Water Management Program

July 2023

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1.0 Purpose and Scope

Reed College has implemented a water management program to ensure proper maintenance and care of water infrastructure campus wide and to provide clean, safe water to our community. The water management program prescribes preventative maintenance practices, a monitoring and sampling schedule of potable and non-potable water throughout the Reed campus, and remedial actions in the event of discovery of out of specification water samples.

For plan specifics including system schematics and historical data please reach out to the Environmental Health and Safety Department.

2.0 Responsibilities of Positions

2.1 Environmental Health and Safety Department (EHS)

EHS oversees the overall Water Management Program including compliance and reporting within the organization or to outside parties. EHS provides executive oversight and is responsible for contacting the appropriate stakeholders in the event of suspected or confirmed Legionnaires' Disease case or other failed water quality standards.

2.2 Facilities Management

Facilities Management is responsible for the implementation of the Water Management Plan. This includes maintenance, monitoring, and operations of systems outlined within the document.

2.3 Building Services

Building Services is responsible for maintaining the cleanliness of potable water sources, including the cleaning of sinks, bathing showers, and water fountains.

3.0 Plan Action Items

3.1 Preventative Maintenance

Facilities maintenance and building services work collaboratively to maintain a clean and functional water system. The following list of tasks are performed by department members at the identified intervals.

3.1.1 Flushing

Residential Hot Water

Hot water heaters and storage tanks that supply residential buildings are fully drained semi-annually after periods of extended vacancy. Target dates for this maintenance coincide with the return of residents after the summer and winter break periods. The following hot water systems are maintained in this manner:

- Old Dorm Block, MacNaughton, Foster/Scholz Central Water Storage System
- Anna Mann Central Water Storage System
- Language Houses Central Water Storage System
- Bragdon Central Water Storage System
- Cross Canyon Dorm Complex Central Water Storage System
- Sullivan/Naito Central Water Storage System
- Trillium Central Water Storage System
- Grove Dorm Complex (Sitka, Aspen, Bidwell, Sequoia) Central Water Storage System
- Birchwood Apartments Non-Central Storage Water Heaters
- Birchwood Laundry Non-Central Storage Water Heaters
- Reed College Apartments Non-Central Storage Water Heaters

Safety Equipment

Safety equipment throughout campus is flushed to ensure a supply of clean water. This includes weekly flushing of eyewashes and monthly flushing of safety showers.

3.1.2 Inspection and Verification

Hot Water Heaters and Storage Tanks

Hot water storage heaters and storage tanks will be inspected annually for the presence of biofilm, scale build, and overall system integrity. Associated gauges and valves will be inspected and verified for functionality, ensuring the delivery water at the proper temperature per plan guidelines.

Backflow Valves

As required by the Portland Water Bureau, annual inspection and verification of cold water backflow valves is conducted by Reed College staff or outside contractors at the request of the Facilities Department. For a complete list of backflow valve locations please contact Facilities Services.

Cooling Water Tower

The cooling water tower is located by the Chemistry facility. The tower is monitored monthly to ensure that it is functioning properly. This includes checking for the buildup or presence of organic material, biofilm, algae, scale, sediment and silt/dust deposits, organics (oil and grease),

and other visible contaminants. Additionally, the chemical disinfectant supply and delivery system is inspected and augmented if necessary.

3.1.3 Chemical Disinfectants and Cleaning

Faucets and Outlets

Regular cleaning of faucets, showerheads, hand wands, and other potable water outlets is conducted by Building Services Staff. Private residential areas (apartments) are cleaned prior to resident occupancy at the beginning of the academic year. Devices are inspected for signs of biofilm growth or scale development and are treated and cleaned accordingly.

Cooling Water Tower

Chemicals and biocides are supplied in accordance with the manufacturer's directions. These disinfectants are administered in quantities sufficient to limit the presence of *Legionella* and biofilms, as well as help prevent the development of scale and corrosion that may facilitate microbial growth. Additional disinfectant may be added in a remediation event.

Evaporative Coolers

Also referred to as "swamp coolers," these devices are used within the Biology greenhouses to help moderate temperature in the summer months. When in use, the evaporative coolers are equipped with a float device that administers chlorine. Additional disinfectant may be added in a remediation event. End of season draining and cleaning is performed as well.

3.2 Monitoring and Sampling

Regular monitoring and sampling of water systems is conducted in order to certify proper mechanical function as well protection from waterborne pathogens and other hazards. Specific criteria vary between systems and locations, but in general the following threshold values are utilized.

3.2.1 Metals

Both the U.S. Environmental Protection Agency (EPA) and the Oregon Department of Human Services-Drinking Water Program set water quality standards. The primary standards, designed to protect public health, are called maximum contaminant levels (MCL). Secondary standards identify levels of substances that may affect the taste, odor, or color of water, may stain sinks and bathtubs, or may interfere with treatment processes. At Reed, we typically check for two primary contaminants – lead and copper – and one secondary contaminant – iron.

Each year Reed staff take water samples of different taps around campus used by the community. Locations include multi-use, administrative, and educational buildings, as well as faculty and student housing. During testing the first liter of water is collected from the tap and sent to a laboratory in Portland to test for the presence of metals. EHS keeps a log of both

sample locations and their results. If results show Reed has unusual sources of contamination above the EPA standards, we determine remedial steps to take and follow-up with an additional round of testing that includes all locations that could potentially be affected (i.e. all sinks within faculty housing). Corrective action reports are filed and kept for documentation.

EPA Standard Requirements

In Parts Per Million (ppm)

Metal	Standard Level	Threshold
Copper (Cu)	Primary	<1.3 ppm
Lead (Pb)	Primary	<0.015 ppm
Iron (Fe)	Secondary	<0.3 ppm

3.2.2 Temperature

Like the rest of Portland, Reed College gets its water from two reservoirs in the protected Bull Run watershed 35 miles east of Portland and from 27 wells located near the south shore of the Columbia River. Water temperatures affect the rate and chance of microbial growth and survival; maintaining appropriate water temperatures throughout the water delivery systems ensures safe water is available for our community.

Potable Water

Each year Reed College tests various residential, academic, and administrative buildings for water temperature (both hot and cold). When available, measurements are taken at the outlet faucet furthest away from the water mains. This is done in an effort to identify any possible worst case scenarios and ensure that the water delivery systems as a whole are functioning properly. Out of specification samples result in additional testing as well as remedial action.

Water kept less than 77 degrees Fahrenheit or above 120 degrees Fahrenheit is generally considered safe from potential *Legionella* contamination. Stagnation of water within plumbing systems can lead to temperatures becoming more conducive to microbial survival and growth.

3.2.3 Disinfectant Residual

The City of Portland is responsible for introducing chlorine to potable water. Chlorine acts as a disinfectant and reduces the likelihood of microbial growth.

Potable Water

Each year Reed College tests various residential, academic, and administrative buildings for chlorine residual (both hot and cold). When available, samples are collected at the outlet faucet furthest away from the water mains. This is done in an effort to identify any possible worst case

scenarios and ensure that the water delivery systems as a whole are functioning properly. Out of specification samples result in additional testing as well as remedial action.

A chlorine residual of 0.5-1.0 mg/L for hot water systems and 1.0-1.5 mg/L for cold water systems is considered adequate for preventing microbial growth. Stagnation can lead to lower concentrations of chlorine in potable water due to natural off-gassing.

Evaporative Coolers

The evaporative coolers are supplied with a continuous feed of chlorine during the months of operation. When in use, chlorine residual is monitored by Facilities Maintenance staff weekly. 2 ppm of chlorine is considered adequate for controlling microbial growth. Out of specification samples result in remedial action.

Cooling Water Tower

The cooling water tower is supplied with a continuous feed of biocide. Twice a year the system is tested for chlorine residual. 0.2-1.8 mg/L of free chlorine is considered adequate for controlling microbial growth. Out of specification samples result in remedial action.

Sports Center Pool

Pool disinfectant residual, as well as other parameters, are monitored and maintained by Athletics, Fitness, and Outdoor Programs staff. Free concentrations of chlorine are maintained between 0.8ppm - 5.0ppm. Should monitoring discover that a parameter is out of specification, corrective action will be performed.

3.2.4 Legionella

Legionella bacteria can cause life threatening diseases, referred to as Legionellosis, especially in individuals with weakened immune systems. Legionellosis refers to two illnesses associated with *Legionella* bacterium. When the bacterium *Legionella* causes pneumonia, the disease is referred to as Legionnaires' disease. *Legionella* can also cause a less severe influenza-like illness known as Pontiac Fever. Most cases of legionellosis are the result of exposure to *Legionella* associated with building water systems.

The presence alone of *Legionella* bacteria in building water systems is not sufficient to cause legionellosis. Other factors including environmental conditions, water temperatures, biofilms, etc. and a means of transmitting the bacteria to people in the building via aerosol generation are necessary to cause an outbreak of disease as a result of exposure. Legionellosis is contracted via inhalation of *Legionella* bacteria. Disease is not transmitted person-to-person.

Potable Water

Water supplied to residential, academic, and administrative buildings is sampled on a rotational basis for *Legionella* bacteria. Both hot and cold water systems are sampled annually at a representative outlet for the respective system. Samples are sent to a lab where a culture test is

performed, the presence of 1 CFU/mL (colony forming units per milliliter) constitutes a positive sample and will result in remedial action.

Cooling Water Tower

Reed College performs quarterly water system testing of the cooling water tower for the presence of *Legionella* bacteria. Water samples are taken and sent to a laboratory in Portland for testing. If *Legionella* is found in concentrations greater than 10 CFU/mL, corrective actions steps are taken and the cooling water tower is re-tested.

Evaporative Coolers

Annual testing for *Legionella* is conducted on evaporative coolers. Water samples are taken and sent to a laboratory in Portland for testing. If *Legionella* is found in concentrations greater than 10 CFU/mL, corrective measures will be performed.

Sportscenter Pool

Legionella sampling is conducted annually at the Sports Center Pool. If *Legionella* is found in any concentration remedial actions will be performed.

3.2.5 Bacterial CFU

Bacterial Colony Forming Units can be tested for water systems on a per request basis. Monitoring for disinfectant residual, temperature, and *Legionella* provides adequate information to determine if the water systems are performing as desired or if remedial action is required.

3.3 Remediation

Should a system or sample fail the criteria listed above, one or more remediation efforts will take place. Affected parties will be notified after a known exposure to a failed quality standard and prior to any disruption to normal water access.

3.3.1 System Flushing and Blowdown

System wide flushing will be conducted in the event of a failed temperature check, lack or over prevalence of disinfectant residual, detection of *Legionella* or high bacterial count, or any other failed parameter of applicable water delivery or storage devices.

3.3.2 Outlet Cleaning and Disinfecting

Cleaning of discharge points will be conducted in the event of a detection of *Legionella* or high bacterial count. Cleaning may be restricted to only the affected outlet if there is no indication of systemic failure. Outlet aerators should be removed and/or cleaned of debris if metal testing reports high concentration.

3.3.3 Thermal Shock

Increasing the temperature of hot water storage systems may be necessary if a system cannot be successfully or completely flushed. Thermal shock may be useful for remediation of storage tanks only. System flushing is preferred due to hazards of high temperature water and lack of system wide distribution capabilities. Additionally, high heat can cause stress or damage on water delivery systems.

Remedial Thermal Shock

Return water temperature of hot water systems should be increased to a minimum of 124 degrees Fahrenheit. The system should then be run and flushed for 30 minutes.

Emergency Thermal Shock

Maintain storage tank water temperature at 158 degrees Fahrenheit for 24 hours while progressively flushing each outlet (including sinks, showers, and drain valves) for at least 20 minutes.

3.3.4 Chemical Shock

Addition of chemical disinfectant to systems where the feeding chemicals is feasible may be utilized in the event of an out of specification sample result. Disinfection should be coupled with washing and cleaning of water holding tanks and accessible areas of the systems to remove algae/biofilms and debris.

Cooling Water Tower

When conducting a chemical shock remediation, follow the following procedure:

1. Turn off scale and corrosion inhibitor feed equipment and any other chemistry or monitoring device that may be affected by a high disinfectant concentration.
2. Maintain operation of condenser water pumps and ensure all other system pumps are active and running. Also, confirm that all side stream devices, secondary loops, balancing lines and cross-connections are open to allow flow during the disinfection process. No part of the system should be out-of-service during the disinfection process.
3. Add an oxidizing biocide to the cooling water tower sump or basin per one of the following:
    - If system pH is less than 8.0, add oxidizing biocide to achieve at least 5 mg/L as free chlorine.
    - If system pH is greater than 8.0, add oxidizing biocide to achieve at least 10 mg/L as free chlorine.

    Notes:

    a. *The existing oxidizing biocide used for water treatment may be used and must be applied in a manner consistent with label use directions.*

   b. *When using chlorine where the system pH is greater than 8.0, it may be necessary to open the blow-down valve to reduce the system pH below 8.0 before chlorine is added.*
   c. *If the system is being treated with a stabilized oxidizing biocide, precautions must be made to prevent over stabilization. Stabilized oxidizing biocide should not be used for shock treatments.*
   d. *If a non-oxidizing biocide is used for "Shock Treatment," it must be applied consistently per label use directions. DBNPA is the recommended non-oxidizing biocide for this purpose.*

4. Allow the system to mix for 15 minutes and measure free chlorine using high range free chlorine indicator strips or equivalent to verify system dosage. Only one of these collected samples is needed to meet or exceed the target dosage.
5. Add additional biocide if required to achieve the target dosage as available chlorine. The target dosage needs only to be achieved, not maintained.
6. Turn on system blowdown for 24 hours to allow system release of biofilms and other solids that may remain suspended in the system.
7. Record action taken, amount of chemical added for future reference, and free chlorine level achieved.
8. Return all equipment to normal operation after the 24-hour blowdown period.
9. Followup testing should be conducted 5 days after treatment to ensure successful remediation.

Evaporative Coolers

When a chemical shock remediation, follow the procedure as stated for the cooling water tower. Consult manufacturer recommendations for steps that may damage or alter parts such as the evaporative media.

3.3.5 Fixture/Pipe Replacement

Fixtures (fountains and faucets) as well as pipes may need to be replaced if samples determine the presence of metals of concern. Multiple samples may need to be drawn to identify the source of the metals (see Appendix 1). Once accurately identified, the source of the metal contamination will be removed to prevent future release.

4.0 References

- 3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities (2018) – Environmental Protection Agency Office of Ground Water and Drinking Water
- Water Management Program Prepared for Reed College (2021) – Nalco Water, An Ecolab Company
- The CDC Investigation of Legionnaires' Disease Among Patients at the VA Pittsburgh Healthcare System (2013) – Centers for Disease Control and Prevention

Appendix 1: Exhibit 4.2 Sample Strategy Flowchart (*3Ts for Reducing Lead in Drinking Water in Schools: Revised Technical Guide. EPA Ground Water and Drinking Water (2007)*)

Exhibit 4.2: Sample Strategy Flowchart