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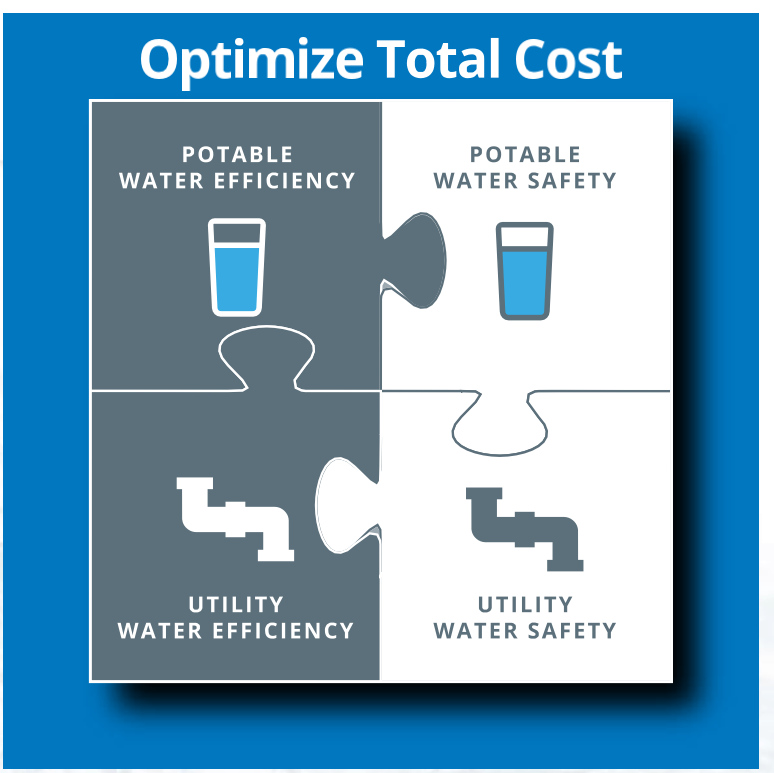
Independent Water Management

University of Pittsburgh
Water Management Program

12 October 2022



Water Management Program (WMP) Documentation

Organization: University of Pittsburgh

WMP Name: University of Pittsburgh

Enclosed please see the Water Management Program Documentation developed through collaboration with Phigenics

Table of Contents:

Water Management Program (WMP) Documentation	Description
Executive Summary	Outlines program goals
Water Management Team (WMT)	Members of the cross-functional site WMT responsible for developing, implementing, and maintaining the WMP
Water Use Description	Written description of water processing at the facility, functioning as a supplemental document to the Process Flow Diagram
Process Flow Diagram (PFD)	A step-by-step drawing of the building water system that includes the location of all water processing steps that are part of the building water system
System Analysis	Includes the systematic evaluation of potentially hazardous conditions associated with each processing step for the purpose of identifying control locations
Program Controls Summary	Outlines specific control measures and activities implemented for an operational WMP
Validation Criteria	Outlines strategy for confirming the effectiveness of an operational WMP
Risk Characterization Matrix*	Includes a matrix that characterizes the clinical and environmental risk in locations determined by the team to help facilitate sample plan decisions
Validation Response Guide	Outlines the plan for responding to validation results that fall outside of the criteria designated in the “Validation Criteria” document
Verification and Validation Schedule	Outlines timeline and frequencies for activities required to operationalize the WMP

*Healthcare only

Executive Summary

Organization: University of Pittsburgh

WMP Name: University of Pittsburgh Document last updated 09/15/2022

The University of Pittsburgh is implementing a Water Management Program (WMP) aligned with ANSI/ASHRAE Standard 188 (revised publication August 2021) Legionellosis: Risk Management for Building Water Systems, and the CDC Toolkit (January 2021): Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings. The scope of the WMP focuses on safety of potable and utility water systems on the Pittsburgh campus.

The purpose of the Water Management Program (WMP) is to assess and control hazards within campus water systems in three broad risk categories: physical (scalding), chemical (lead, copper, disinfection byproducts, etc.), and microbial risks (*Legionella*, *etc.*). Implementation of the Water Management Program improves water safety, increases operational efficiency, and provides ANSI/ASHRAE Standard 188 documentation for all water systems. It is also a goal of the WMP to consider utility and efficiency opportunities that can be assessed from a high-level review (without test collection or time-intensive studies).

The University of Pittsburgh has established a Water Management Team (WMT) that makes decisions regarding the water systems and the WMP. The WMT will evaluate the controls necessary to minimize identified hazards or risk to students, staff, and visitors; and will define the validation measures that ensure the program is functioning to control those hazards.

The following documents will be maintained as defined in ANSI/ASHRAE Standard 188:

- Process Flow Diagram & Water Use Description
- System Analysis Summary (Functional Risk Assessment)
- Program Controls Summary
- Validation Criteria
- Validation and Verification Schedule

To characterize risk, the WMT took into consideration the predominant population in a building and how that population interacts with water. The population on campus is comprised of students, staff, and visitors. The campus population is considered to be generally healthy (as opposed to the population of a healthcare facility). Most students are younger and generally have fewer health problems than older staff. However, the WMT is very aware that there are many individuals with underlying health conditions in all three groups that may make them more susceptible to microbial, chemical, and scalding hazards.

To achieve efficiency, the WMT must focus resources where they are most needed, therefore the WMT categorized buildings by water use and relative risk. Higher Risk buildings are those where the combination of population and exposure was higher relative to other buildings on campus. Lower Risk buildings are those where the combination of population and exposure was less relative to other buildings on campus. It must be understood that Higher Risk does not equate to high risk nor does Lower Risk equate to low or no risk. Higher and Lower are meant to describe the relative risk between various buildings on campus.

The type of water use and assigned higher/lower risk characterization is as follows:

Higher Risk Building Types

- Academic/Administration Buildings with Showers
- Academic/Lab Buildings with Supplemental Disinfection
- Athletic Buildings
- Residence Hall/Housing
- Residence Hall with Supplemental Disinfection
- Residence Hall with Supplemental Disinfection & Food Service

Lower Risk Building Types

- Academic/Administration Buildings
- Academic Buildings with Lab
- Life Sciences Lab Buildings
- Other (*e.g.*, Sports Dome, Garages)

A detailed list of buildings in each category is included in the WMP. The WMT recommends monitoring and validating (testing) Higher Risk buildings on a regular basis. Lower Risk buildings will not be monitored or validated on a regular basis. The details are contained in the WMP. Individual building categorization and other aspects of the WMP will be modified over time as additional data is collected and analyzed.

The University of Pittsburgh WMT goal is to operate, validate and verify the safety of campus water systems in alignment with current standards,

guidance, regulations, and best practices at an optimal cost.

Water Management Team

Organization: University of Pittsburgh

WMP Name: University of Pittsburgh

Document last updated 09/19/2022

Name	Title	Functional Area	Team Role	Member Type	Email Address
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Working Document
Version Date: August 2021
WMT Review Date: July 2021

University of Pittsburgh Potable and Non-Potable Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
***Potable and Non-potable water is defined according to ASHRAE**

The purpose of this Process Flow Diagram is to present a visual depiction of the variety of water systems present at the University of Pittsburgh. These are not plumbing diagrams of specific buildings, but instead show the typical water processing steps present in a given building type. All potable and non-potable processing steps considered as part of the water management program are listed below. The processing step codes and Key entries apply to all of the following diagrams. A new list of processing steps for the utility system is stored on that diagram directly (reference the last page of the packet).

Processing Steps

1. Receiving
A – Municipal Supply
D.1 - RO/DI in Campus Labs
D.2 - RO in Animal Facilities
F - Laboratory/High Purity Water
G - Dental Water

2. Supplemental Disinfection
B.1 - Hot Water Injection [Copper/Silver]
B.2 - Hot Water Injection [Monochloramine]
C - Decorative Water Feature
D - Pool
E - Jetted Tubs

3. Conditioning
A – Softening
B – Filtration [Ice Machines]
C – Filtration [Point of Use]

4. Heating
A – Hot Water [115-125°F]
B – Higher Temp (Kitchen) Hot Water

5. Storage
A - Hot Water

6. Distribution (Potable)
A – Cold Water
B – Cold Water [Ice Machines]
C – Hot Water
D - Higher Temp (Kitchen) Hot Water

7. Distribution (Non-Potable)
A – Fire Suppression
B – Irrigation
C – Decorative Water Feature
D – Pool
E – Jetted Tub

8. Waste

Key

Fixtures:
AC = Autoclaves
AF = Automatic Faucets
BS = Bedpan Sprayer
BWF = Bottled Water Filler
DF = Drinking Fountain
DS = Drink Station
ES = Emergency Shower
EVS = EVS Closet
EW = Eye Wash
FSE = Food Service Equipment
H = Humidifier
HB = Hose Bibb
IM = Ice Machine
JT = Jetted Tub
L = Laundry
MA = Misters/ Atomizers
OS = Other Specialty
S = Sink (Manual)
SA = Sink with Aerator
SE = Sterile Equipment
SF = Sink with Faucet Flow Restrictor
SH = Shower
SHH = Shower with Hose
SL = Sink with Laminar Flow
T = Toilet/ Urinal
TU = Tubs
WHA = Water Hammer Arrestor

CL = Control Location

Equipment

= Thermostatic Mixing Valve

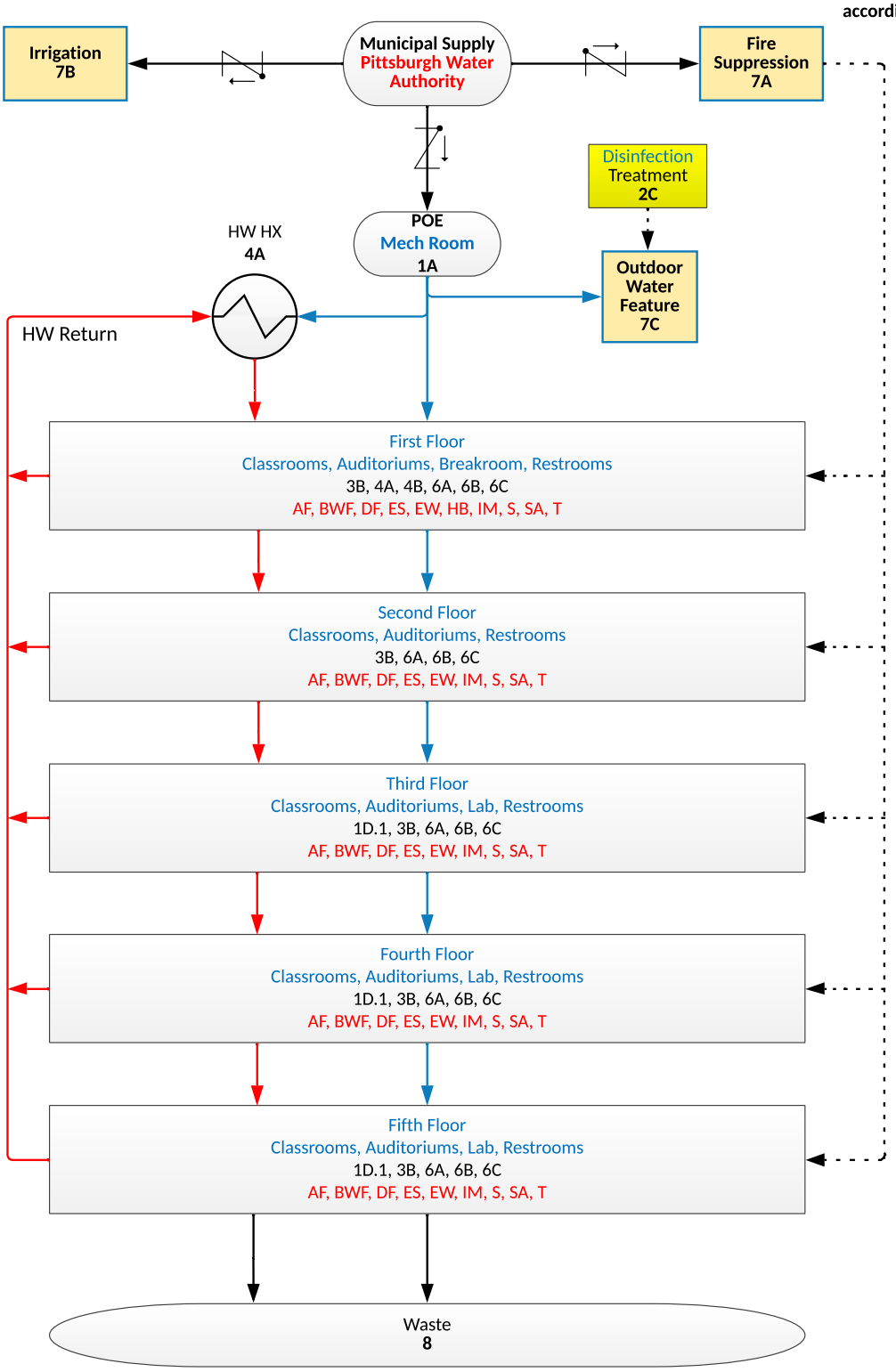
= RPZ Backflow Preventer

= Potable HW Heat Exchanger

University of Pittsburgh
Potable and Non-Potable
Water Process Flow Diagram
(This does not depict a plumbing riser diagram)
***Potable and Non-potable water is defined**
according to ASHRAE

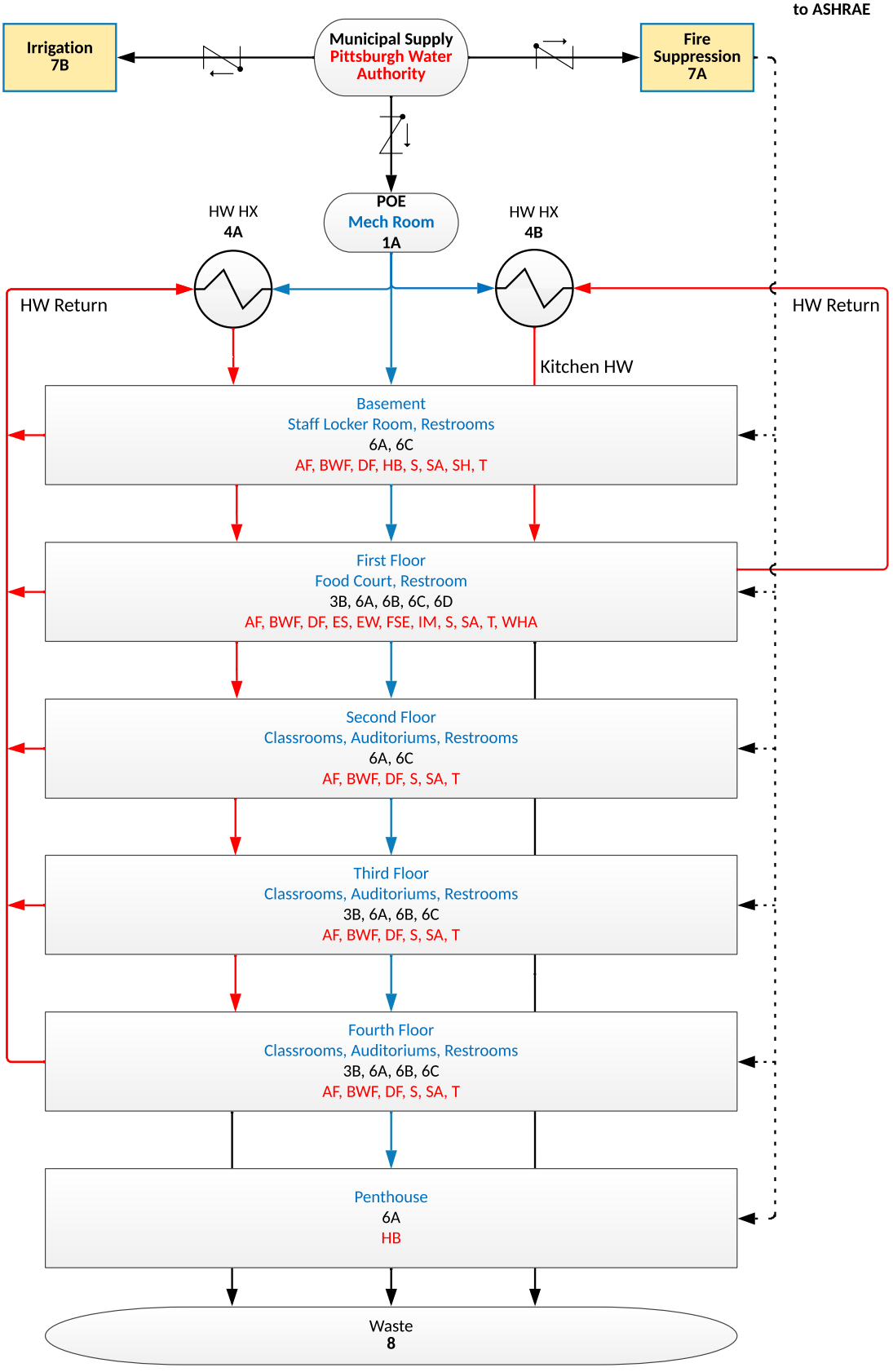
University of Pittsburgh
Academic/Administration Buildings
Potable and Non-Potable Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



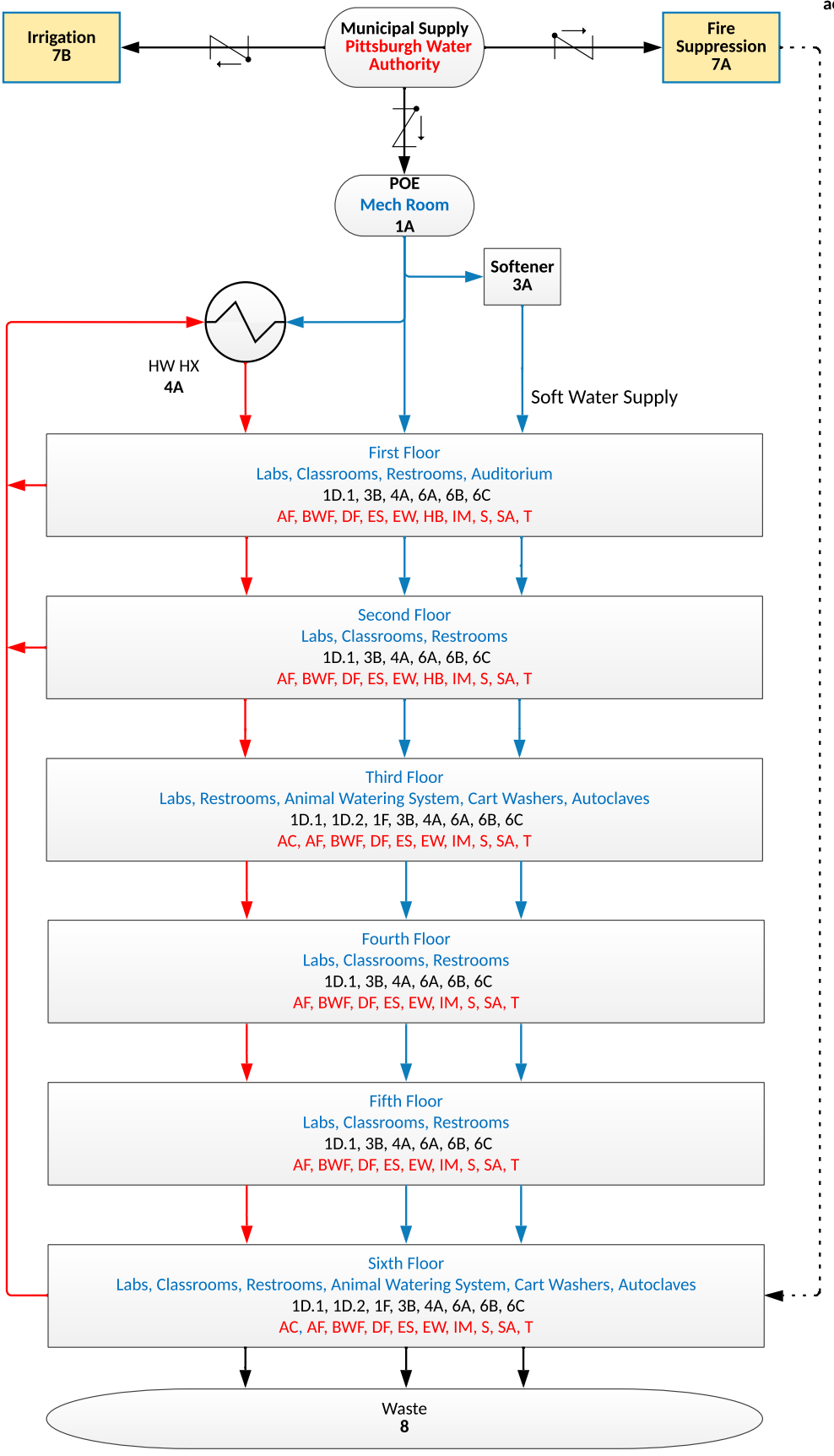
University of Pittsburgh
Academic/Administration
Buildings with Commuter Showers
Potable and Non-Potable
Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



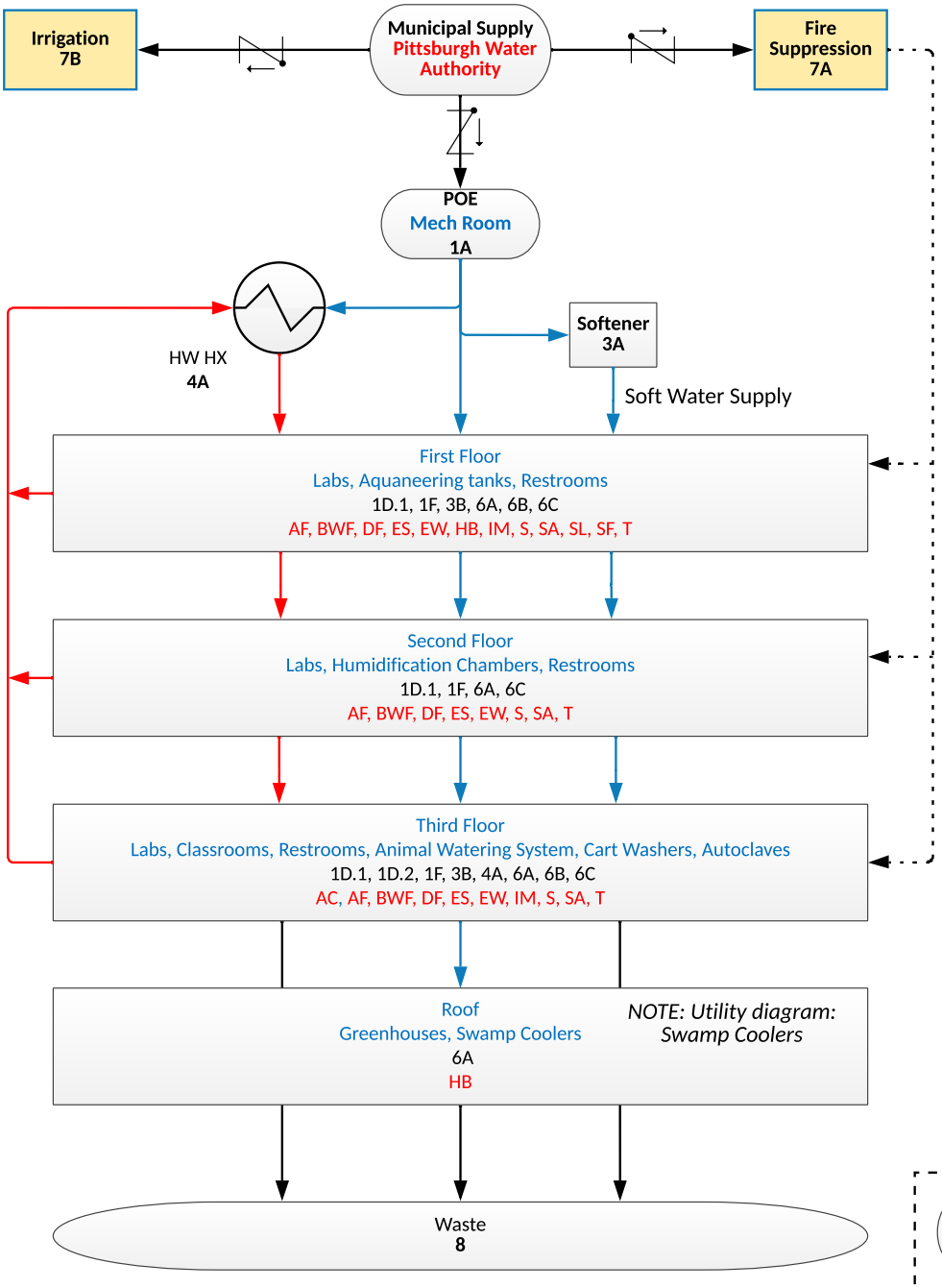
University of Pittsburgh
Academic Buildings with Lab
Potable and Non-Potable Water Process Flow Diagram

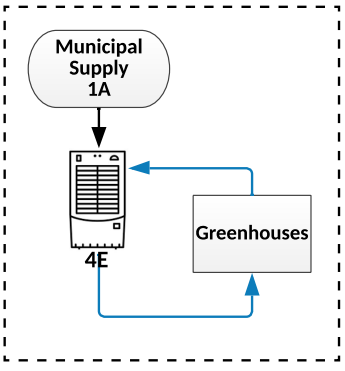
(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



University of Pittsburgh
Life Sciences Lab Buildings
Potable and Non-Potable Water Process Flow Diagram

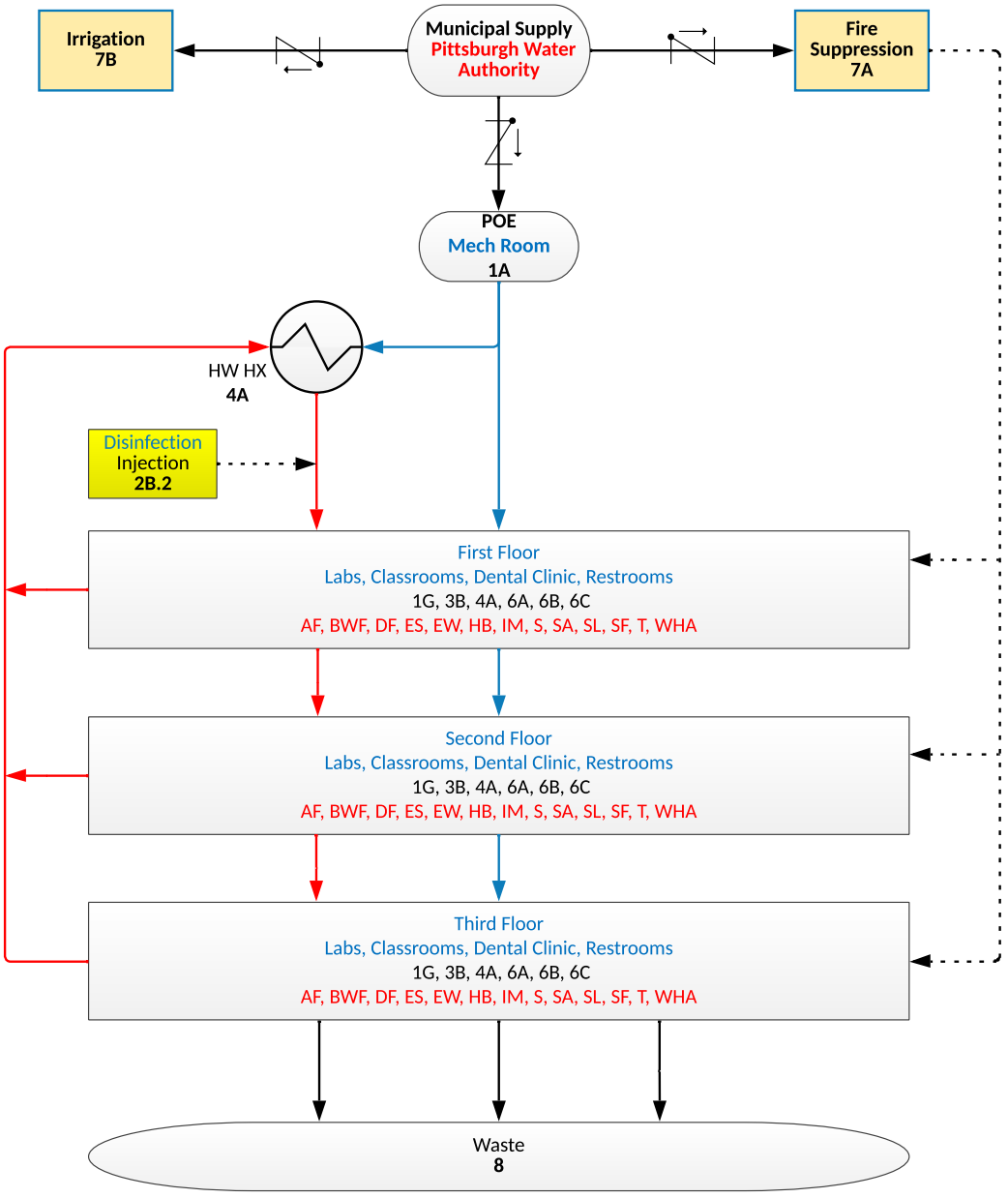
(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE





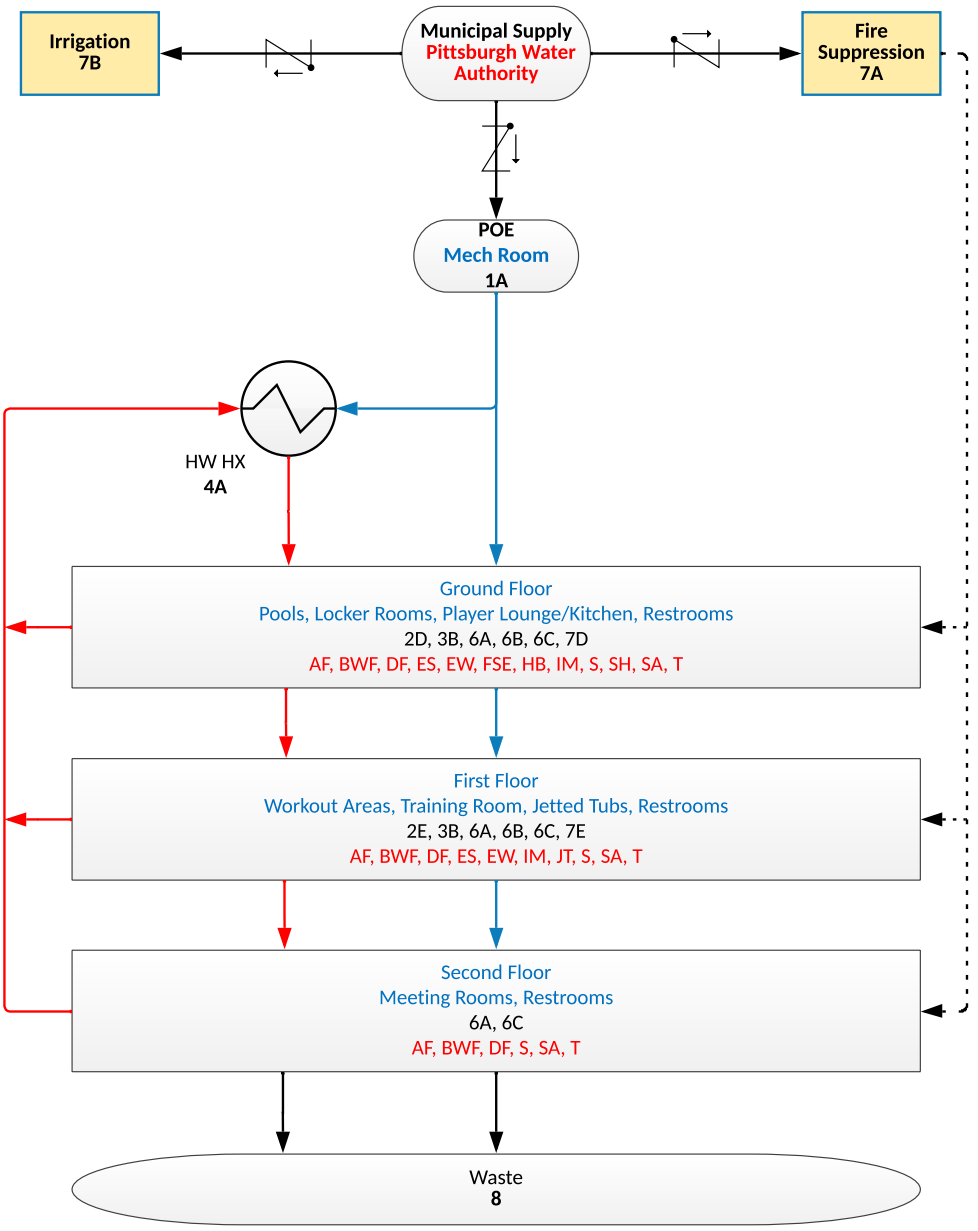
University of Pittsburgh
Academic/Lab Buildings with Supplemental Disinfection
Potable and Non-Potable Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



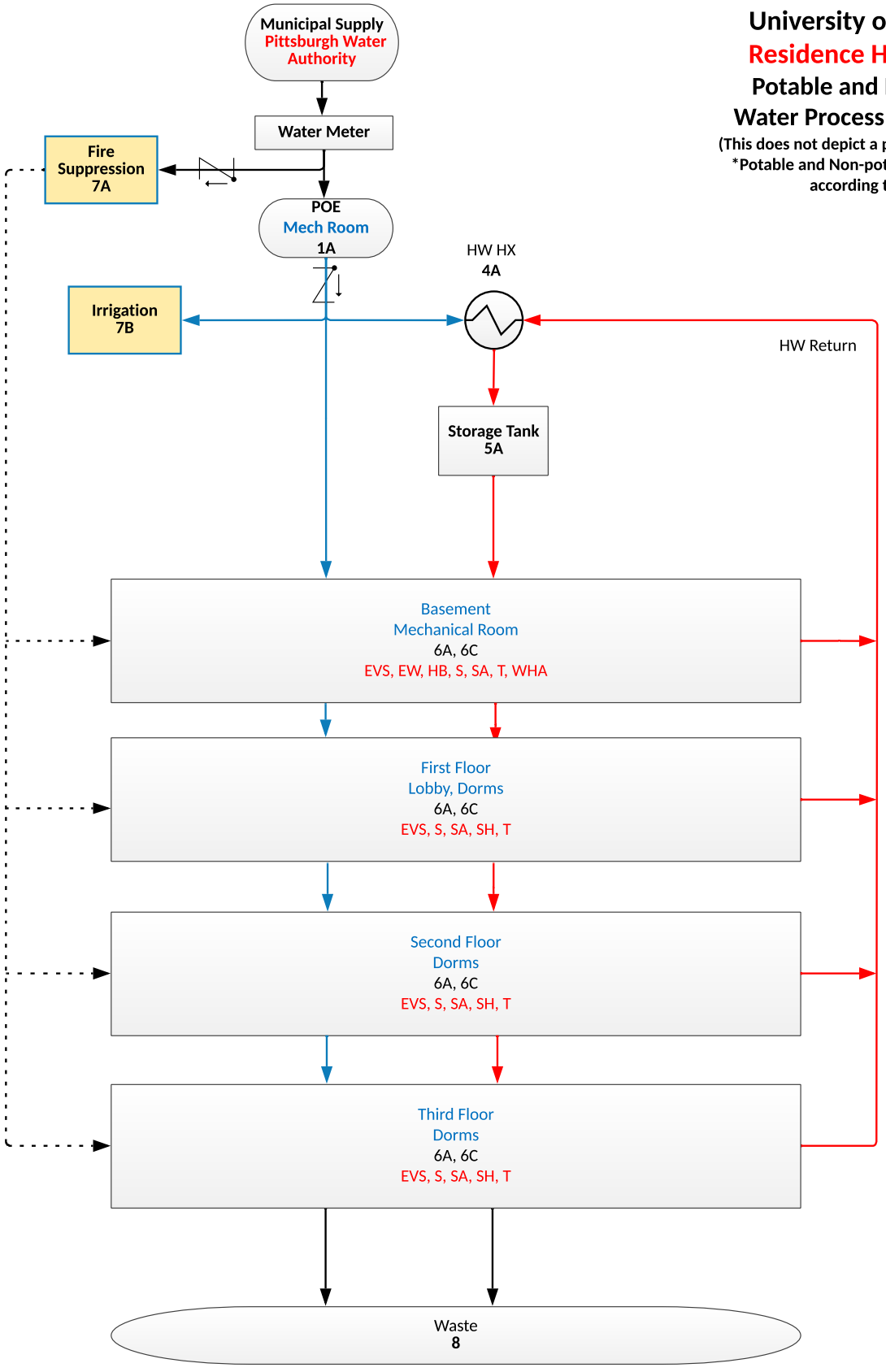
University of Pittsburgh
Athletic Buildings
Potable and Non-Potable Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



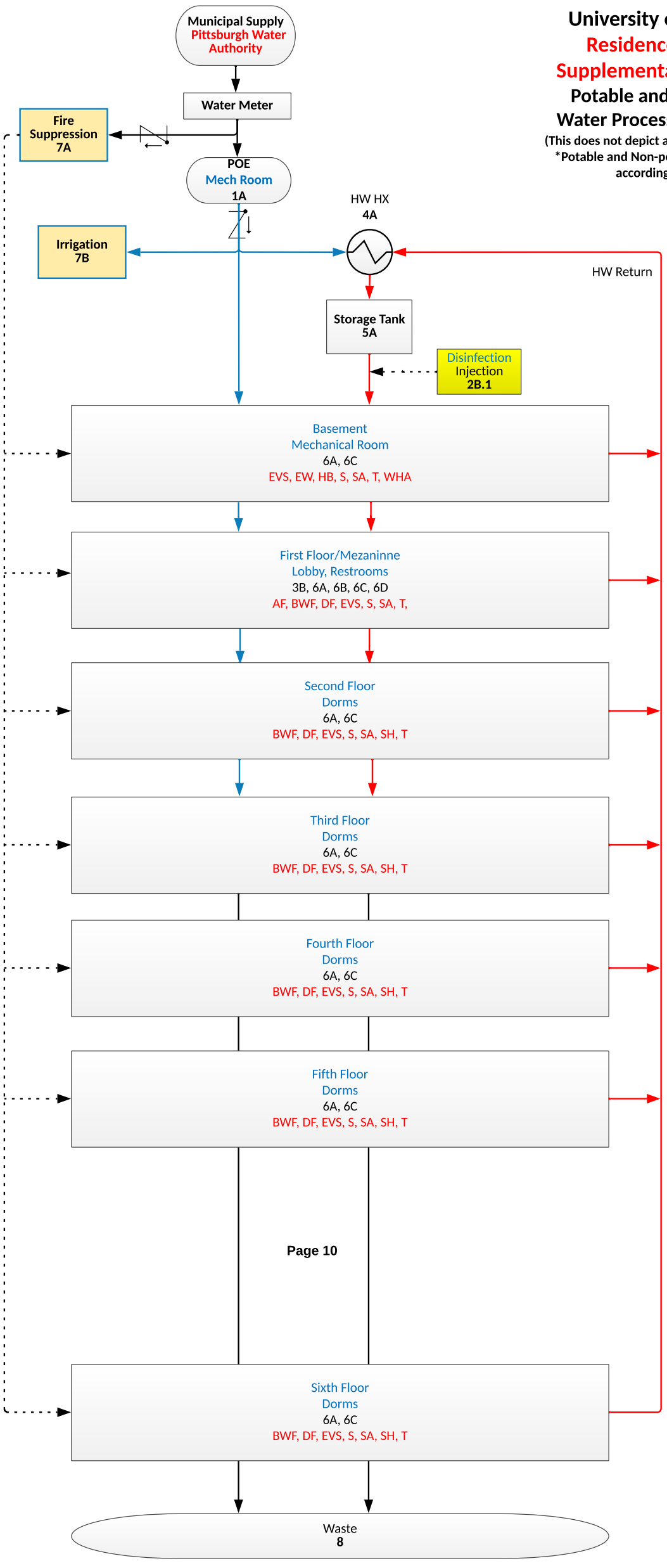
University of Pittsburgh
Residence Hall/Housing
Potable and Non-Potable Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



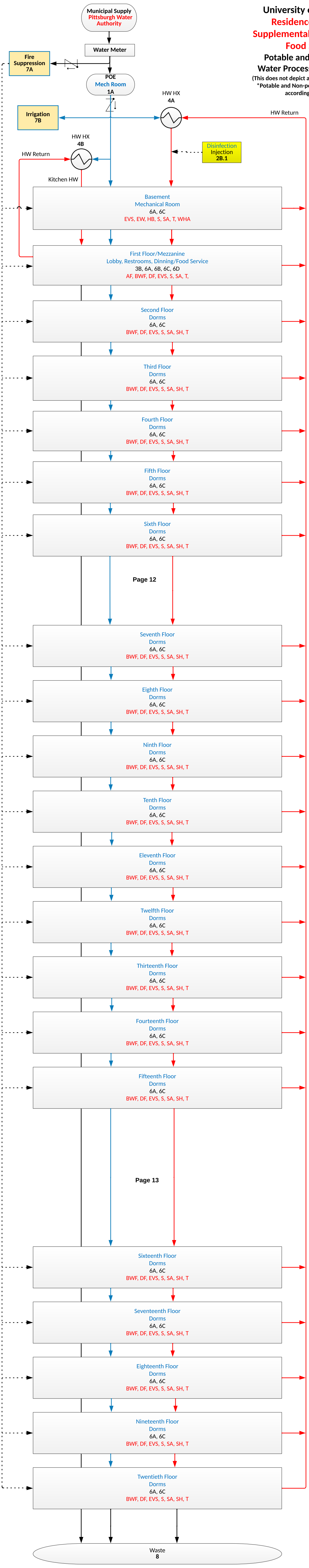
University of Pittsburgh
Residence Hall with Supplemental Disinfection
Potable and Non-Potable Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



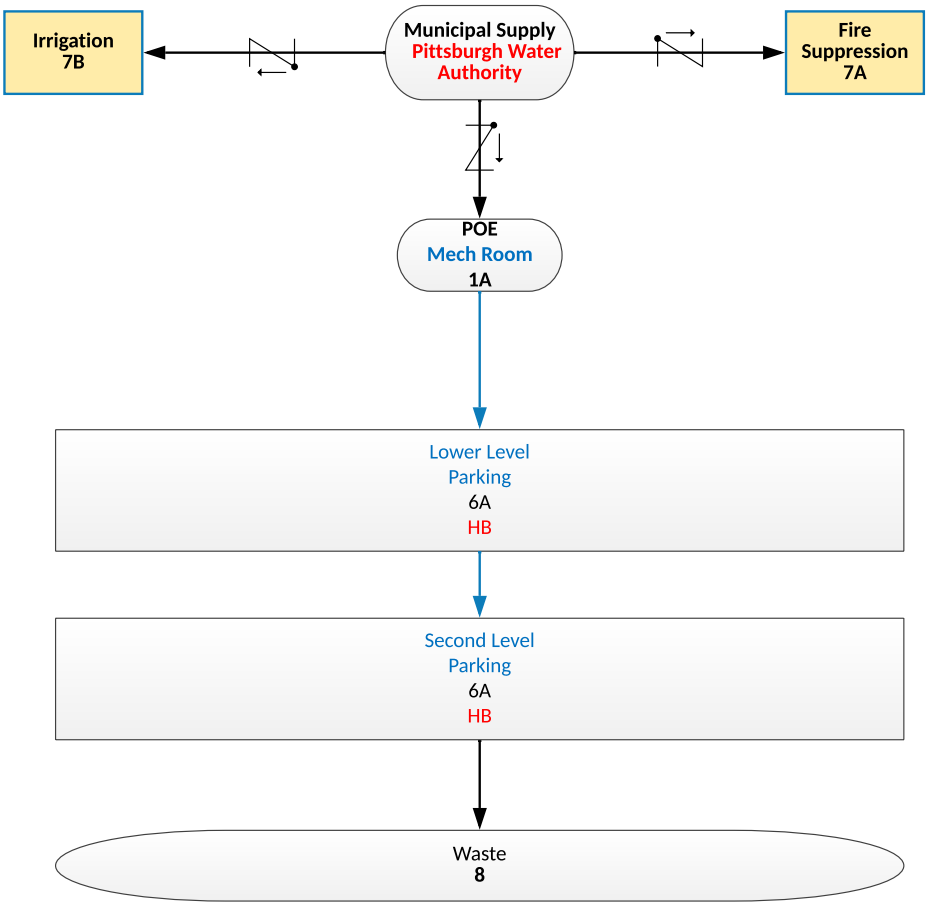
University of Pittsburgh
Residence Hall with Supplemental Disinfection & Food Service
Potable and Non-Potable Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



University of Pittsburgh
Other (Sports Dome and Parking Garages)
Potable and Non-Potable Water Process Flow Diagram

(This does not depict a plumbing riser diagram)
*Potable and Non-potable water is defined according to ASHRAE



NOTE: This depicts a composite system representative of the different utility processing steps on campus. In reality, multiple boiler and cooling tower systems are spread across campus. Reference the Water Use Description for more details.

University of Pittsburgh
Utility Water Systems
Non-Potable: Utility Water Process Flow Diagram

(This does not depict a plumbing riser diagram)

1. Receiving
A – Municipal Supply

2. Conditioning
A - Softening
B - Filtration
C - RO System
D - Deaeration

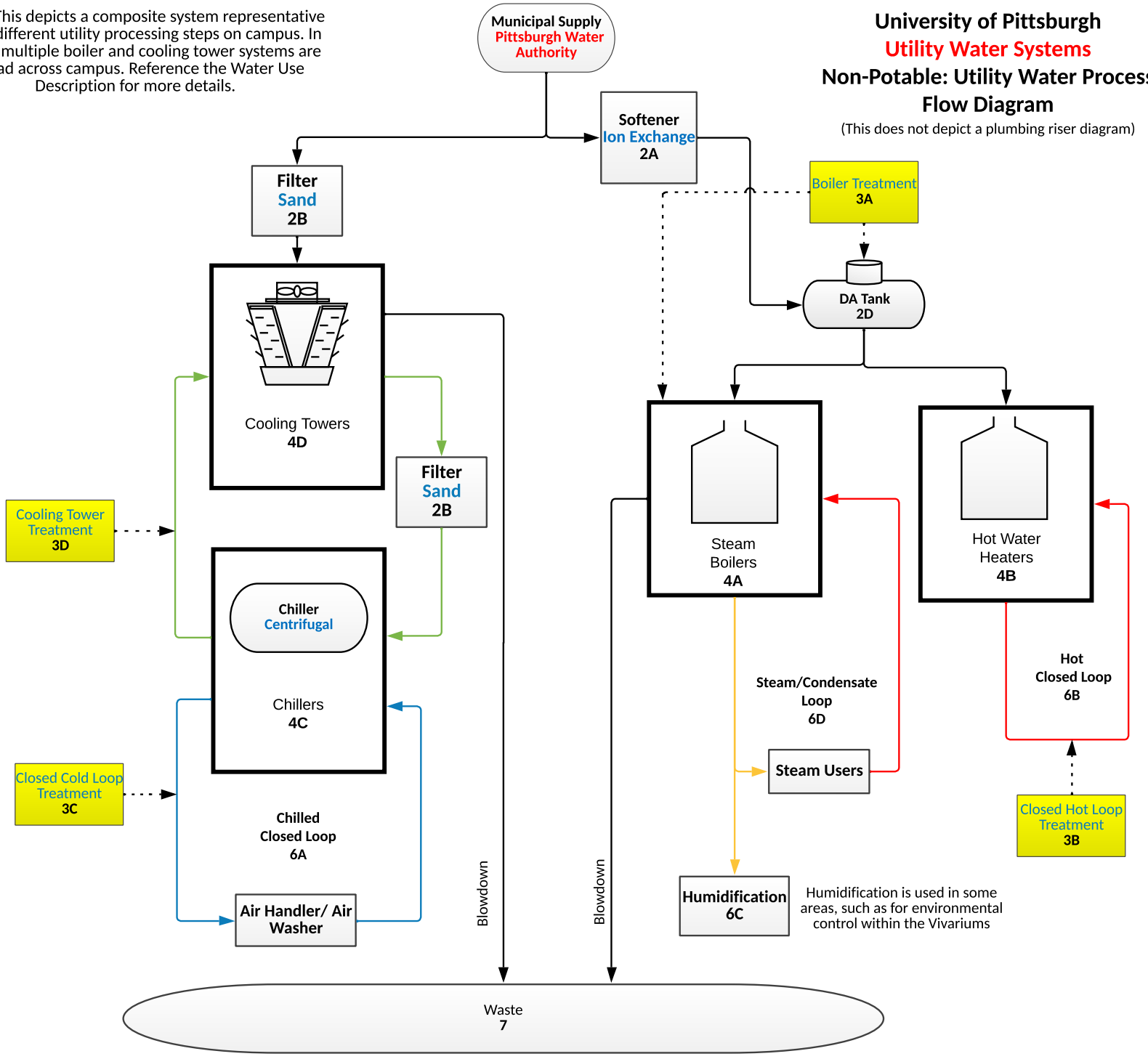
3. Treatment
A – Treatment, Boilers
B – Treatment, Closed Hot Loop
C – Treatment, Closed Chilled Loop
D – Treatment, Cooling Tower

4. Heating and Cooling
A - Steam Generation
B - Hot Water Generation
C - Chilled Water Generation
D - Cooling Tower
E - Swamp Cooler *(shown on page 6)*

5. Storage
A - Hot Water
B - Cold Water

6. Distribution
A – Circulation, Chilled Closed Loop
B – Circulation, Hot Closed Loop
C - Humidification
D – Steam (Kitchen Service, Sterile Processing)

7. Waste



University of Pittsburgh Water Management Program
4200 Fifth Ave
Pittsburgh, PA 15260

Water Use Description
Version Date: June 2022

Potable Water Processing Steps

1. Receiving

A - Municipal Supply

- Potable water is received onto the campus from Pittsburgh Water and Sewer Authority.
- All the buildings on campus are fed from the municipal water system, with independent connections.
- The municipality applies chlorine as the final disinfectant.

D.1 - RO/DI in Campus Labs

- There are Reverse Osmosis (RO) and Deionization (DI) systems in use in many labs across campus.
- Lab departments provide oversight of these systems.
- The system is maintained by a third party vendor per the manufacturer's recommendations.

D.2 - RO in Animal Facilities

- Reverse Osmosis (RO) systems are in use for facilities with animals.
- The system is maintained by a third party vendor per the manufacturer's recommendations.

F - Laboratory/High Purity Water

- There are various high purity water systems (polishers, etc.) in use in labs across campus.
- These systems are maintained by various departments, facilities has no direct oversight.
- The system is maintained by a third party vendor per the manufacturer's recommendations.
- All of these systems are closed, non-potable systems with low exposure.

G - Dental Water

- Dental water is used in Salk Hall on campus.
- Lines are flushed by facilities on a weekly basis.

2. Supplemental Disinfection

B.1 - Potable Hot Water Treatment Copper Silver

- Copper/Silver ionization is applied to the multiple housing buildings on campus. Treatment is applied to the recirculating hot water loops.
- LiquiTech is responsible for monthly on site maintenance of the systems.

- Facilities performs visual inspections daily and flow cell cleanings monthly.

B.2 - Potable Hot Water Injection of Monochloramine

- Chemical treatment is applied to the dental buildings on campus.
- Treatment is applied to the recirculating hot water loops.
- LiquiTech is responsible for monthly on site maintenance of the systems.

C - Decorative Water Feature

- There are four decorative water fountains on campus located at Heinz Chapel, Biomedical Science Tower 3, Cathedral of Learning and Frick Fine Arts. All features are located outdoors.
- When in operation (May-October), some features are disinfected with chlorine tabs, others are disinfected with bromine.
- Facilities is responsible for the treatment and maintenance.
- *NOTE the above documentation describes the decorative water features based on this Supplemental Disinfection processing step, however downstream processing at the point of Distribution is referenced later in the Water Use Description.*

D - Pool

- There are two pools located in Trees Hall and Bellefield Hall.
- The pools are treated with chlorine.
- Facilities is responsible for the treatment and maintenance.
- *NOTE the above documentation describes the pool based on this Supplemental Disinfection processing step, however downstream processing at the point of Distribution is referenced later in the Water Use Description.*

E - Jetted Tubs

- Jetted tubs are located in Fitzgerald Field House and the Petersen Events Center.
- The jetted tubs are treated with chlorine.
- Athletic training is responsible for the treatment and maintenance.
- *NOTE the above documentation describes the jetted tubs based on this Supplemental Disinfection processing step, however downstream processing at the point of Distribution is referenced later in the Water Use Description.*

3. Conditioning (all sub-processing steps)

A - Softening

- Potable cold water serving labs and dental areas in various buildings on campus is softened using an ion-exchange softener resin.
- Those buildings include: Benedum Hall, GSPH Annex, Salk Hall Pavilion, Thomas Boulevard, Center for Bioengineering, Biomedical Science Tower 3, McGowan Institute for Regenerative Medicine.

B - Filtration (Ice Machines)

- Ice machines with filtration are in use across campus and in all buildings with food service.

- Ice machines are pre-filtered, either with internal filtration or a mounted filter behind the unit.
- Facilities and Business and Auxiliary Services (BAS) departments maintain preventative maintenance activities.
- *NOTE the above documentation describes the machines based on this Conditioning processing step, however downstream processing at the point of Distribution is referenced later in the Water Use Description.*

C - Filtration (Point of Entry)

- There are point-of-entry filters on the University Club building on campus. The University Club is maintained by U Pitt facilities and Family House
- U Pitt facilities maintains the quarterly filter change.

4. Heating

A - Hot Water, 115-125°F

- Domestic hot water serving buildings on campus is generated via gas, steam or electric hot water heaters/heat exchangers at a target temperature of 115-125°F.
- The systems are a recirculating loop with a hot water return.

B - Additional Hot Water, 130-160°F

- Potable hot water serving kitchen and food service areas is generated via gas, steam or electric hot water heaters/heat exchangers at a target temperature of 130-160°F.
- The systems are a recirculating loop with a hot water return.

5. Storage

A - Hot Water

- After leaving the heaters, potable hot water serving some residence halls is fed to a storage tank. A list of buildings with storage tanks can be found in the system analysis.
- After leaving the storage tank the water is distributed throughout the building.

6. Distribution (Potable) -- all sub-processing steps

A - Cold Water; B - Cold Water (Ice Machines); C - Hot Water; D - Additional Hot Water (Kitchen)

- The potable water distribution system serves the following outlets:
  - Automatic Faucets
  - Bottled water filler
  - Drinking Fountains
  - Drink Stations
  - EVS Closets
  - Emergency Eyewash
  - Emergency Showers
  - Food Service Equipment
  - Hose Bibb
  - Ice Machine
  - Jetted Tubs

- Laundry
- Sink (manual)
- Sink with Aerator
- Shower
- Toilet/Urinal
- Tubs (Bathing)
- Water Hammer Arrestors
- Other Specialty

7. Distribution (Non-Potable)

A - Fire Suppression

- The fire suppression system is received into the building via its own water main or by splitting off the main municipal supply line. The configuration varies by building.
- The fire suppression system is maintained per state and local requirements.

B - Irrigation

- There are irritation systems throughout campus plumbed from the municipal supply.
- It consists of spray and drip irrigation and operates via timers during the day.
- The systems are seasonally operated and blown out in the fall/winter.

C - Decorative Water Feature

- *Note: Description is included as part of the Conditioning processing step.*

D - Pool

- *Note: Description is included as part of the Conditioning processing step.*

E - Jetted Tub

- *Note: Description is included as part of the Conditioning processing step.*

8. Waste

- All potable water outlets drain to the sanitary waste system.

Non-Potable: Utility Water Processing Steps

1. Receiving

A - Municipal Supply

- Potable water is received onto the campus from Pittsburgh Water and Sewer Authority.
- The municipality applies chlorine as the final disinfectant.

2. Conditioning

A - Softening

- All water serving the boilers is softened using an ion-exchange softener.
- Post-softener, cold water travels to the DA tank.
- The system is maintained per the manufacturer's recommendations.

B - Filtration

- A sand filter exists upstream of the cooling towers.

- The filter is changed per manufacturer specifications.

D - Deaeration

- The deaeration tank is used to reduce dissolved gasses in the water. It also provides a location to add chemicals and brings water up to temperature prior to introduction to the boiler.

3. Treatment

A - Boiler

- Treatment for scale and corrosion control is applied to the boiler system.
- The boiler treatment is managed by a third-party vendor.

B - Hot Closed-Loop

- Treatment for corrosion inhibition is applied to the closed-loop system.
- The hot closed-loop treatment is managed by a third-party vendor.

C - Chilled Closed-Loop

- Treatment for corrosion inhibition is applied to the closed-loop system.
- The chilled closed-loop treatment is managed by a third-party vendor.

D - Cooling Tower

- A dual biocide program, including an oxidizing and a non-oxidizing biocide, is used for microbiological control.
- Treatment for scale and corrosion control is applied to the cooling tower system.
- The cooling tower treatment is managed by a third-party vendor.

4. Heating and Cooling

A - Steam Generation

- Boilers are used to generate steam for distribution to campus.
- The steam boilers are located in the Carrillo and Belleville plants.

B - Closed Loop Heaters

- Boilers generate hot water in order to supply building heating.
- Water is recirculated back to the boilers.

C - Chilled Water Generation

- Chilled water is maintained via centrifugal chillers. The system supplies cooling to the building's air handler units.

D - Cooling Tower

- Cooling towers provide heat rejection to the chiller system and operate year round.

E - Swmp Cooler

- Outdoor air is cooled by passing through wet evaporative cooler pads.
- Seven swamp coolers are used to cool the greenhouses located on the roof of Langley Hall.

6. Distribution

A - Circulation- Chilled Closed Loop

- Chilled water supplies cooling to the building's air handler units.

B - Circulation- Hot Closed Loop

- Hot closed loop water supplies heating to the building's air handler units.

C - Humidification

- Steam is distributed to campus for use in building humidification.

D - Steam

- Condensate is collected and returned to the deaeration/feedwater tank.

7. Waste

- All non-potable: utility water outlets drain to the sanitary waste system.

Safety Analysis Summary Table

Organization: University of Pittsburgh

WMP Name: University of Pittsburgh

Document last updated 09/15/2022

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
1A. RECEIVING - Municipal Supply (Potable)	B	C	P	No	Cold water is received from Pittsburgh Water and Sewer Authority. Water is processed in accordance with Primary Drinking Water Standards as required in the Code of Federal Regulations. As part of the disinfection process, the municipality treats the water with chlorine. All the buildings on campus are fed from the municipal water system, with independent connections. Significant changes in system pressure can negatively impact water quality and safety throughout the potable and non-potable plumbing systems. Unplanned water service disruptions as defined by ANSI/ASHRAE Standard 188 resulting from emergency events which may include natural disasters or adverse weather conditions are within the scope of the program. The WMT will follow the procedures in the University of Pittsburgh "Emergency Response Guide", Appendix F, Attachment 1 (Water Outage Contingency Plan) to address these events if they arise.	1. Confirm Source Water Safety 2. Confirm Source Water Quality
1D.1 RECEIVING (Non-Potable) - RO/DI in Campus Labs	B			No	Although there are specifically RO/DI units in many campus labs, these systems are low exposure and not for potable consumption.	1. Notice for non-potable water sources 2. Preventative Maintenance
1D.2 RECEIVING (Non-Potable) - RO in Animal Facilities	B			Yes	There are some RO systems purifying water for use in the facilities with animals. This is for consumption by the animals. Exposure by humans is low, but still possible. There are controls to manage this risk, around how the RO systems are maintained. More details on which buildings and how this is managed is located in the Water Use Description.	**1. Preventative Maintenance**

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
1F. RECEIVING (Non-Potable) - Laboratory/High Purity Water	B	C		No	There are various high purity water systems (polishers, etc.) in use in labs across campus. These systems are maintained by various departments, facilities has no direct oversight. All of these systems are closed, non-potable systems with low exposure.	1. Disinfectant
1G. RECEIVING (Potable) - Dental Water	B	C		Yes	There is potential direct tissue exposure through oral dental work. The dental work spray tool aerosolizes when in operation. Dental water is used in the following buildings on campus: Salk Hall Salk Annex	1. Disinfectant **2. Preventative Maintenance**
2B.1 SUPPLEMENTAL DISINFECTION - Potable Hot Water Treatment Copper Silver	B	C		Yes	Based upon application of supplemental disinfection treatment, this processing step represents an area for focus and control to ensure the safety of the water system. Staff currently apply control through copper/silver disinfection units, with LiquiTech as the vendor.	**1. Inspection** **2. Preventative Maintenance** **3. Treatment**
2B.2 SUPPLEMENTAL DISINFECTION - Potable Hot Water Injection of Monochloramine	B	C		Yes	Based upon application of supplemental disinfection treatment, this processing step represents an area for focus and control to ensure the safety of the water system. Staff currently apply control through monochloramine.	**1. Disinfectant**
2C/7C. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Decorative Water Feature	B	C		Yes	Decorative water features have been associated with cases of waterborne pathogen disease and outbreaks of Legionellosis due to the potential for waterborne pathogen growth and aerosolization of water droplets. There are four decorative fountains on campus, located at Heinz Chapel, BST3, Cathedral of Learning, and Frick Fine Arts. They are located outdoors. Some fountains are disinfected with chlorine tabs, others are disinfected with bromine. They are operated seasonally from mid-May to mid-October. The Heinz Chapel fountain is managed by FM Certified Pool Operator. The Cathedral of Learning fountain is managed by FM Engineers. Both the Frick Fine Arts and BST3 fountains are both managed by FM Plumbers.	**1. Disinfectant** **2. Inspection & Preventative Maintenance**

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
2D/7D. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Pool	B	C		Yes	Pools have been associated with cases of waterborne pathogen disease and outbreaks of Legionellosis due to the potential for waterborne pathogen growth and aerosolization of water droplets. There are pools on campus in Trees Hall and Bellefield Hall.	**1. Disinfectant** **2. Media Filter**
2E/7E. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Jetted Tubs	B	C		Yes	Jetted tubs have been associated with cases of waterborne pathogen disease and outbreaks of Legionellosis due to the potential for waterborne pathogen growth and aerosolization of water droplets. There are jetted tubs on campus in Fitzgerald Field House and the Petersen Events Center.	**1. Disinfectant** **2. Cleaning/Preventative Maintenance**
3A. CONDITIONING - Softening (Potable)	B			No	Softeners can act as storage tanks leading to water stagnation and reduced water quality. Failure of softeners can also lead to reduced equipment life and increased scale formation downstream of the softener, which provides a better environment for microbial growth downstream. Significant softener systems are located in the following buildings on campus: • Benedum Hall • GSPH - Annex • Salk Hall Pavilion • Thomas Boulevard • Center for Bioengineering • Biomedical Science Tower 3 (BST3) • McGowan Institute for Regenerative Med.	1. Disinfection 2. Inspection
3B/6B. CONDITIONING/DISTRIBUTION (Potable) - Filtration (Ice Machines)	B			Yes	Ice machines have been associated with cases of waterborne pathogen disease based on the potential for water aspiration. Ice machines are in use across the campus and in all buildings with food service. The Facilities and Business and Auxiliary Services (BAS) departments maintain preventative maintenance activities and documentation within the TMA system. The ice machines are pre-filtered, either with internal filtration or a mounted filter behind the unit.	**1. Preventative Maintenance**

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
3C. CONDITIONING - Filtration (Potable)	B			Yes	Improperly maintained filters can cause poor water quality downstream. There is point-of-entry filters on the University Club building on campus. The University Club is maintained by U Pitt facilities and Family House. There is a separate water management program in place for this building. However, U Pitt facilities maintains the quarterly filter change, therefore is documented in this program.	**1. Filter Change**
4A. HEATING (Potable) - Hot Water [115-125°F]	B		P	No	There is some potential for scalding at this processing step based upon the high target temperature of the water leaving the heating system. Based on the target temperature of the heating systems, the risk of *Legionella* growth remains. Due to the closed nature of the mechanical room, the exposure risk is limited to staff. Risk of exposure occurs in the distribution system and is addressed at that processing step. There are commercial mixing valves at all showers, limiting potential for scalding. Some heaters include thermostatic mixing valves at the heater outlet to manage the temperature at this processing step. Heaters with and without thermostatic mixing have outlet set points in the 115-125°F range (either exiting the heater, or exiting the thermostatic mixing valve). Some buildings include multiple hot water loops.	1. Heat
4B. HEATING (Potable) - Higher Temp Hot Water (Kitchen) [120-160°F]	B		P	No	There is potential for scalding at this processing step based upon the high target temperature of the water leaving the heating system. There are some separate hot water loops for kitchen facilities around campus. Exposure potential to these facilities is low, limited to trained staff.	1. Heat

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
5A. STORAGE (Potable) - Hot Water [120-140°F]	B		P	Yes	Stored water can become stagnant with infrequent turnover, which can increase risk for *Legionella* growth. However, after the storage step, there is significant downstream processing, so there is limited exposure risk. The following residence buildings have hot water storage tanks: Panther Hall Pennsylvania Hall (Irvis) Ruskin Hall Sutherland Hall College Gardens - 5820 College Gardens - 5821 College Gardens - 5830 College Gardens - 5831 College Gardens - 5840 College Gardens - 5841 Darragh Street Apartment Complex Forbes Craig Trees Hall The temperatures at which hot water is stored are favorable for microbial growth and amplification.	**1. Flushing** 2. Preventative Maintenance
6A. DISTRIBUTION (Potable) - Cold Water	B			Yes	The distribution system is the avenue through which exposure occurs, at building fixtures which aerosolize water. Temperatures of cold water systems reduce the risk of microbial amplification within the system compared to hot water systems, but do not remove the potential for microbial growth and amplification. Free residual oxidant (FRO) readings are important to further understand the risk of growth in the distribution system.	1. Disinfectant **2. Routine Flushing**
6C. DISTRIBUTION (Potable) - Hot Water [120-140°F]	B		P	Yes	The distribution system is the avenue through which exposure occurs, at building fixtures which aerosolize water. Temperatures of the hot water distribution system are favorable for microbial growth and amplification, and the recirculating nature of the hot water loops increases water age, allowing for dissipation of residual oxidant. These factors increase the risk of the hot water system as compared to the cold water system. Free residual oxidant (FRO) readings are important to further understand the risk of growth in the distribution system.	1. Disinfectant **2. Routine Flushing** **3. Flushing - All of Salk Annex & floors 2-4 in Salk Hall**

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
6D. DISTRIBUTION (Potable) - Higher Temp Hot Water (Kitchen) [120-160°F]	B		P	No	There is potential for scalding at this processing step based upon the high target temperature of the water leaving the heating system. There are some separate hot water loops for kitchen facilities around campus. Exposure potential to these facilities is low, limited to trained staff.	1. Flushing 2. Disinfectant
7A. DISTRIBUTION (Non-Potable) - Fire Suppression	B			No	The fire suppression systems are fed from the municipal supply line that enters each building. All buildings on campus have fire suppression in them. There is consistent maintenance and monitoring of fire suppression systems throughout campus. There is potential for microbiological growth due to stagnant lines.	1. Flush Testing
7B. DISTRIBUTION (Non-Potable) - Irrigation	B			No	There are irrigation systems throughout campus. Spraying aerosolizes water, and can lead to exposure depending on when, during the day, the system is operated, and where the spraying occurs (near common walkways, etc.) All Business and Auxiliary Services buildings have an irrigation system coming off of building water system (mist style irrigation). They are seasonally operated. Some Non-Business and Auxiliary Services (BAS) buildings have irrigation systems throughout campus.	1. Irrigation Schedule 2. Flushing
8. WASTE (Potable/Non-Potable)	B	C	P	No	Sewage can transmit pathogens or other contaminants, however exposure is limited and well controlled. Sewage drains to the sanitary waste system. There is no history of problems with back-flow or other exposure to the sewage systems on campus.	1. Sanitary Sewer 2. Backflow Prevention
1A. RECEIVING - Municipal Supply (Non-Potable: Utility)	B	C	P	No	Cold water is received from Pittsburgh Water and Sewer Authority. Water is processed in accordance with Primary Drinking Water Standards as required in the Code of Federal Regulations. As part of the disinfection process, the municipality treats the water with chlorine. Water delivered to the utility systems enters areas where exposure is limited.	1. Confirm Source Water Safety 2. Confirm Source Water Quality

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
2A. CONDITIONING - Softening (Non-Potable: Utility)	B			No	There is potential for loss of oxidant across the softener if the system is not properly sized and properly managed. There is opportunity to increase frequency of regeneration during low usage periods which could reduce risk of potential microbiological growth. Downstream process controls exist to address exposure to potential hazards.	1. Disinfection 2. Preventative Maintenance
2B. CONDITIONING - Filtration (Non-Potable: Utility)	B			No	Filtration helps reduce suspended solids in mainstream flow helping maintain design efficiencies. There is side-stream filtration on some cooling tower systems on campus. Failure of these processing steps could lead to pressure drop across the filter and loss of efficiency in the system, but is not a safety concern. Biologic activity in the towers is addressed at other processing steps.	1. Filter Replacement
2C. CONDITIONING - RO System (Non-Potable: Utility)	B			No	Reverse osmosis water can transmit pathogens or other contaminants if the system is not properly maintained. Downstream process controls exist, so exposure is limited at the Conditioning processing step.	1. Preventative Maintenance
2D. CONDITIONING - Deaeration (Non-Potable: Utility)		C	P	No	The operating temperature and pressure of the DA tank prevents microbial issues but have potential to cause scalding. Because the water is processed after leaving the DA tank, there is a low level of exposure risk to anyone except for trained FMS employees and the water treatment provider.	1. Personal Protective Equipment (PPE)
3A. TREATMENT - Boiler (Non-Potable: Utility)		C		No	Chemical treatment is performed for the steam boiler system in order to optimize system performance. There is risk of chemical exposure for those working with the system in the Carrillo Plant. The closed nature of the system prevents introduction and consequent growth of microorganisms. The risk of exposure is also reduced as only trained members of the University of Pittsburgh access this system.	1. Personal Protective Equipment (PPE)
3B/3C. TREATMENT - Hot and Cold Closed Loops (Non-Potable: Utility)		C	P	No	Chemical application to closed loops is performed by trained operators within FMS or the chemical provider. Chemistry is modified and monitored monitored by Kurita. The closed nature of the systems limits exposure to the treated water, and the chemical application is limited to trained staff and contractors.	1. Personal Protective Equipment (PPE)

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
3D/4D. TREATMENT/HEATING AND COOLING - Condenser Water (Cooling Tower) (Non-Potable: Utility)	B	C	P	Yes	Open loop condenser water systems are documented sources of microbial growth due to the operating temperatures, exposure to open air, and the aerosolization of waters through the mechanical cooling process and subsequent evaporation of water. The cooling tower systems require additional control to reduce the risk of microbiological growth. If chemical control is not applied correctly, microbes can proliferate and result in exposure to the surrounding environment. Cooling tower water systems are currently maintained and treated by an outside vendor.	**1. Treatment** 2. Personal Protective Equipment (PPE)
4A. HEATING AND COOLING - Steam Generation (Non-Potable: Utility)		C	P	No	The steam temperature does not present a biological hazard risk due to lack of support for growth of microorganisms including *Legionella*. However, the high temperature does present a scalding risk. The closed nature of the system prevents introduction and consequent growth of microorganisms. The risk of exposure is also reduced as only trained members of the University of Pittsburgh access this system.	1. Treatment
4B/4C. HEATING AND COOLING - Hot and Cold Water Generation for Closed Loops (Non-Potable: Utility)		C	P	No	While there is potential for scalding or burn injury around hot pipes and sample locations, microbiological hazards are controlled based on temperature and chemical addition to the closed system. Similar logic applies to the cold systems, in which the heat transfer stage occurs in a closed chiller. At the actual step where heating hot water and chilled loop streams are generated (at the heater, the chiller), exposure is limited.	1. Treatment
4E. HEATING AND COOLING - Swamp Cooler	B			No	At this processing step, outdoor air is cooled by passing through wet evaporative cooler pads. Open systems are documented sources of microbial growth due to the operating temperatures, exposure to open air, and the aerosolization of waters through the mechanical cooling process and subsequent evaporation of water. On campus, seven swamp coolers are used to cool the greenhouses located on the roof of Langley Hall. Exposure is limited at this step as only trained staff member are able to access this location. All units are winterized and cleaned in the spring.	**1. Disinfection**

Processing Step	Potential Hazards			Risk Significant?	Risk Basis	Control Measure(s)
5A/5B. STORAGE - Hot Water/Cold Water (Non-Potable: Utility)	B		P	No	Stored water can become stagnant with infrequent turnover, which can increase risk for *Legionella* growth. However, after the storage step, there is significant downstream processing, so there is limited exposure risk. There are large hot water storage tanks like a 7,500 gallon condensate pumping station, stored at 200°F, and there are also chilled water storage tanks. However, the potential exposure to these streams is limited. Operating temperature of the hot side prevents bacterial growth, and the closed nature of the cold system limits propagation of any bacteria out of the systems.	1. Flushing
6A/6B. DISTRIBUTION - Circulation, Chilled Closed Loops and Hot Closed Loops (Non-Potable: Utility)	B	C		No	There are closed heating and cooling loops in use extensively across campus. In the cooled loop, growth of microorganisms is reduced due to lower operating temperatures and chemical treatment applied to the chilled water used for cooling. Exposure to both types of systems is limited to trained members of the University of Pittsburgh staff or contracted services staff.	1. Treatment
6C. DISTRIBUTION - Humidification (Non-Potable: Utility)		C	P	No	The loop providing steam for heating processes to the facility is a closed system resulting in limited exposure. Additionally, only trained members of the University of Pittsburgh staff are exposed to the system reducing the risk of scalding during maintenance.	1. Treatment
6D. DISTRIBUTION - Steam (e.g. Kitchen Service, Sterile Processing) (Non-Potable: Utility)		C	P	No	The loop providing steam for heating processes to the facility is a closed system resulting in limited exposure. Additionally, only trained members of the University of Pittsburgh staff are exposed to the system reducing the risk of scalding during maintenance.	1. Treatment
7. WASTE (Non-Potable: Utility)	B	C	P	No	Sewage can transmit pathogens or other contaminants, however exposure is limited and well controlled. Sewage drains to the sanitary waste system. Waste in a non-potable (utility system) has the potential to contain chemicals that may require alternate disposal.	1. Sanitary Sewer 2. Backflow Prevention

Potential Hazards: (B)iological, **(C)**hemical, **(P)**hysical

Program Control Summary Table

Organization: University of Pittsburgh

WMP Name: University of Pittsburgh

Document last updated 09/15/2022

Processing Step	Water System	Control Measure(s)	Control Limit	Monitoring Method	Frequency	Corrective Action	Records
1D.2 RECEIVING (Non-Potable) - RO in Animal Facilities	Potable	1. Preventative Maintenance	Preventative maintenance performed by a third party vendor, Avidity	Perform procedures per manufacturer's recommendations	Semi-Annually/As Needed	1. If maintenance not performed, perform immediately.	Vendor Service Report - Avidity (DLAR)
1G. RECEIVING (Potable) - Dental Water	Potable	1. Preventative Maintenance	Flush 2-4 minutes as part of preventative maintenance		Weekly	1. If flushing is not performed, determine cause, perform immediately	TMA System
2B.1 SUPPLEMENTAL DISINFECTION - Potable Hot Water Treatment Copper Silver	Potable	1. Inspection 2. Preventative Maintenance 3. Treatment	Completion of visual inspection Clean flow cells 0.3 - 1.3ppm Cu	Perform visual inspection of equipment panels Cleaning performed via acid soak and scrub Test distal slop sink	Weekly Monthly Monthly	1. If visual inspection not performed, perform immediately 2. If visual inspection not performed, perform immediately 3. • If values are high, flush and retest • Contact vendor	TMA System TMA System Vendor Report
2B.2 SUPPLEMENTAL DISINFECTION - Potable Hot Water Injection of Monochloramine	Potable	1. Disinfectant	Total Chlorine: 1.0-3.0 ppm as Cl2 (Target 2.15ppm) ORP: ___ mV	Automated analyzer (Sanipur) On-site vendor visit to check at the source (Kurita)	Continuous; Monthly	1. Confirm feed strategy with vendor	Vendor Service Reports (Sanipur; Kurita)

Processing Step	Water System	Control Measure(s)	Control Limit	Monitoring Method	Frequency	Corrective Action	Records
2C/7C. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Decorative Water Feature	Non-Potable	1. Disinfectant	Chlorine: Free Residual Oxidant (FRO): 0.5-5.0 ppm Bromine: Free Residual Oxidant (FRO): 3.0-10.0 ppm	Perform free chlorine test on the colorimeter at the decorative water feature	2x Week	1. Verify chemical feed and retest oxidant level	TMA System
		2. Inspection & Preventative Maintenance	Completion of visual inspection/maintenance	Visual Inspection Perform cleaning/maintenance as required for operation	2x Weekly	2. If visual inspection/maintenance not performed, perform immediately	Facilities Logs/PM System
2D/7D. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Pool	Non-Potable	1. Disinfectant	Free Residual Oxidant (FRO): 2.0-4.0 ppm as Cl_2	Perform free chlorine test at the pool	2x Daily	1. Adjust chlorine feed	Pool Logs
		2. Media Filter	Replace media every 14 days Clean filter annually (August)	Perform maintenance/cleaning as required for operation	Every 14 days; Annually	2. If visual inspection/maintenance not performed, perform immediately	Pool Logs
2E/7E. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Jetted Tubs	Non-Potable	1. Disinfectant	Free Residual Oxidant (FRO): 3.0-5.0 ppm as Cl_2	Perform free chlorine test on the colorimeter at the tub	Daily (When in use)	1. Adjust chlorine feed	Athletic Training Logs
		2. Cleaning/Preventative Maintenance	Completion of cleaning/maintenance prior to use	Perform per manufacturer's recommendations	Daily (When in use)	2. If cleaning/maintenance not performed, perform immediately	Athletic Training Logs
3B/6B. CONDITIONING/DISTRIBUTION (Potable) - Filtration (Ice Machines)	Potable	1. Preventative Maintenance	• Change filter • Clean/disinfect internal and external components	Perform procedures per manufacturer's recommendations	Quarterly	1. If maintenance not performed, remove unit from service and perform immediately	TMA System
3C. CONDITIONING - Filtration (Potable)	Potable	1. Filter Change	Change Filter	Perform procedure as per manufacturer recommendations	Quarterly	1. If maintenance not performed, perform immediately	TMA System

Processing Step	Water System	Control Measure(s)	Control Limit	Monitoring Method	Frequency	Corrective Action	Records
5A. STORAGE (Potable) - Hot Water [120-140°F]	Potable	1. Flushing	Completion of maintenance/flushing of storage tanks	Perform procedures per manufacturer's recommendations	Quarterly for tanks > 100 gallons and Annually for tanks < 100 gallons	1. If maintenance/flushing not performed, perform immediately	TMA System
6A. DISTRIBUTION (Potable) - Cold Water	Potable	1. Routine Flushing	Target Flush Time: 2-4 minutes	Flushing performed during periods of low occupancy for greater than 7 days	Weekly	1. If flushing is not performed, perform immediately	TMA System
6C. DISTRIBUTION (Potable) - Hot Water [120-140°F]	Potable	1. Routine Flushing	Flush for 2 min.	Flushing performed during periods of low occupancy > 7 days	Weekly	1. If flushing is not performed, determine cause, perform immediately	TMA System
		2. Flushing - All of Salk Annex & floors 2-4 in Salk Hall	Flush for 15 min.	Flushing performed at all dental sinks on Monday	Weekly	2. If flushing is not performed, determine cause, perform immediately	Departmental spreadsheet
3D/4D. TREATMENT/HEATING AND COOLING - Condenser Water (Cooling Tower) (Non-Potable: Utility)	Non-Potable (Utility)	1. Treatment	Free Residual Oxidant (FRO): 0.2-0.5ppm as Cl_2	Free chlorine test performed by facilities daily and Kurita monthly	Daily; Monthly	1. Adjust chemical feed accordingly	Vendor service reports are provided, with parameters measured while on site and comments on any work performed.

Validation Criteria Summary Table

Organization: University of Pittsburgh

WMP Name: University of Pittsburgh

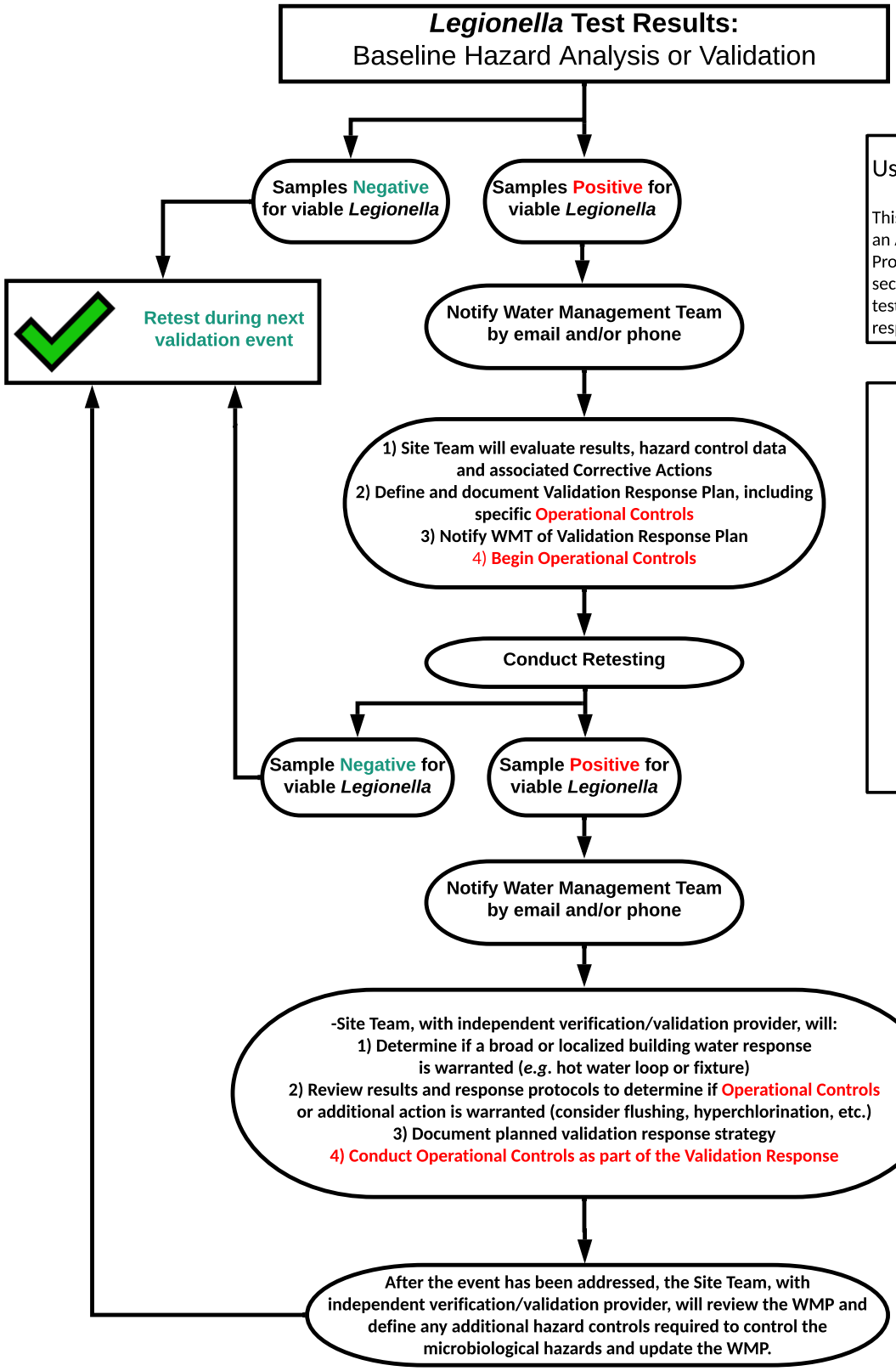
Document last updated 09/15/2022

Processing Step	Water System Type	Validation Criteria	Frequency
1D.2 RECEIVING (Non-Potable) - RO in Animal Facilities	Potable	There is testing on these streams performed once every 3 years via National Testing Lab	Every 3 years
1G. RECEIVING (Potable) - Dental Water	Potable	Heterotrophic Plate Count < 200 CFU/mL	Bi-weekly
2B.1 SUPPLEMENTAL DISINFECTION - Potable Hot Water Treatment Copper Silver	Potable	Copper & Silver Levels at Distal Locations • Copper 0.1-0.8 ppm or mg/L • Silver: 30-80 ppb	Monthly (Vendor)
2B.2 SUPPLEMENTAL DISINFECTION - Potable Hot Water Injection of Monochloramine	Potable	Monochloramine < 4.0 ppm as NH2Cl	Monthly (Vendor)
2C/7C. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Decorative Water Feature	Non-Potable	Standard ISO 11731 Non-detectable (< 1 CFU/mL) of *Legionella* bacteria	Annually
2D/7D. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Pool	Non-Potable	• Total Coliforms: < log mean of 200/100 ml • Heterotrophic plate count: < 200/CFU mL	Weekly
2E/7E. SUPPLEMENTAL DISINFECTION/DISTRIBUTION (Non-Potable) - Jetted Tubs	Non-Potable	• Total Coliforms: < 1/CFU mL • Heterotrophic plate count: < 200/CFU mL • Standard ISO 11731 Non-detectable (< 1 CFU/mL) of *Legionella* bacteria	TBD; Annually
3B/6B. CONDITIONING/DISTRIBUTION (Potable) - Filtration (Ice Machines)	Potable	Standard ISO 11731 Non-detectable (< 1 CFU/mL) of *Legionella* bacteria	Annually
3C. CONDITIONING - Filtration (Potable)	Potable	*Validation Testing via Standard ISO 11731 method is completed through a separate WMP specific to this building*	Annually
5A. STORAGE (Potable) - Hot Water [120-140°F]	Potable	Standard ISO 11731 Non-detectable (< 1 CFU/mL) of *Legionella* bacteria	Annually
6A. DISTRIBUTION (Potable) - Cold Water	Potable	Bacterial Validation: Standard ISO 11731 Non-detectable (< 1 CFU/mL) of *Legionella* bacteria Corrosion Control Validation (per EPA	Bacterial Validation: Annually; Lead Validation for housing and elementary aged children: Annually; Lead Validation for other university buildings: Every three years or more frequently if needed

Processing Step	Water System Type	Validation Criteria	Frequency
		Primary Drinking Water Standards): 0.015 mg/L lead per 90th percentile calculation	
6C. DISTRIBUTION (Potable) - Hot Water [120-140°F]	Potable	Bacterial Validation: Standard ISO 11731 Non-detectable (< 1 CFU/mL) of *Legionella* bacteria Corrosion Control Validation (per EPA Primary Drinking Water Standards): 0.015 mg/L lead per 90th percentile calculation	Bacterial Validation: Annually; Lead Validation for housing and elementary aged children: Annually; Lead Validation for other university buildings: Every three years or more frequently if needed
3D/4D. TREATMENT/HEATING AND COOLING - Condenser Water (Cooling Tower) (Non-Potable: Utility)	Non-Potable (Utility)	• THAB less than or equal to 10^4 CFU/mL • Standard ISO 11731 Non-detectable (< 10 CFU/mL) of *Legionella* bacteria	Monthly

Validation Response Guide
Working Document
Version Date: April 2022

University of Pittsburgh
Water Management Program
Validation Response Guide



Using This Guide:

This document is designed to be used along with an ANSI/ASHRAE aligned Water Management Program (WMP). Reference the Validation Criteria section of the WMP for more information on the test method and results that trigger a validation response.

Example Operational Controls:

- 7 day short-term monochloramine system
- Thermal eradication
- Low-level (4ppm) hyperchlorination
- 20ppm hyperchlorination
- Flushing hot/cold water at fixture or surrounding area
- Cleaning/disinfection/replacement of hoses, shower heads, aerators, ice machine lines etc. with a 10% bleach solution
- Hanging shower hoses to drain

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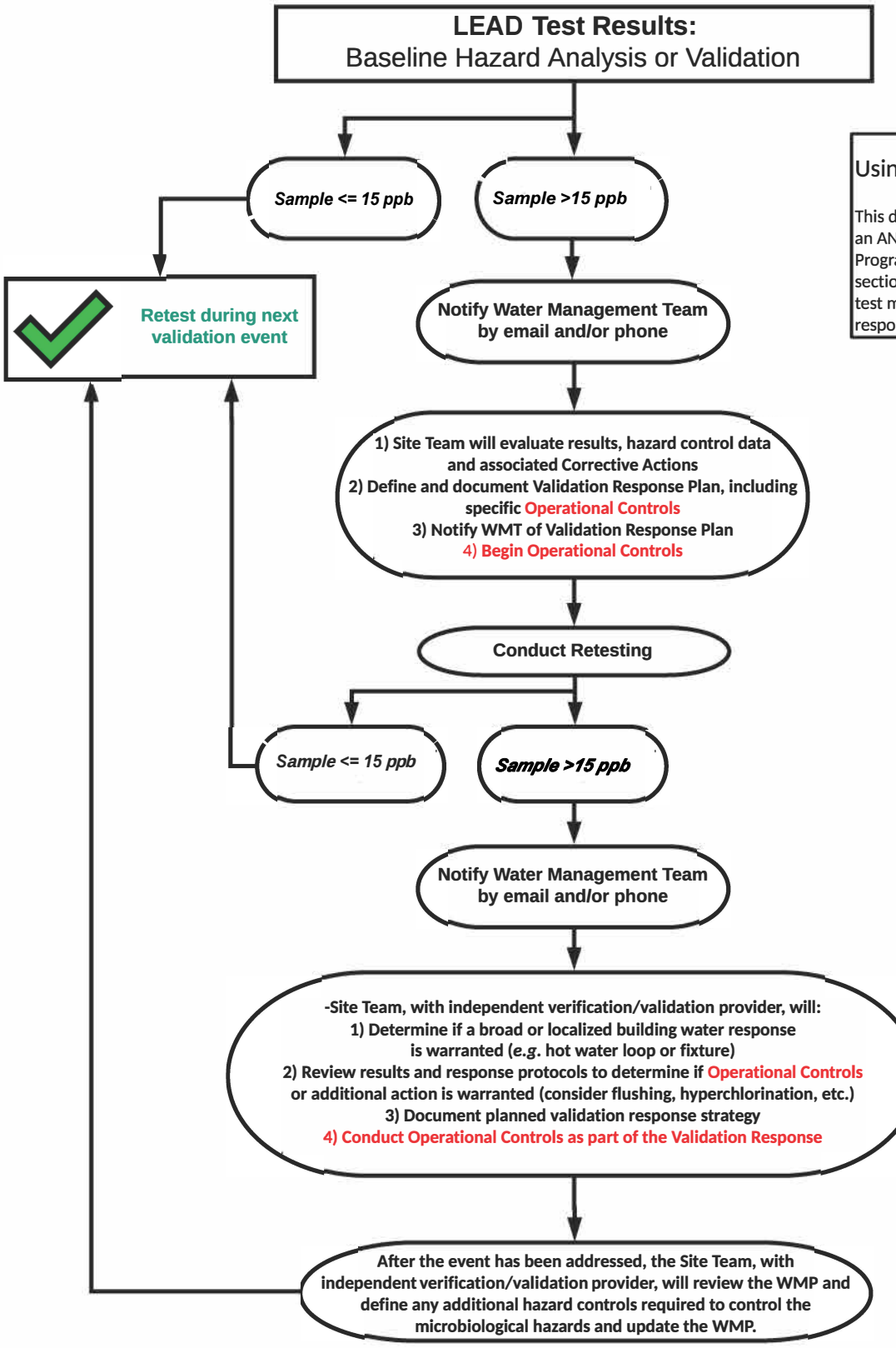
Validation Response Guide for LEAD

Working Document

Version Date: 05 JULY 2022

University of Pittsburgh
Water Management Program



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Verification and Validation Schedule

Organization: University of Pittsburgh

WMP Name: University of Pittsburgh

Document last updated 12/03/2021

Activity	Frequency	Responsibility
1. Verification Review to ensure the program is being implemented as designed (i.e., all controls and planned data collection are being executed).	Quarterly after first implementation of the Program.	Water Management Team/Independent, Third Party Facilitator (Phigenics)
2. Routine validation of the WMP at the scope defined in the Validation Criteria section.	Annual - Typically starting in May and completing by/in August.	Water Management Team/Independent, Third Party Facilitator (Phigenics)
3. Annual reassessment of the WMP to confirm accuracy of of documentation and update as necessary (to include new buildings, newly installed water processing steps, etc.).	Annually per ANSI/ASHRAE 188, or as needed	Water Management Team/Independent, Third Party Facilitator (Phigenics)
4. Routine meetings of the Water Management Team (operations).	Monthly starting September 2021, tentatively moving to quarterly starting April 2022.	Water Management Team/Independent, Third Party Facilitator (Phigenics)
5. Verification that monitoring and corrective action is being performed at defined locations according to the WMP	Quarterly	Water Management Team/Independent, Third Party Facilitator (Phigenics)