, operate and/or service this equipment. Read and understand the instruction manual in its entirety before proceeding. Failure to observe this precaution could result in equipment damage and/or severe bodily injury or loss of life.
ATTENTION: The user is responsible for conforming with all applicable local and national codes. Failure to observe this precaution could result in severe bodily injury or loss of life.
1. Customer to provide primary protection per NEC and/or other applicable codes.
2. All wiring shown with dashed lines is to equipment/devices located external to the Main Control Panel.
3. Unless otherwise noted this panel is NOT UL Listed.
C 5/23/11 AS-BUILT AFS
B 3/9/11 ISSUED FOR CONSTRUCTION AFS
A 01/25/11 Issued for Approval JDB
NO. DATE DESCRIPTION BY
Customer Supplied 115VAC, 1Ø, 60Hz
Control Panel
MP-410
MP-510
VE-400 Caustic
VE-300 Acid
FRESH WATER INLET
P-110
VE-100 Transfer Tank
Water Return
Cooling Water
P-200
VE-200 Treatment Tank
AV-300
To Sewer

Case Study 3



Type: pH Adjustment System for Chemical Manufacturer

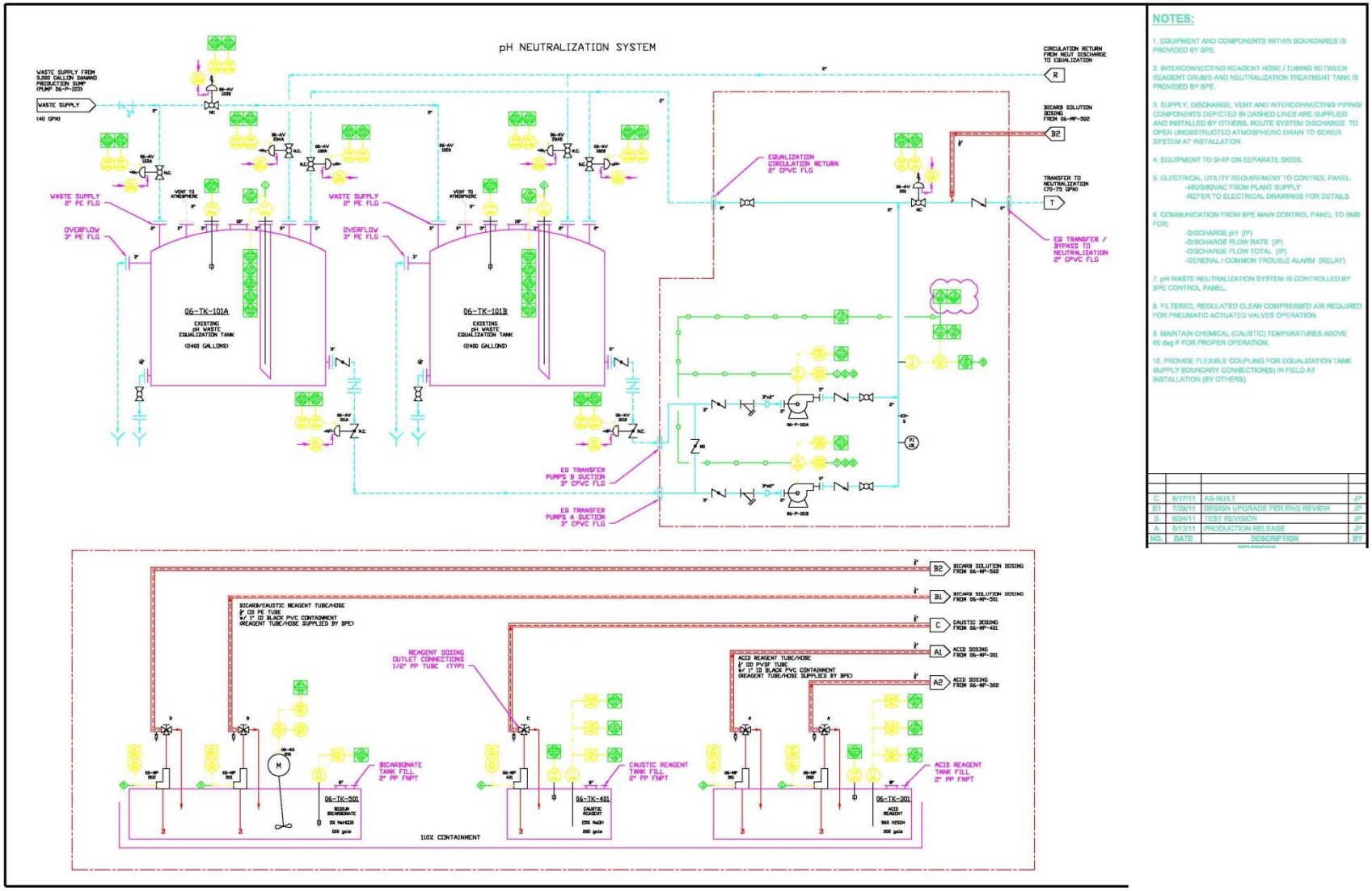
Details:

The system accepts waste byproduct from the chemical production of semiconductor chemistries. Waste includes low alkaline water and reagent grade pH water (greater than 13 pH).

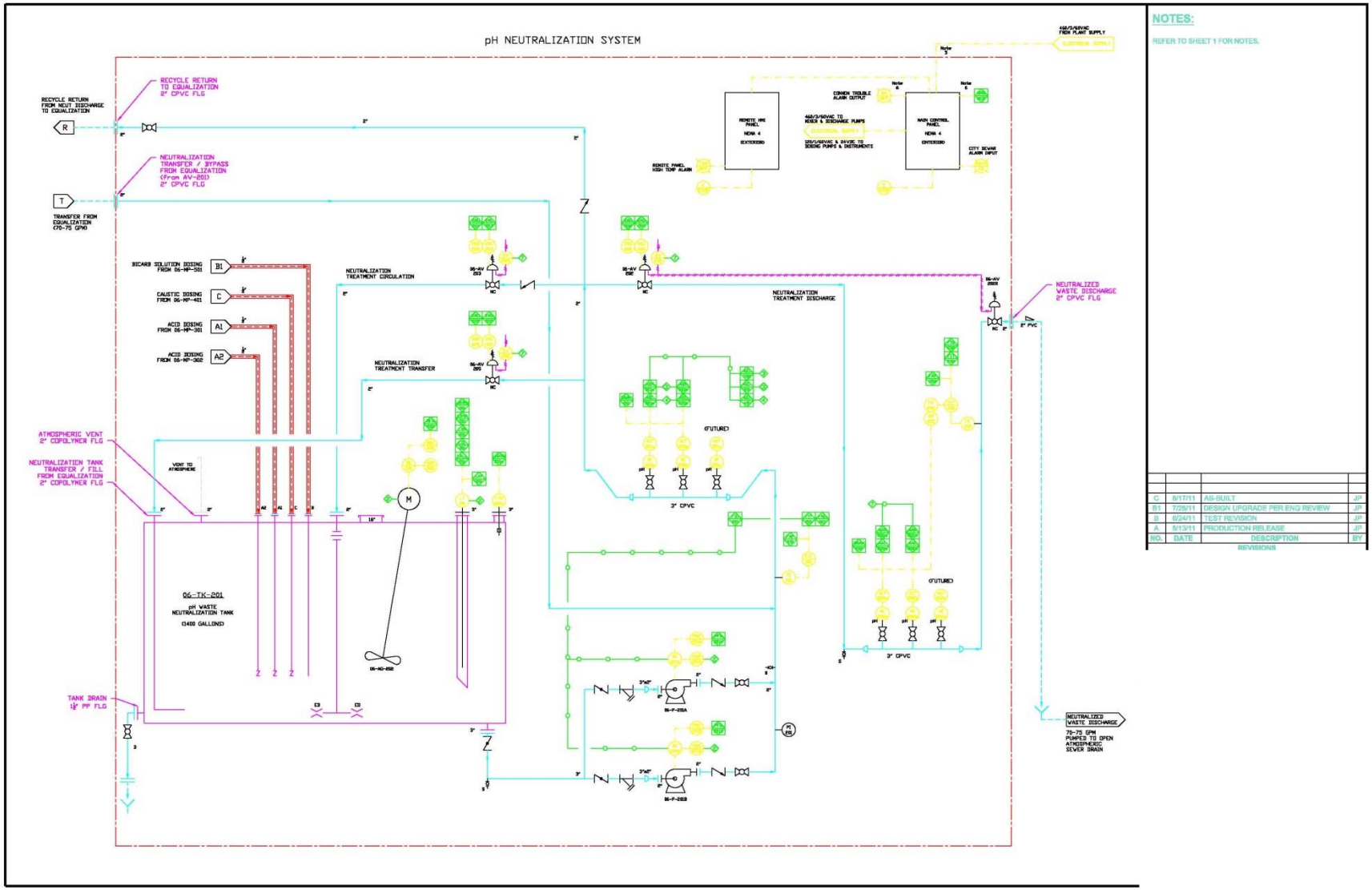
Unit Features:

1. Equalization storage with control for the transfer of concentrated chemistry (greater than pH 13) for segregated treatment.
2. High flow/low flow metering pumps for more accurate control
3. Memory programmed pH probes
4. Buffer injection to compensate for low alkaline water
5. Designed for outdoor installation

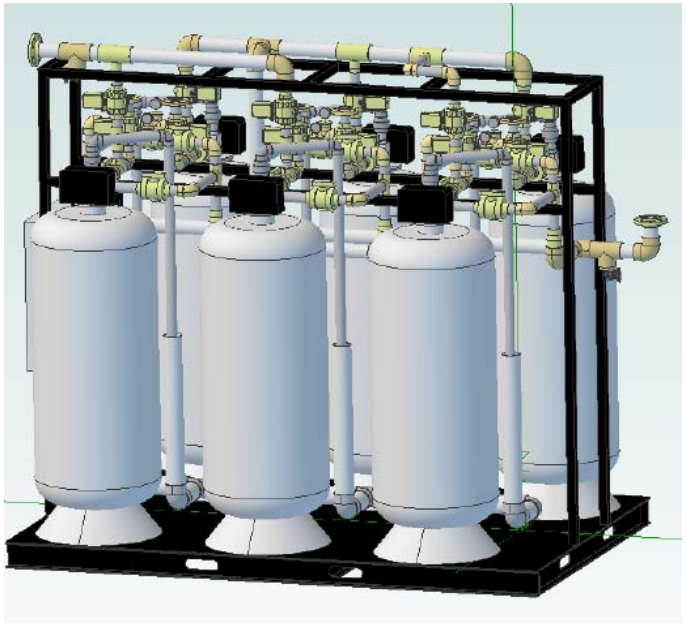
Case Study 3


pH NEUTRALIZATION SYSTEM
WASTE SUPPLY FROM 9,000 GALLON DANNARD PRODUCTION SUMP (PUMP 06-P-103)
WASTE SUPPLY
(40 GPM)
WASTE SUPPLY 2" PE FLG
OVERFLOW 3" PE FLG
VENT TO ATMOSPHERE
06-TK-101A
EXISTING pH WASTE EQUALIZATION TANK
(2400 GALLONS)
06-TK-101B
EXISTING pH WASTE EQUALIZATION TANK
(2400 GALLONS)
EQUALIZATION CIRCULATION RETURN 2" CPVC FLG
CIRCULATION RETURN FROM NEUT DISCHARGE TO EQUALIZATION
R
BICARB SOLUTION DOSING FROM 06-MP-502
B2
TRANSFER TO NEUTRALIZATION (70-75 GPM)
T
EQ TRANSFER / BYPASS TO NEUTRALIZATION 2" CPVC FLG
EQ TRANSFER PUMPS B SUCTION 3" CPVC FLG
EQ TRANSFER PUMPS A SUCTION 3" CPVC FLG
06-P-101A
06-P-101B
B2 BICARB SOLUTION DOSING FROM 06-MP-502
B1 BICARB SOLUTION DOSING FROM 06-MP-501
C CAUSTIC DOSING FROM 06-MP-401
A1 ACID DOSING FROM 06-MP-301
A2 ACID DOSING FROM 06-MP-302
BICARB/CAUSTIC REAGENT TUBE/HOSE
1/2" OD PE TUBE
w/ 1" ID BLACK PVC CONTAINMENT
(REAGENT TUBE/HOSE SUPPLIED BY BPE)
ACID REAGENT TUBE/HOSE
1/2" OD PVDF TUBE
w/ 1" ID BLACK PVC CONTAINMENT
(REAGENT TUBE/HOSE SUPPLIED BY BPE)
REAGENT DOSING OUTLET CONNECTIONS 1/2" PP TUBE (TYP)
BICARBONATE TANK FILL 2" PP FNPT
CAUSTIC REAGENT TANK FILL 2" PP FNPT
ACID REAGENT TANK FILL 2" PP FNPT
06-TK-501
06-TK-401
06-TK-301
110% CONTAINMENT
NOTES:
1. EQUIPMENT AND COMPONENTS WITHIN BOUNDARIES IS PROVIDED BY BPE.
2. INTERCONNECTING REAGENT HOSE / TUBING BETWEEN REAGENT DRUMS AND NEUTRALIZATION TREATMENT TANK IS PROVIDED BY BPE.
3. SUPPLY, DISCHARGE, VENT AND INTERCONNECTING PIPING/ COMPONENTS DEPICTED IN DASHED LINES ARE SUPPLIED AND INSTALLED BY OTHERS. ROUTE SYSTEM DISCHARGE TO OPEN UNOBSTRUCTED ATMOSPHERIC DRAIN TO SEWER SYSTEM AT INSTALLATION.
4. EQUIPMENT TO SHIP ON SEPARATE SKIDS.
5. ELECTRICAL UTILITY REQUIREMENT TO CONTROL PANEL:
-460/3/60VAC FROM PLANT SUPPLY
-REFER TO ELECTRICAL DRAWINGS FOR DETAILS
6. COMMUNICATION FROM BPE MAIN CONTROL PANEL TO BMS FOR:
-DISCHARGE pH (IP)
-DISCHARGE FLOW RATE (IP)
-DISCHARGE FLOW TOTAL (IP)
-GENERAL / COMMON TROUBLE ALARM (RELAY)
7. pH WASTE NEUTRALIZATION SYSTEM IS CONTROLLED BY BPE CONTROL PANEL.
8. FILTERED, REGULATED CLEAN COMPRESSED AIR REQUIRED FOR PNEUMATIC ACTUATED VALVES OPERATION.
9. MAINTAIN CHEMICAL (CAUSTIC) TEMPERATURES ABOVE 60 deg F FOR PROPER OPERATION.
10. PROVIDE FLEXIBLE COUPLING FOR EQUALIZATION TANK SUPPLY BOUNDARY CONNECTION(S) IN FIELD AT INSTALLATION (BY OTHERS).
NO. DATE DESCRIPTION BY
C 8/17/11 AS-BUILT JP
B1 7/26/11 DESIGN UPGRADE PER ENG REVIEW JP
B 6/24/11 TEST REVISION JP
A 5/13/11 PRODUCTION RELEASE JP

Case Study 3


pH NEUTRALIZATION SYSTEM
RECYCLE RETURN TO EQUALIZATION 2" CPVC FLG
NEUTRALIZATION TRANSFER / BYPASS FROM EQUALIZATION (From AV-203) 2" CPVC FLG
TRANSFER FROM EQUALIZATION (70-75 GPM)
NEUTRALIZATION TREATMENT CIRCULATION
NEUTRALIZATION TREATMENT TRANSFER
NEUTRALIZATION TREATMENT DISCHARGE
NEUTRALIZED WASTE DISCHARGE 2" CPVC FLG
ATMOSPHERIC VENT 2" COPOLYMER FLG
NEUTRALIZATION TANK TRANSFER / FILL FROM EQUALIZATION 2" COPOLYMER FLG
TANK DRAIN 1" PP FLG
06-TK-201
pH WASTE NEUTRALIZATION TANK
(1400 GALLONS)
(FUTURE)
3" CPVC
NEUTRALIZED WASTE DISCHARGE
70-75 GPM PUMPED TO OPEN ATMOSPHERIC SEWER DRAIN
NOTES:
REFER TO SHEET 1 FOR NOTES.
C 8/17/11 AS-BUILT JP
B1 7/28/11 DESIGN UPGRADE PER ENG REVIEW JP
B 6/24/11 TEST REVISION JP
A 5/13/11 PRODUCTION RELEASE JP
NO. DATE DESCRIPTION BY
REVISIONS

Case Study 4



Type: Waste Treatment System for semi-conductor lab.

Details:

The system treats semiconductor lab waste. The waste water is initially treated for particulate matter, organics, and then metals removal utilizing resin prior to pH adjustment.

Unit Features:

1. Particulate filtration and organics removal
2. Metals removal utilizing resin
3. Buffer injection for low alkaline water
4. Hybrid batch technology pH adjustment system

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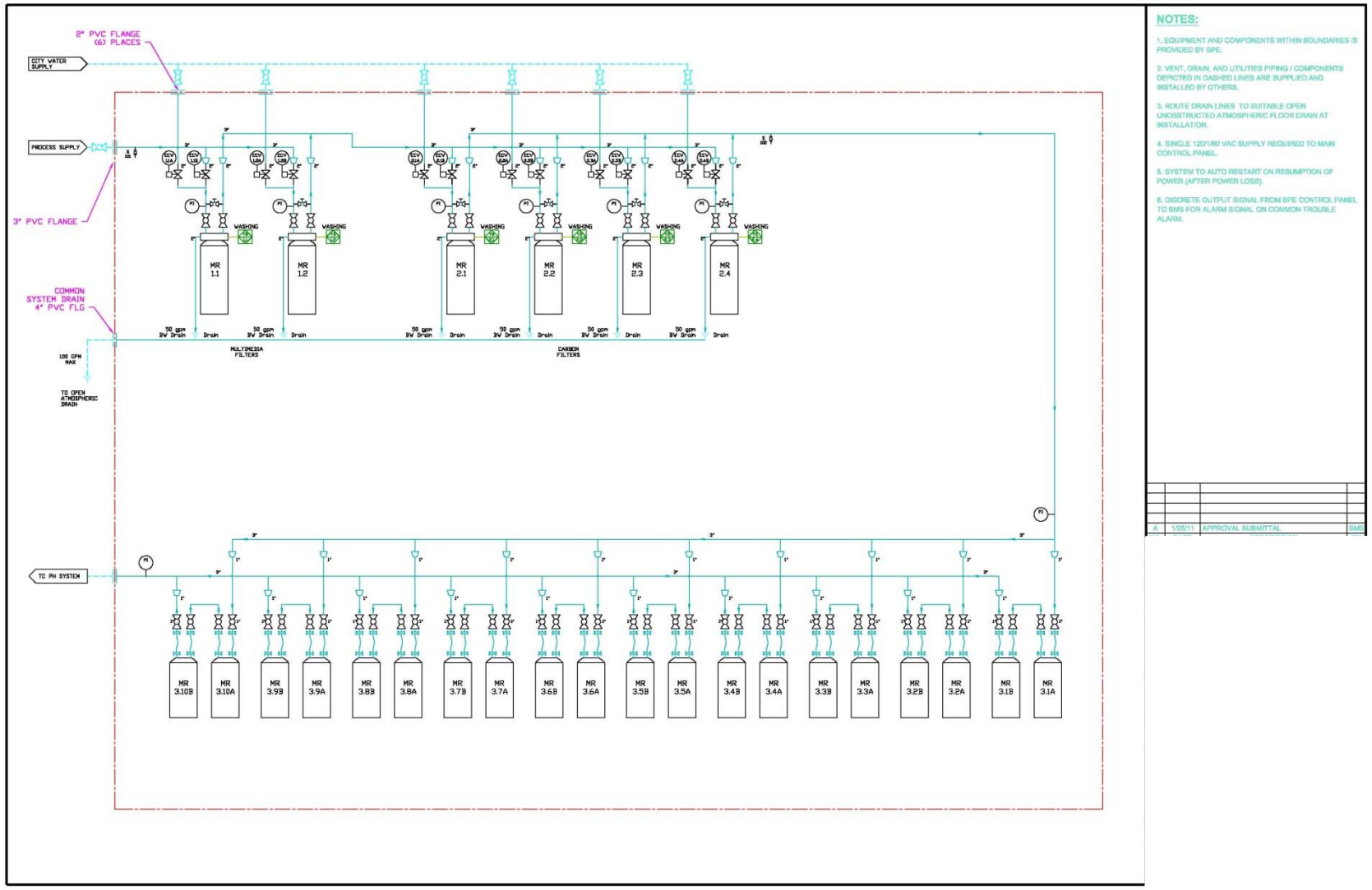
2" PVC FLANGE (60 PLACES)
CITY WATER SUPPLY
PROCESS SUPPLY
3" PVC FLANGE
COMMON SYSTEM DRAIN 4" PVC FLG
100 GPM MAX
TO OPEN ATMOSPHERIC DRAIN
TO PH SYSTEM
WASHING
MR 1.1
MR 1.2
MR 2.1
MR 2.2
MR 2.3
MR 2.4
50 gpm BW Drain
Drain
MULTIMEDIA FILTERS
CARBON FILTERS
MR 3.10B
MR 3.10A
MR 3.9B
MR 3.9A
MR 3.8B
MR 3.8A
MR 3.7B
MR 3.7A
MR 3.6B
MR 3.6A
MR 3.5B
MR 3.5A
MR 3.4B
MR 3.4A
MR 3.3B
MR 3.3A
MR 3.2B
MR 3.2A
MR 3.1B
MR 3.1A
NOTES:
1. EQUIPMENT AND COMPONENTS WITHIN BOUNDARIES IS PROVIDED BY BPE.
2. VENT, DRAIN, AND UTILITIES PIPING / COMPONENTS DEPICTED IN DASHED LINES ARE SUPPLIED AND INSTALLED BY OTHERS.
3. ROUTE DRAIN LINES TO SUITABLE OPEN UNOBSTRUCTED ATMOSPHERIC FLOOR DRAIN AT INSTALLATION.
4. SINGLE 120/1/60 VAC SUPPLY REQUIRED TO MAIN CONTROL PANEL.
5. SYSTEM TO AUTO RESTART ON RESUMPTION OF POWER (AFTER POWER LOSS).
6. DISCRETE OUTPUT SIGNAL FROM BPE CONTROL PANEL TO BMS FOR ALARM SIGNAL ON COMMON TROUBLE ALARM.
A 1/25/11 APPROVAL SUBMITTAL

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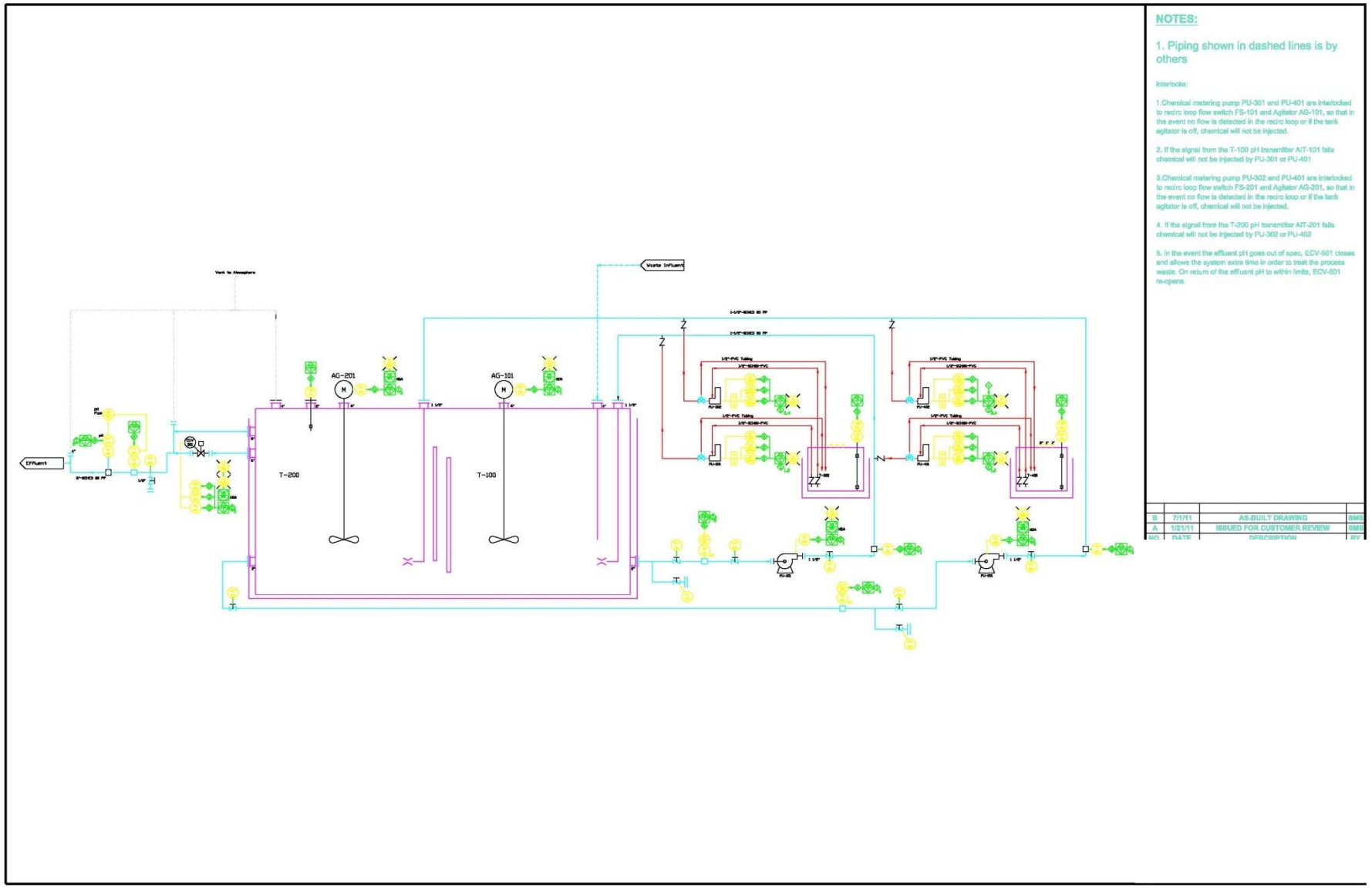
NOTES:
1. Piping shown in dashed lines is by others
Interlocks:
1.Chemical metering pump PU-301 and PU-401 are interlocked to recirc loop flow switch FS-101 and Agitator AG-101, so that in the event no flow is detected in the recirc loop or if the tank agitator is off, chemical will not be injected.
2. If the signal from the T-100 pH transmitter AIT-101 fails chemical will not be injected by PU-301 or PU-401
3.Chemical metering pump PU-302 and PU-401 are interlocked to recirc loop flow switch FS-201 and Agitator AG-201, so that in the event no flow is detected in the recirc loop or if the tank agitator is off, chemical will not be injected.
4. If the signal from the T-200 pH transmitter AIT-201 fails chemical will not be injected by PU-302 or PU-402
5. In the event the effluent pH goes out of spec, ECV-501 closes and allows the system extra time in order to treat the process waste. On return of the effluent pH to within limits, ECV-501 re-opens.
B 7/1/11 AS-BUILT DRAWING SMD
A 1/21/11 ISSUED FOR CUSTOMER REVIEW SMD
NO. DATE DESCRIPTION BY
Vent to Atmosphere
Waste Influent
Effluent
AG-201
AG-101
T-200
T-100

pH Adjustment System Questionnaire **Burt**

Process Equipment

Date	
Company Name	
Contact Name	
Phone	
Fax	
Address	
Additional Contact Info.	
Solution Information	
Chemical Composition	
Temperature Range (°F)	
Solids in Suspension (PPM)?	
Specific Gravity	
Oil and Grease Present (PPM)?	
Available Utilities	
Electrical (Voltage, Frequency, phase)	
Compressed air (psig, SCFM)	
Service Conditions (Batch Treatment Only)	
Total Accumulated Flow/batch (gallons)	
Batch Frequency (# batches/day or week)	
Service Conditions (Continuous Treatment Only)	
Average Flowrate (gpm)	
Maximum Flowrate (gpm)	
pH Range of Influent (min-max)	
Desired Effluent pH Range (min-max)	
Service Conditions (Batch Treatment Only)-continued	
List Any Concentrated Dumps to the System	
Chemical Composition	
Concentration (%)	
Volume (gallons)	
Frequency of dumps (dumps/day, week, month)	

pH System Selection Criteria

- Determine water ***waste characteristics***
- Determine ***waste volume***
- Select type of system based on quantity and waste characteristics of water to be treated

Thank you

Questions?