



July 24, 2023

Follow-up Limited Legionella Assessment Report

**Department of Industrial Relations
State of California
7575 Metropolitan Dr
San Diego, CA 92108**

Prepared for:

**Scott Leonard
Facilities and Business Services Manager
Department of Industrial Relations
State of California
1750 Howe Ave, Suite 120
Sacramento, CA 95825
415.629.8802 | SLeonard@dir.ca.gov**

Prepared By:

**Kristy Thornton, MS, COH
Forensic Analytical Consulting Services
3111 Camino del Rio N, Suite 429
San Diego, CA 92108
858-256-7665 |
Kristy.thornton@forensicanalytical.com**

FACS Project #PJ76066

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Executive Summary

Forensic Analytical Consulting Services (FACS) was retained by the California Department of Industrial Relations (DIR) to provide environmental health services regarding a limited *Legionella* assessment of the potable water system serving the Mission Valley State Building located at 7575 Metropolitan Dr., San Diego, California, including the DIR leased space at the building. The assessment was performed as part of a due diligence investigation with respect to *Legionella* bacteria in response to a reported confirmed legionellosis case for one occupant. FACS performed the initial assessment on April 17 & 18, 2023, which included a visual assessment of selected components of the potable water system, collection of water samples for *Legionella* at representative site fixtures, and collection of supporting water chemistry data. Following implementation of hyperchlorination of the domestic hot water (DHW) and domestic cold water (DCW) systems in the building by a third-party water treatment contractor, follow-up assessments were performed by FACS on May 3, June 6, and July 6, 2023, to evaluate the efficacy of remediation efforts.

The current status of the water systems in the building following the July 6, 2023, sampling, as well as a summary of recommendations made to date, are provided in the tables below.

Water Systems Status Following 7/6/23 Sampling	
Water System	Status
Municipal Water	<i>The disinfectant level in the municipal water entering the building remains above the recommended level and temperature is below the recommended minimum. Legionella was not detected in July samples collected from the municipal water. Therefore, Legionella amplification is not suspected in the municipal water.</i>
Central Hot and Cold Water System and Distribution Piping	<i>Results of previous follow-up sampling indicated that hyperchlorination was effective at initially reducing Legionella contamination in the domestic hot water (DHW) and domestic cold water (DCW) systems and distribution piping, however the July assessment found some DHW and DCW samples with Legionella concentrations above recommended action levels. Due to this increase in Legionella concentration over time following the hyperchlorination, re-amplification in the DHW and DCW is suspected. DHW temperatures measured at representative points have decreased to below the recommended minimum over time, which may be contributing to re-amplification. Point-of-use or in-line filters are in place at all fixtures within the building. Samples collected from fixtures with filters on were non-detect for Legionella, which indicates that filters are effective in controlling potential exposure to Legionella in the central water systems.</i>
Janitor Closet Sinks and Breakroom Sinks	<i>Results of follow-up sampling indicate that hyperchlorination was effective at addressing localized Legionella contamination in localized janitor closet and break room sinks. Manual faucets located in the janitor closet sinks are fitted with point-of-use filters. All breakroom sink fixtures are fitted with in-line filters. Pre-flush samples collected in July with filters removed at these fixtures were non-detect for Legionella. Therefore, localized Legionella amplification at these fixtures is not suspected.</i>
Restroom Showers	<i>Results of previous follow-up sampling indicated that hyperchlorination was effective at addressing localized Legionella contamination in showers. All showers are fitted with point-of-use filters. A pre-flush sample collected in July at a restroom shower fixture found Legionella concentration above recommended action levels. This result indicates there is localized re-amplification of Legionella at the shower sampled. There is potential for localized Legionella re-amplification in other restroom showers.</i>
Restroom Automated Sinks	<i>Results of follow-up sampling indicate that hyperchlorination and fixture replacement efforts were effective at addressing localized Legionella contamination in localized automated restroom sinks. All automated fixtures in the restrooms have been replaced and all fixtures are equipped with an in-line filter, at a minimum. Select additional fixtures are equipped with both an in-line and point of use filter. Pre-flush samples collected in July with filters removed were non-detect for Legionella. Therefore, localized Legionella amplification at these fixtures is not suspected.</i>

Water Systems Status Following 7/6/23 Sampling	
Water System	Status
Drinking Fountains	Results of previous follow-up sampling indicated localized Legionella contamination at drinking fountains. All drinking fountains were cleaned and disinfected or replaced. A post-flush sample from a drinking fountain collected in July found Legionella concentration above recommended action levels. As only the post-flush sample found Legionella, this result is likely related to re-amplification of Legionella in the central DCW system and not localized re-amplification at the drinking fountain fixture. Localized Legionella amplification at drinking fountains is not suspected. However, recommendations for drinking fountains are provided below as a measure of precaution.
DCW Expansion Tank	Results of previous follow-up sampling indicated localized Legionella contamination at the rooftop mechanical area expansion tank. The sample collected in July from the expansion tank found Legionella concentrations above recommended levels. Temperature measurements in the DCW from the expansion tank have been above the recommended maximum temperature, which is likely due to the configuration of the nearby domestic hot water return piping. The expansion tank does not represent a risk for occupant exposure as there is no exposure point where water is accessible. Recommendations are provided to prevent Legionella contamination of downstream systems. See recommendations.
KEY	Corrective Action Recommended, See Recommendations Summary Corrective Action Not Recommended, Continue to Monitor

FACS Recommendations Summary		
#	Recommendations Made After the Initial Assessment (April 17-18, 2023)	Completion
1.	Develop a corrective action plan within a reasonable timeframe (i.e., within about a week) to address Legionella amplification in the domestic hot and cold-water systems for the building.	<input type="checkbox"/>
2.	Remediation of the domestic hot and cold-water systems should be included in the corrective action plan. Consult with a qualified water treatment contractor regarding the most appropriate methods, however chemical treatment (e.g., with a chemical oxidant) is often referenced as an effective method for short-term remediation.	<input type="checkbox"/>
3.	If point of use (POU) and in-line filters are installed to control potential Legionella exposure while remediation efforts are completed and confirmed effective, a plan needs to be developed for regular inspection and replacement of filters.	<input type="checkbox"/>
4.	Additional recommendations for the building include ensuring the DHWST is supplying water consistently stored at 140°F or above. Where scalding concerns are present, delivery temperatures should be targeted as close to 120°F as possible.	<input type="checkbox"/>
5.	Perform a visual assessment of accessible point-of-use fixtures, aerators, and laminar flow devices to identify areas of excessive scale, corrosion, biofilm, or debris. Perform cleaning and disinfection of fixtures, aerators, and laminar flow devices exhibiting excessive scale, corrosion, biofilm, or debris. Alternatively, these fixtures, aerators, and laminator flow devices can be replaced.	<input type="checkbox"/>
6.	Following any additional remediation activities, perform validation sampling to ensure efficacy of remediation efforts to reduce Legionella concentrations in the building.	<input type="checkbox"/>
7.	Consider the development and implementation of a comprehensive water management plan to manage ongoing Legionella risk for the property in the future.	<input type="checkbox"/>
#	Recommendations Made After the First Follow-Up Assessment (May 3, 2023)	Completion
1.	Develop a corrective action plan within a reasonable timeframe (i.e., within about a week) to address the identified localized contamination at fixtures represented by the sample results.	<input type="checkbox"/>
2.	Physically clean and disinfect, or alternatively replace, all fixtures represented by positive sample results. Filtration should remain in place until follow-up sampling demonstrates adequate control of localized Legionella contamination.	<input type="checkbox"/>

FACS Recommendations Summary		
3.	<i>Perform ongoing follow-up sampling at regular intervals (e.g., every two weeks for three months followed by every month for an additional three months) to validate continued control of Legionella amplification in the building.</i>	<input type="checkbox"/>
#	Recommendations Made After the Second Follow-Up Assessment (June 6, 2023)	Completion
1.	<i>Develop a corrective action plan within a reasonable timeframe (i.e., within about a week) to address the identified localized contamination at fixtures represented by the sample results.</i>	<input type="checkbox"/>
2.	<i>It is recommended to thoroughly clean (including removal of scale and debris) and disinfect all drinking fountains, followed by validation sampling. In the interim, all of these fixtures should be removed from service, as installation of point of use filters is not feasible.</i>	<input type="checkbox"/>
3.	<i>It is recommended that all automated fixtures be disinfected or replaced, followed by validation sampling. In the interim, all of these fixtures should be equipped with point of use filters or removed from service. It should be noted that while these fixtures have in-line filters in place between building piping and the fixture, such filters do not protect from Legionella in the fixture itself and associated lines after the filter.</i>	<input type="checkbox"/>
4.	<i>It is recommended that the DCW expansion tank be cleaned and disinfected. In addition, the location of this tank and its proximity to nearby hot water lines should be evaluated in order to reduce future risk of Legionella amplification.</i>	<input type="checkbox"/>
5.	<i>Perform ongoing follow-up sampling at regular intervals (e.g., every two weeks for three months followed by every month for an additional three months) to validate continued control of Legionella amplification in the building.</i>	<input type="checkbox"/>
#	Recommendations Made After the Third Follow-Up Assessment (July 6, 2023)	Completion
1.	<i>Develop a corrective action plan within a reasonable timeframe (i.e., within about a week) to address the identified localized contamination at fixtures represented by the sample results. This action plan should include a daily flushing program. Consider hyperdisinfection to address potential re-amplification of Legionella in the centralized DHW and DCW water systems serving the building.</i>	<input type="checkbox"/>
2.	<i>Install in-line filters on the drinking fountains or, alternatively, remove drinking fountains from service if an appropriate filtration option cannot be identified.</i>	<input type="checkbox"/>
3.	<i>Increase the temperature of the domestic hot water storage tank (DHWST) such that DHW delivery temperatures are as close to 120°F as possible. Available guidance recommends that DHW is consistently stored at 140°F or above and DHW delivery temperatures be 120°F or above. Risk of scalding should be considered in accordance with local public health regulations, as applicable.</i>	<input type="checkbox"/>
4.	<i>Evaluate the configuration of the roof top DCW expansion tank and its proximity to the nearby domestic hot water return line to assess the potential for conductive heat gain. Consult with a building engineer, as needed.</i>	<input type="checkbox"/>
5.	<i>Continue to implement point-of-use and in-line filtration at all building fixtures until further validation sampling demonstrates that the Legionella amplification is controlled in building water systems.</i>	<input type="checkbox"/>
6.	<i>Perform ongoing follow-up sampling at regular intervals (e.g., every two weeks for three months followed by every month for an additional three months) to validate continued control of Legionella amplification in the building.</i>	<input type="checkbox"/>
7.	<i>Work towards the development and implementation of a comprehensive water management plan to manage ongoing Legionella risk for the property in the future.</i>	<input type="checkbox"/>

Introduction

Forensic Analytical Consulting Services (FACS) was retained by the California Department of Industrial Relations (DIR) to provide environmental health services regarding a limited *Legionella* assessment of the potable water system serving the Mission Valley State Building located at 7575 Metropolitan Dr., San Diego, California, including the DIR leased space at the building. The assessment was performed as part of a due diligence investigation with respect to *Legionella* bacteria in response to a reported confirmed legionellosis case for one occupant. FACS performed the initial assessment on April 17 & 18, 2023, which included a visual assessment of selected components of the potable water system, collection of water samples for *Legionella* at representative site fixtures, and collection of supporting water chemistry data. Following implementation of hyperchlorination (i.e., disinfection) of the domestic hot water (DHW) and domestic cold water (DCW) systems in the building by a third-party water treatment contractor, follow-up assessments were performed by FACS on May 3, June 6, and July 6, 2023, to evaluate the efficacy of remediation efforts.

The purpose of the initial and follow-up assessments was to 1) perform a due diligence investigation and assess the water system and related components for potential sources of *Legionella* amplification; 2) make recommendations for corrective action, as necessary; and 3) provide information for consideration in assessing risk to building occupants.

Background

Legionella

Legionella bacteria are waterborne pathogens that may naturally be present, albeit typically in low concentrations, in various water system types including surface, ground, potable, and other water systems or reservoirs. While naturally occurring in the environment, *Legionella* bacteria can become a concern for public health when amplification, or growth, of the bacteria occurs in a water system, which results in subsequent human exposure. Exposure to *Legionella* bacteria can result in illness, specifically Legionnaires' Disease, Pontiac Fever, or extrapulmonary legionellosis. Immunocompromised individuals are more susceptible to developing *Legionella*-related illness following exposure to *Legionella*.

Available guidance documents have recognized several conditions that favor amplification of *Legionella* bacteria in water systems. In general, these conditions include:

- Lack of flow or water stagnation either by design (e.g., cap) or lack of use (e.g., unused fixture).
- Improper water chemistry, including low or no residual oxidant or available water treatment.
- Temperature within the growth range of the bacteria.
- The presence of backflow problems or cross-connection between water systems with different uses/purposes.
- The presence of scale, debris, algae, or other commensurate organisms in the water system or equipment served by the system.

To prevent potential exposure to *Legionella* bacteria, it is important to identify and control the source(s) of *Legionella* to limit growth and amplification. Amplification can impact downstream and upstream service connections and pipe work, resulting in increased contamination of the water system over time. Therefore, control of growth conditions within a water system with appropriate water management practices significantly reduces the risk of exposure to *Legionella* bacteria.

Available Guidance

The assessment technique and recommendations draw upon principles and concepts contained in the guidelines and references listed below, as well as other industry guidelines and documents:

- American Industrial Hygiene Association (AIHA): “Recognition, Evaluation and Control of *Legionella* in Building Water Systems, 2nd Ed. (2022)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): “ANSI/ASHRAE Standard 188-2021 Legionellosis: Risk Management for Building Water Systems” (2021)
- United States Centers for Disease Control (CDC) “Toolkit for Controlling *Legionella* in Common Sources of Exposure (*Legionella* Control Toolkit)” (2021)
- United States Centers for Disease Control (CDC) “Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings: A Practical Guide to Implementing Industry Standards, Version 1.1” (2021)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): “ASHRAE Guideline 12-2020 Managing the Risk of Legionellosis Associated with Building Water Systems” (2020)
- United States Environmental Protection Agency (EPA): “Technologies for *Legionella* Control in Premise Plumbing Systems: Scientific Literature Review” (2016)

Site Characterization

A site and water systems characterization has been previously described in FACS reports dated June 23, 2023, June 1, 2023, and May 8, 2023.

Site History

Based on conversations with site representatives, FACS developed the following site history:

- In April 2023, DIR was notified of an employee with a legionellosis diagnosis.
- The employee worked on level 2 of the state building.
- DIR contacted FACS on April 14, 2023, to perform a due diligence limited *Legionella* assessment with a focus on previous positive locations, as sampled by a separate party (DGS’ water treatment contractor). This assessment was also established to shadow the water treatment contractor for DGS for due diligence sampling.
- On April 17 & 18, 2023, FACS was on site to conduct an initial assessment and water sampling at the building.
- A professional water treatment contractor was retained by DGS, who performed hyperchlorination of the DHW & DCW systems serving the building. The hyperchlorination protocol was developed by DGS’ water treatment contractor.
- On April 21, 2023, point of use (POU) or in-line filters were installed on sinks and showers by DGS and the water treatment contractor as an additional control measure. This was done only at locations where positive sample results were collected.
- On April 24, 2023, FACS received preliminary water sample results from the laboratory. Verbal recommendations were provided to DIR and included recommendations for remediation of the DHW and DCW systems at the property.
- FACS was onsite on May 3, 2023, to perform a follow-up assessment to evaluate the efficacy of remediation efforts. Following receipt of positive sampling results at various fixtures, FACS made

recommendations for corrective actions, including addressing all fixtures that were represented by the positive sampling results, not just the specific fixtures sampled.

- On June 2, 2023, DGS replaced only the specific fixtures where positive Legionella samples were found and installed POU filters.
- FACS was onsite on June 6, 2023, to perform a second follow-up assessment to evaluate the efficacy of remediation efforts. Following receipt of positive sampling results at various fixtures, FACS made recommendations for corrective actions, including addressing all fixtures that were represented by the positive sampling results, not just the specific fixtures sampled.
- FACS was onsite July 6, 2023, to perform a third follow-up assessment to evaluate the efficacy of remediation efforts. DGS had replaced all automated restroom fixtures in the building and drinking fountains had either been replaced or thoroughly cleaned and disinfected prior to this assessment. Following receipt of positive sampling results at various locations, FACS made recommendations for corrective actions.

Scope of Work

In the course of this project, FACS conducted the following scope of work:

1. Development of a site characterization and history (see sections above).
2. Review of available plumbing plans and diagrams provided by DIR and DGS representatives where available.
3. Visual assessment of representative water systems and components including collection of environmental data (e.g., water temperature/oxidant/pH) from representative water systems and components.
4. Collection of water samples for *Legionella* bacteria from representative water systems and components with a focus on the centralized domestic hot and cold water systems and locations that had previous positive results.

The following data collected in the course of the investigation is presented in the appendices of this report as follows:

- Photographs from site inspection
- Data summaries from environmental sampling

Sampling and Analytical Methods

Legionella Samples

Water samples for *Legionella* analysis were collected from representative water systems and components at the facility during the assessment. Each water sample was selected based on review of the plumbing plans, building characteristics, and water systems distribution and related risk assessment to assess potential sources of *Legionella* amplification.

FACS collected both pre-flush and post-flush samples from representative point-of-use fixtures throughout the property during the initial assessment (April 17 & 18, 2023) and follow-up assessments (May 3, June 6, 2023, and July 7, 2023). Pre-flush samples were collected without flushing the fixture to be representative of water in contact with the fixture since the previous use. Post-flush samples were collected after flushing until the water temperature was stable to represent water originating from the main distribution header. Each sample type was selected to provide information related to potential sources of *Legionella* in the water supply, pre-flush samples being heavily influenced by the fixture and local plumbing condition, and post-flush samples representing water quality from the municipal supply

and main distribution pipes. Additionally, temperature, pH, and residual disinfectant (monochloramine) readings were collected at representative sampling locations.

Water samples were collected in 250 milliliter sterile plastic containers provided by the laboratory and pre-preserved with sodium thiosulfate. Water samples were shipped overnight to Special Pathogens Laboratory (SPL) for identification, enumeration and serotyping of *Legionella* bacteria. SPL is a Centers for Disease Control & Prevention (CDC) Environmental *Legionella* Isolation Techniques Evaluation (ELITE) Program certified laboratory.

A description of the materials and methods used for data and sample collection and analysis can be found in Appendix B.

Findings & Conclusions

General Observations

Backflow Protection

Backflow preventers are devices that are installed to allow water to flow only in one direction and prevent flow in the opposite direction. These devices prevent cross-contamination of bacteria or other contaminants from one water system to another. Backflow preventers are typically in place to separate municipal supply or non-potable water systems (e.g., irrigation or industrial water systems) from potable water systems.

A backflow protection device was observed at the incoming municipal supply on the street prior to entry to the property. Appropriate backflow protection was also observed at DCW connections to ICW supplies and relevant equipment.

Scale, Debris, and Biofilm

The presence of scale, biofilm, and other debris or particulate can serve as a nutrient source as well as surface area that can promote the growth of *Legionella* in water systems. Scale was observed at the following fixtures during the initial assessment:

Moderate levels of scale, sediment, or biofilm were observed at the following fixtures:

- Follow-up Assessment, July 6, 2023
 - All fixtures replaced, no fixtures identified with scale or biofilm
- Observations from previous initial and follow-up assessments are detailed in the FACS reports dated May 8, 2023, June 1, 2023 and June 23, 2023.

Chemistry & Temperature

In domestic water, a residual monochloramine concentration of at least 0.5 ppm with a maximum of 3.0 ppm is typically recommended in the available guidance. The disinfection efficacy of monochloramine is less impacted by pH as compared with chlorine, with a recommended pH for domestic water system ranging from approximately 6.5 – 8.5.

Most available guidance documents regarding the control of *Legionella* in building water systems recommend that the temperature of cold-water systems be maintained below 68-77°F for the prevention of amplification of *Legionella*. Recommended domestic hot water temperatures are typically ≥120°F at the delivery point and ≥140°F for hot water storage. According to the CDC, the ideal temperatures for *Legionella* growth typically lie between 77-113°F.

FACS collected field samples for monochloramine, temperature, and pH at various components within the domestic water systems on the property during the July 6, 2023 follow-up assessment.

Chemistry and temperature measurements from previous initial and follow-up assessments are detailed in the FACS reports dated May 8, 2023, June 1, 2023 and June 23, 2023.

Incoming Municipal Supply

The stabilized monochloramine measurement was 2.68 ppm at the incoming point of entry into the building, which was above the recommended minimum monochloramine concentration for *Legionella* control in potable water of 0.5 ppm, indicating water entering the building is within the acceptable range. pH was measured at 7.8 – 8.0 and was within the acceptable range for monochloramine disinfection efficacy.

The domestic cold water (DCW) temperature at the incoming point of entry was 75°F, which was below the recommended DCW delivery temperature of ≤77°F and showed acceptable temperature.

Domestic Cold Water (DCW)

Temperature measurements at DCW sampling points during the third follow-up assessment (7/6/23) ranged from 67-84°F, with four samples above the maximum recommended temperature for DCW (≤77°F), recorded at the Suite 108 breakroom, Janitor closet J-11, Women's Restroom adj 300-5, and again at the DCW expansion tank lead line on the roof. Testing for residual disinfectant at the DCW sampling points found concentrations of monochloramine ranging from 0.10 – 2.57 ppm, with three of the four samples below the target range for disinfection of domestic water systems (≥0.5 ppm). pH measurements at the DCW sampling points were within the recommended target range for potable water treated with monochloramine.

Domestic Hot Water (DHW)

Temperature measurements at DHW sampling points ranged from 105-121°F (7/6/23), with six temperatures below the minimum recommended temperature for DHW (≥120°F). In general, DHW temperatures at sampling points have decreased over time with repeated follow-up assessments. Testing for residual disinfectant at DHW sampling points found concentrations of monochloramine ranged from 0.07-1.36 ppm (7/6/23), with four (4) locations below the target range for disinfection of domestic water systems (≥0.5 ppm). pH measurements at DHW sample points were within the recommended target range for potable water treated with monochloramine during all assessments.

Temperature measurements collected at the domestic hot water storage tank (DHWST) serving the building recorded 121°F (7/6/23) and was below the recommended minimum temperature for hot water storage (≥140°F). In general, DHWST temperatures have decreased over time with repeated follow-up assessments. Residual disinfectant concentration at the DHWST measured 0.24 ppm (6/6/23) and was below the target range for disinfection of domestic water systems (≥0.5 ppm). pH measurements at the DHWST sample points were within the recommended target range for potable water treated with monochloramine during all assessments.

Legionella Sample Results

Limited guidance is available from several agencies and organizations for the interpretation of *Legionella* sample results. The CDC and AIHA provide some quantitative recommendations for interpreting sample results by water source as well as subsequent corrective actions to be taken based upon currently available guidance and knowledge. The CDC recommends a multi-factorial approach to sample interpretation that includes sample concentration, change in sample concentration over time, the extent of sample positivity, and the type or species of *Legionella* identified. The AIHA approach to interpretation is based on sample concentration with recommendations based on concentration and whether

legionellosis cases have been identified. The CDC and AIHA interpretation guidance are provided in Appendix E.

Legionella sample results from previous initial and follow-up assessments are detailed in the FACS reports dated May 8, 2023, June 1, 2023 and June 23, 2023.

Municipal Water

Legionella was not detected in samples (0% positivity) collected from the municipal supply during the third follow-up assessment (7/6/23).

These sample results meet criteria established by the CDC for a controlled water system. They also meet criteria established by the AIHA to indicate no action is required in the DCW system. Therefore, amplification of *Legionella* in the municipal water is not suspected.

Domestic Cold Water (DCW)

Legionella was detected in four (4) of eighteen (18) samples (22% positivity) collected from the DCW system during the third follow-up assessment (7/6/23). Concentrations of *Legionella* ranged from 5.0-105.0 CFU/mL with the following type identified: *Legionella pneumophila* not serogroups 1-6. *Legionella pneumophila* types are highly associated with *Legionella*-related illness according to the CDC.

These sample results meet criteria established by the CDC for a poorly controlled or uncontrolled water systems based on concentration, extent of positivity, increase in concentration over time, and types of *Legionella* identified. They also meet criteria established by the AIHA to indicate *Legionella* growth in the DCW system and distribution piping. Therefore, re-amplification of *Legionella* in the central DCW system following initial hyperchlorination is suspected.

It should be noted that POU and in-line filters have been installed at all fixtures and all samples collected with the filters in place did not detect *Legionella*, which indicates that filters are effective in controlling potential exposure to Legionella in the central water systems.

Domestic Hot Water (DHW)

Legionella was detected in four (4) of eleven (11) post-flush samples (36% positivity) collected from the DHW system during the third follow-up assessment (7/6/23). Concentrations of *Legionella* ranged from 5.0-65.0 CFU/mL with the following type identified: *Legionella pneumophila* not serogroups 1-6. *Legionella pneumophila* types are highly associated with *Legionella*-related illness according to the CDC.

These sample results meet criteria established by the CDC for a poorly controlled or uncontrolled water system based on concentration, extent of positivity, increasing concentration over time, and types of *Legionella* identified. They also meet criteria established by the AIHA to indicate *Legionella* growth in the DHW system and distribution piping. Therefore, re-amplification of *Legionella* in the central DHW system following initial hyperchlorination is suspected. DHW temperatures measured at representative points have decreased to below the recommended minimum over time, which may be contributing to re-amplification.

It should be noted that POU and in-line filters have been installed at all fixtures and all samples collected with the filters in place did not detect *Legionella*, which indicates that filters are effective in controlling potential exposure to Legionella in the central water systems.

Localized Fixtures

Janitor Closet Sinks and Breakroom Sinks

Legionella was not detected in samples (0% positivity) collected from the janitor's closet sinks or breakroom sinks during the third follow-up assessment (7/6/23).

These sample results meet criteria established by the CDC for controlled fixtures. They also meet criteria established by the AIHA to indicate no action is required. Therefore, localized amplification of *Legionella* at janitor's closet and breakroom sinks is not suspected.

Restroom Showers

Legionella was detected in the pre-flush sample collected from the Women's Restroom (13-1) shower during the third follow-up assessment (7/6/23) at a concentration of 55 CFU/mL. The following type was identified: *Legionella pneumophila* not serogroups 1-6. *Legionella pneumophila* types are highly associated with *Legionella*-related illness according to the CDC.

This sample result meets criteria established by the CDC for a poorly controlled or uncontrolled fixture based on concentration and type of *Legionella* identified. It also meets criteria established by the AIHA to indicate *Legionella* growth at the shower fixture. Localized *Legionella* re-amplification is suspected at the Women's Restroom (13-1) showers. There is potential for localized re-amplification of *Legionella* in other restroom showers.

Restroom Automated Sinks

Legionella was not detected in pre-flush samples (0% positivity) collected from the restroom automated sinks during the third follow-up assessment (7/6/23).

These sample results meet criteria established by the CDC for controlled fixtures. They also meet criteria established by the AIHA to indicate no action is required. Therefore, localized amplification of *Legionella* at restroom automated sinks is not suspected.

Drinking Fountains

Legionella was detected in one (1) of six (6) post-flush samples (17% positivity) collected from the drinking fountains during the third follow-up assessment (7/6/23) at a concentration of 105 CFU/mL. The following type was identified: *Legionella pneumophila* not serogroups 1-6. *Legionella pneumophila* types are highly associated with *Legionella*-related illness according to the CDC.

As only the post-flush sample found *Legionella*, this result is likely related to re-amplification of *Legionella* in the central DCW system and not localized re-amplification at the drinking fountain fixture. Localized *Legionella* amplification at drinking fountains is not suspected. However, recommendations for drinking fountains are provided as a measure of precaution.

Mechanical Equipment

DCW Expansion Tank (located Rooftop)

Legionella was detected in the sample collected from the rooftop DCW expansion tank inlet during the third follow-up assessment (7/6/23) at a concentration of 5 CFU/mL. The following type was identified: *Legionella anisa*. *Legionella anisa* is not typically associated with *Legionella*-related illness according to the CDC.

Temperature measurements in the DCW from the expansion tank have been above the recommended maximum temperature, which is likely due to the configuration of the nearby domestic hot water return piping. The expansion tank does not represent a risk for occupant exposure as there is no exposure point where water is accessible. Recommendations are provided to prevent *Legionella* contamination of downstream systems. See recommendations.

A summary of assessment findings, data, and sampling results is provided in Table 1 - Table 5 in Appendix C of this report.

Recommendations

Following the initial assessment (April 17 & 18 2023) and each of the follow-up assessments (May 3, June 6, and July 6, 2023), verbal recommendations were provided to DIR for immediate implementation. It is understood DIR are not the property managers of the building therefore these recommendations may be implemented by another party such as DGS or a third-party contractor. The specific recommendations made were as follows:

Recommendations Provided Following April 17 & 18, 2023 Initial Assessment:

1. Develop a corrective action plan within a reasonable timeframe (i.e., within about a week) to address *Legionella* amplification in the domestic hot and cold-water systems for the building.
2. Remediation of the domestic hot and cold-water systems should be included in the corrective action plan. Consult with a qualified water treatment contractor regarding the most appropriate methods, however chemical treatment (e.g., with a chemical oxidant) is often referenced as an effective method for short-term remediation.
3. If point of use (POU) and in-line filters are installed to control potential *Legionella* exposure while remediation efforts are completed and confirmed effective, a plan needs to be developed for regular inspection and replacement of filters.
4. Additional recommendations for the building include ensuring the DHWST is supplying water consistently stored at 140°F or above. Where scalding concerns are present, delivery temperatures should be targeted as close to 120°F as possible.
5. Perform a visual assessment of accessible point-of-use fixtures, aerators, and laminar flow devices to identify areas of excessive scale, corrosion, biofilm, or debris. Perform cleaning and disinfection of fixtures, aerators, and laminar flow devices exhibiting excessive scale, corrosion, biofilm, or debris. Alternatively, these fixtures, aerators, and laminator flow devices can be replaced.
6. Following any additional remediation activities, perform validation sampling to ensure efficacy of remediation efforts to reduce *Legionella* concentrations in the building.
7. Consider the development and implementation of a comprehensive water management plan to manage ongoing *Legionella* risk for the property in the future.

Recommendations Provided Following May 3, 2023, Follow-Up Assessment:

1. Develop a corrective action plan within a reasonable timeframe (i.e., within about a week) to address the identified localized contamination at fixtures represented by the sample results.
2. Physically clean and disinfect, or alternatively replace, all fixtures represented by positive sample results. Filtration should remain in place until follow-up sampling demonstrates adequate control of localized *Legionella* contamination.
3. Perform ongoing follow-up sampling at regular intervals (e.g., every two weeks for three months followed by every month for an additional three months) to validate continued control of *Legionella* amplification in the building.

Recommendations Provided Following June 6, 2023, Follow-Up Assessment:

1. Develop a corrective action plan within a reasonable timeframe (i.e., within about a week) to address the identified localized contamination at fixtures represented by the sample results.
2. Thoroughly clean (including removal of scale and debris) and disinfect all drinking fountains, followed by validation sampling. In the interim, all of these fixtures should be removed from service, as installation of point of use filters is not feasible.
3. All automated fixtures should be disinfected or replaced, followed by validation sampling. In the interim, all of these fixtures should be equipped with point of use filters or removed from service. It should be noted that while these fixtures have in-line filters in place between building piping and

the fixture, such filters do not protect from *Legionella* in the fixture itself and associated lines after the filter.

4. The DCW expansion tank be cleaned and disinfected. In addition, the location of this tank and its proximity to nearby hot water lines should be evaluated in order to reduce future risk of *Legionella* amplification.
5. Perform ongoing follow-up sampling at regular intervals (e.g., every two weeks for three months followed by every month for an additional three months) to validate continued control of *Legionella* amplification in the building.

Recommendations Provided Following July 6, 2023, Follow-Up Assessment:

1. Develop a corrective action plan within a reasonable timeframe (i.e., within about a week) to address the identified localized contamination at fixtures represented by the sample results. This action plan should include a daily flushing program. Consider hyperdisinfection to address potential re-amplification of *Legionella* in the centralized DHW and DCW water systems serving the building.
2. Install in-line filters on the drinking fountains or, alternatively, remove drinking fountains from service if an appropriate filtration option cannot be identified.
3. Increase the temperature of the domestic hot water storage tank (DHWST) supplying such that DHW delivery temperatures are as close to 120°F as possible. Available guidance recommends that DHW is consistently stored at 140°F or above and DHW delivery temperatures be 120°F or above. The risk of scalding should be considered in accordance with local public health regulations, as applicable.
4. Evaluate the configuration of the roof top DCW expansion tank and its proximity to the nearby domestic hot water return line to assess the potential for conductive heat gain. Consult with a building engineer, as needed.
5. Continue to implement point-of-use and in-line filtration at all building fixtures until further validation sampling demonstrates that the *Legionella* amplification is controlled in building water systems.
6. Perform ongoing follow-up sampling at regular intervals (e.g., every two weeks for three months followed by every month for an additional three months) to validate continued control of *Legionella* amplification in the building.
7. Work towards the development and implementation of a comprehensive water management plan to manage ongoing *Legionella* risk for the property in the future.

Limitations

This investigation is limited to the conditions and practices observed and information made available to FACS. The methods, conclusions, and recommendations provided are based on FACS' judgment, experience and the standard of practice for professional service. They are subject to the limitations and variability inherent in the methodology employed. As with all environmental investigations, this investigation is limited to the defined scope and does not purport to set forth all hazards, nor indicate that other hazards do not exist.

Please do not hesitate to contact our office if you have any additional questions or concerns. Thank you for the opportunity to assist the California Department of Industrial Relations (DIR) in promoting a more healthful environment.

Respectfully,
FORENSIC ANALYTICAL



Kristy Thornton, MS, COH
Local Director, San Diego



Reviewed by,
FORENSIC ANALYTICAL



Megan Canright Racicot, MPH, CIH
Director of Scientific Operations



Appendix A

Photographs



Photo #1: Cleaned and disinfected drinking fountain



Photo #2: Cooler for water fountain



Photo #3: In-line filter - Suite 108 breakroom sink



Photo #4: In-line filter and hot water heater – Suite 108 restroom sink



Photo #5: New fixtures being installed in restrooms



Photo #6: Newly replaced drinking fountain



Photo #7: POU filter installed in restroom with new fixture



Photo #8: Mixer tap in breakroom



Photo #9: In-line filter installed under breakroom sink



Photo #10: Water heater under breakroom sink



Photo #11: Janitor close sink – POU filter



Photo #12: DHWST

Appendix B

Data Collection and Laboratory Methods

Legionella. Sample collection materials were provided by the laboratory performing the analysis. All bacterial samples were collected using aseptic technique. For water samples, approximately 250 milliliters (mL) of water were collected using wide-mouth sterile plastic containers containing sodium thiosulfate preservative. Collection of pre-flush (first-draw) water samples at fixtures was performed first, followed by collection of post-flush (late-draw) samples from fixtures when the water temperature had stabilized (typically after approximately one minute of flushing). Collection of water temperature, residual disinfectant, and pH measurements was performed alongside water sampling.

Water samples were collected in plastic containers provided by the laboratory and pre-preserved with sodium thiosulfate. The samples were sealed and labeled and placed in an insulated container for shipment. Samples were sent under chain of custody to Special Pathogens Laboratories (SPL) for culture analysis for *Legionella* using the International Organization for Standardization (ISO) Method 11731:2017 (E). SPL is a CDC Environmental *Legionella* Isolation Techniques Evaluate (ELITE) proficient laboratory for analysis of *Legionella*. Samples were transported in insulated packaging to the analytical laboratory and reached the laboratory within 24 hours of collection. Results are presented as a concentration of viable *Legionella* in colony forming units per milliliter of sample (CFU/mL).

Water Sampling Colorimetry. All colorimetric measurements were collected using a Hach DR900 colorimeter. A small volume of water was collected into a cuvette, which was used to blank correct the colorimeter with each new source of water sampled. Following blank adjustment, a reagent powder or liquid, specific to the type of measurement, was added to the sample and the sample was agitated to facilitate reaction. After a reaction period specified by the appropriate method (listed below), the cuvette was then inserted into the colorimeter and read for specific concentration.

Chemical	US EPA Method	Detectable Range (ppm)	Reagent Type/s	HACH #
Monochloramine	Indophenol 10171	0.04-4.50 Cl ₂	Monochlor F Reagent Pillows	DOC316.53.01015

Temperature. Temperature was measured using a National Institute of Standards and Technology (NIST) traceable thermometer. Water was collected in a satellite container and the temperature probe was inserted and swirled in the water to ensure adequate probe contact, mixing, and to reduce temperature stratification during temperature measurement.

pH. Measurements of pH were collected using a calibrated pen-type pH meter. Water was collected in a satellite container and the pH probe was inserted into the water to collect a measurement.

Appendix C

Data Summary Tables

Table 1: Water Chemistry and Sampling Data Summary Table – Initial Assessment (April 17, 2023)

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Temp (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
W of Bldg, Metropolitan Drive		Municipal Backflow Preventer	City Water	Source	Post	W01	62	1.82	8.2	ND	/
1 – West	Mens RR 11-1	Right sink faucet	DCW	Near	Pre-Flush	W02	-	-	-	10.0	LP
1 – West	Mens RR 11-1	Right sink faucet	DCW	Near	Post-Flush	W03	70	0.10	7.8	ND	/
1 – West	Mens RR 11-1	Right sink faucet	DHW	Near	Post-Flush	W04	124	0.53	8.5	70.0	LP
2 – West	Mens RR 22	Right sink faucet	DCW	Mid	Pre-Flush	W05	-	-	-	60.0	LP
2 – West	Mens RR 22	Right sink faucet	DCW	Mid	Post-Flush	W06	69	0.19	7.9	20.0	LP
2 – West	Mens RR 22	Right sink faucet	DHW	Mid	Post-Flush	W07	127	0.42	8.5	25.0	LP
2 – East	Womens RR 24	Right sink faucet	DHW	Mid	Pre-Flush	W08	-	-	-	900.0	LP
2 – East	Womens RR 24	Right sink faucet	DHW	Mid	Post-Flush	W09	130	0.67	8.4	55.0	LP
2 – East	Womens RR 24	Right sink faucet	DCW	Mid	Post-Flush	W10	72	0.05	7.7	45.0	LP
3 – East	Janitor Closet J-30	Mop sink	DCW	Distal	Post-Flush	W11	67	0.11	7.1	ND	/
Roof	DCW Makeup Line	Hose bib	DCW	Distal	Post-Flush	W12	70	0.19	7.2	ND	/
Roof	DCW Expansion Tank	Inlet drain	DCW	Distal	Post-Flush	W13	100	0.14	7.7	10.0	LA
Roof	DHWST	Drain line	DHW	Near	Post-Flush	W14	134	0.19	7.6	5.0	LP
Roof West	Exterior Hose Bib	Hose bib	DCW	Distal	Post-Flush	W15	73	0.31	7.5	ND	/
1 – West	Janitor Closet J-11	Mop sink	DHW	Distal	Post-Flush	W16	125	0.99	8.0	ND	/
1 – West	Janitor Closet J-11	Mop sink	DCW	Near	Post-Flush	W17	70	0.00	8.0	ND	/

Notes:

DCW = domestic cold water

DHW = domestic hot water

DHWH = domestic hot water heater

ND = not detected

LP = *Legionella pneumophila*, not serogroups 1-6

LA = *Legionella anisa* (Blue-white *Legionella* sp.)

Table 2: Water Chemistry and Sampling Data Summary Table – Initial Assessment (April 18, 2023)

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Temp (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
	W of Bldg, Metropolitan Drive	Municipal Backflow Preventer	City Water	Source	Post	W18	70	1.52	7.9	ND	/
1 – East	Womens RR 13-1	Shower	DHW	Distal	Pre-Flush	W19	-	-	-	255.0	LP
1 – East	Womens RR 13-1	Shower	DHW	Distal	Post-Flush	W20	130	0.08	7.3	95.0	LP
1 – East	Womens RR 13-1	Shower	DCW	Near	Post-Flush	W21	71	0.17	7.6	50.0	LP
1 – East	Mens RR 14-1	Shower	DCW	Near	Pre-Flush	W22	-	-	-	ND	/
1 – East	Mens RR 14-1	Shower	DCW	Near	Post-Flush	W23	71	0.33	7.8	ND	/
1 – West	Drinking Fountain adj Ste 109	Right bubbler	DCW	Near	Post-Flush	W24	56	1.04	7.7	ND	/
1 – West	Mens RR 11-1	Center sink – Filter	DHW	Distal	Pre-Flush	W25	-	-	-	45.0	LP
1 – West	Mens RR 11-1	Center sink – Filter	DHW	Distal	Post-Flush	W26	118	4.00	8.2	30.0	LP
1 – West	Mens RR 11-1	Center sink – Filter	DCW	Near	Post-Flush	W27	71	0.42	7.8	10.0	LP
1 – West	Janitor Closet J-11	Mop sink – POU filter	DCW	Near	Post-Flush	W28	69	-	-	ND	/
2 – East	Drinking Fountain adj 210-3	Left bubbler	DCW	Mid	Post-Flush	W29	58	-	-	ND	/
2 – West	Drinking Fountain adj 210-3	Right bubbler	DCW	Mid	Post-Flush	W30	59	-	-	ND	/
3 – East	Drinking Fountain adj 300-5	Left bubbler	DCW	Distal	Post-Flush	W31	68	-	-	ND	/
3 – West	Drinking Fountain adj 301-32	Right bubbler	DCW	Distal	Post-Flush	W32	58	-	-	10.0	LP
3 – West	Womens RR adj J-32	Center sink	DHW	Near	Pre-Flush	W33	-	-	-	ND	/
3 – West	Womens RR adj J-32	Center sink	DHW	Near	Post-Flush	W34	118	0.82	7.7	5.0	LP
3 – West	Womens RR adj J-32	Center sink	DCW	Distal	Post-Flush	W35	71	0.70	7.6	ND	/
3 – West	RR 301-8	Sink faucet	DHW	Near	Post-Flush	W36	127	-	-	ND	/
3 – West	RR 301-8	Sink faucet	DCW	Distal	Post-Flush	W37	71	-	-	ND	/
3 – West	S Coffee rm 301-35	Sink faucet	DCW	Distal	Pre-Flush	W38	-	-	-	ND	/
3 – West	S Coffee rm 301-35	Sink faucet	DCW	Distal	Post-Flush	W39	72	-	-	ND	/
3 – West	N Coffee rm 301-34	Sink Faucet	DCW	Distal	Pre-Flush	W40	-	-	-	ND	/
3 – West	N Coffee rm 301-34	Sink Faucet	DCW	Distal	Post-Flush	W41	71	-	-	ND	/

Notes:

DCW = domestic cold water

DHW = domestic hot water

DHWH = domestic hot water heater

ND = not detected

LP = *Legionella pneumophila*, not serogroups 1-6

Table 3: Water Chemistry and Sampling Data Summary Table – Follow-Up Assessment (May 3, 2023)

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Temp (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
1 – West	Drinking Fountain adj 110.14	Right bubbler	DCW	Near	Pre-Flush	W42	-	-	-	ND	/
1 – West	Drinking Fountain adj 110.14	Right bubbler	DCW	Near	Post-Flush	W43	59	1.04	8.0	ND	/
1 – West	Janitor Closet J-11	Mop sink – POU filter	DHW	Distal	Pre-Flush	W44	-	-	-	ND	/
1 – West	Janitor Closet J-11	Mop sink – POU filter	DHW	Distal	Post-Flush	W45	111	0.48	8.1	ND	/
1 – West	Janitor Closet J-11	Mop sink – POU filter	DCW	Near	Post-Flush	W46	72	0.18	7.7	ND	/
1 – West	Mens RR 11-1	Right sink – In-Line filter	DHW	Distal	Pre-Flush	W47	-	-	-	ND	/
1 – West	Mens RR 11-1	Right sink – In-Line filter	DHW	Distal	Post-Flush	W48	121	0.52	7.7	ND	/
1 – West	Mens RR 11-1	Center sink – In-Line filter	DCW	Near	Pre-Flush	W49	-	-	-	5.0	LP
1 – West	Mens RR 11-1	Center sink – In-Line filter	DCW	Near	Post-Flush	W50	70	0.51	7.9	1.0	LP
1 – East	Womens RR 13-1	Shower – POU filter	DHW	Distal	Pre-Flush	W51	128	0.14	7.4	ND	/
1 – East	Womens RR 13-1	Shower – POU filter	DHW	Distal	Post-Flush	W52	-	-	-	ND	/
1 – East	Womens RR 13-1	Shower – POU filter	DCW	Near	Post-Flush	W53	72	0.24	7.6	ND	/
1 – East	Mens RR 14-1	Shower – POU filter	DHW	Distal	Pre-Flush	W54	-	-	-	ND	/
1 – East	Mens RR 14-1	Shower – POU filter	DHW	Distal	Post-Flush	W55	130	0.42	7.4	ND	/
2 – West	Drinking Fountain adj 210	Left bubbler	DCW	Mid	Post-Flush	W56	-	-	-	ND	/
2 – West	Mens RR 22	Right sink – In-Line filter	DCW	Mid	Pre-Flush	W57	-	-	-	ND	/
2 – West	Mens RR 22	Right sink – In-Line filter	DCW	Mid	Post-Flush	W58	68	0.37	7.9	ND	/
2 – West	Mens RR 22	Right sink – In-Line filter	DHW	Mid	Post-Flush	W59	127	0.49	8.1	0.5	LP
2 – East	Womens RR 24	Right sink – In-Line filter	DHW	Mid	Pre-Flush	W60	-	-	-	10.0	LP
2 – East	Womens RR 24	Right sink – In-Line filter	DHW	Mid	Post-Flush	W61	129	0.71	8.2	5.0	LP
2 – East	Womens RR 24	Left sink – In-Line filter	DCW	Mid	Pre-Flush	W62	-	-	-	ND	/
2 – East	Womens RR 24	Left sink – In-Line filter	DCW	Mid	Post-Flush	W63	71	0.32	7.8	ND	/
2 – East	Womens RR 24	Hose bib	DCW	Mid	Pre-Flush	W64	-	-	-	ND	/
2 – East	Womens RR 24	Hose bib	DCW	Mid	Post-Flush	W65	73	0.20	7.7	ND	/
2 – East	Ste 208 Lounge	Sink faucet	DCW	Mid	Pre-Flush	W66	-	-	-	ND	/
2 – East	Ste 208 Lounge	Sink faucet	DCW	Mid	Post-Flush	W67	69	0.13	7.8	ND	/
2 – East	Ste 208 Lounge	Sink faucet	DHW	Mid	Post-Flush	W68	-	-	-	ND	/
3 – West	Janitor Closet J-21	Mop sink – POU filter	DCW	Distal	Pre-Flush	W69	68	0.16	7.8	ND	/
3 – West	Janitor Closet J-21	Mop sink – POU filter	DCW	Distal	Post-Flush	W70	-	-	-	ND	/

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Temp (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
3 – West	Janitor Closet J-21	Mop sink – POU filter	DHW	Near	Post-Flush	W71	126	1.12	8.1	ND	/
3 – West	Womens RR adj J-32	Center sink – In-Line filter	DHW	Near	Pre-Flush	W72	-	-	-	ND	/
3 – West	Womens RR adj J-32	Center sink – In-Line filter	DHW	Near	Post-Flush	W73	119	0.48	7.9	ND	/
3 – West	Womens RR adj J-32	Center sink – In-Line filter	DCW	Distal	Post-Flush	W74	72	-	7.7	ND	/
3 – West	Womens RR adj J-32	Hose bib	DCW	Distal	Post-Flush	W75	71	0.30	7.9	ND	/
3 – West	Drinking Fountain 301-32	Right bubbler	DCW	Distal	Pre-Flush	W76	58	-	-	ND	/
3 – West	Drinking Fountain 301-32	Right bubbler	DCW	Distal	Post-Flush	W77	-	-	-	ND	/
3 – East	Mens RR adj 300-31	Left sink – In-Line filter	DHW	Near	Pre-Flush	W78	-	-	-	ND	/
3 – East	Mens RR adj 300-31	Left sink – In-Line filter	DHW	Near	Post-Flush	W79	117	0.28	8.1	ND	/
Roof	DHWST	Drain line	DHW	Near	Post-Flush	W80	135	0.16	7.6	ND	/
Roof	DCW Expansion Tank	Inlet drain	DCW	Distal	Post-Flush	W81	99	0.15	7.8	ND	/
Roof West	Exterior Hose Bib	Hose bib	DCW	Distal	Pre-Flush	W82	73	0.21	7.6	ND	/
Roof West	Exterior Hose Bib	Hose bib	DCW	Distal	Post-Flush	W83	-	-	-	ND	/
W of Bldg, Metropolitan Drive		Municipal Backflow Preventer	City Water	Source	Pre-Flush	W84	62	1.72	8.3	ND	/
W of Bldg, Metropolitan Drive		Municipal Backflow Preventer	City Water	Source	Post-Flush	W85	62	1.78	8.1	ND	/
Notes: DCW = domestic cold water DHW = domestic hot water DHWH = domestic hot water heater ND = not detected LP = <i>Legionella pneumophila</i> , not serogroups 1-6											



Table 4: Water Chemistry and Sampling Data Summary Table – Follow-Up Assessment (June 6, 2023)

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Temp (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
1 – West	Janitor Closet J-11	Mop sink	DHW	Distal	Pre-Flush	W86	-	-	-	ND	/
1 – West	Janitor Closet J-11	Mop sink	DHW	Distal	Post-Flush	W87	103	0.72	8.0	ND	/
1 – West	Janitor Closet J-11	Mop sink	DCW	Near	Post-Flush	W88	78.2	0.48	7.8	ND	/
1 – West	Janitor Closet J-11	Mop sink – POU filter	DCW	Near	Post-Flush	W89	-	-	-	ND	/
1 – East	Womens RR 13-1	Shower	DHW	Distal	Pre-Flush	W90	-	-	-	10.0	LP
1 – East	Womens RR 13-1	Shower	DHW	Distal	Post-Flush	W91	108	0.94	8.3	ND	/
1 – East	Womens RR 13-1	Shower	DCW	Near	Post-Flush	W92	72	-	7.8	ND	/
1 – East	Womens RR 13-1	Shower – POU filter	DHW	Distal	Post-Flush	W93	-	-	-	ND	/
3 – West	Drinking Fountain adj 301-32	Right bubbler	DCW	Distal	Pre-Flush	W94	-	-	-	115.0	LP
3 – West	Drinking Fountain adj 301-32	Right bubbler	DCW	Distal	Post-Flush	W95	68	-	8.1	50.0	LP
3 – West	Womens RR adj J-32	Center sink – In-Line filter	DHW	Near	Pre-Flush	W96	-	-	-	ND	/
3 – West	Womens RR adj J-32	Center sink – In-Line filter	DHW	Near	Post-Flush	W97	92	0.61	8.1	ND	/
3 – West	Womens RR adj J-32	Hose bib	DCW	Distal	Post-Flush	W98	71	0.23	7.7	ND	/
3 – West	Janitor Closet J-32	Mop sink	DHW	Near	Pre-Flush	W99	103	0.17	8.6	0.5	LP
3 – East	Mens RR adj 300-31	Left sink – In-Line filter	DCW	Mid	Pre-Flush	W100	-	-	-	ND	/
3 – East	Mens RR adj 300-31	Left sink – In-Line filter	DCW	Mid	Post-Flush	W101	-	-	-	ND	/
3 – East	Mens RR adj 300-31	Hose bib	DCW	Mid	Post-Flush	W102	72	1.82	8.1	ND	/
2 – West	Janitor Closet J-21	Mop sink	DHW	Mid	Pre-Flush	W103	-	-	-	ND	/
2 – West	Janitor Closet J-21	Mop sink	DHW	Mid	Post-Flush	W104	117	0.11	8.1	ND	/
2 – West	Janitor Closet J-21	Mop sink	DCW	Mid	Post-Flush	W105	-	-	-	ND	/
2 – West	Janitor Closet J-21	Mop sink – POU Filter	DCW	Mid	Post-Flush	W106	-	-	-	ND	/
2 – West	Mens RR 22	Right sink – In-Line filter	DCW	Mid	Pre-Flush	W107	-	-	-	ND	/
2 – West	Mens RR 22	Right sink – In-Line filter	DCW	Mid	Post-Flush	W108	72	0.06	8.6	ND	/
2 – West	Mens RR 22	Hose bib	DCW	Mid	Post-Flush	W109	-	-	-	ND	/
2 – East	Womens RR 24	Right sink – In-Line filter	DHW	Mid	Pre-Flush	W110	-	-	-	ND	/
2 – East	Womens RR 24	Right sink – In-Line filter	DHW	Mid	Post-Flush	W111	99	0.78	8.4	ND	/
2 – East	Janitor Closet J-20	Mop sink	DHW	Mid	Post-Flush	W112	-	-	-	ND	/
2 – East	Womens RR 24	Hose bib	DCW	Mid	Pre-Flush	W113	-	-	-	ND	/
2 – East	Womens RR 24	Hose bib	DCW	Mid	Post-Flush	W114	75	1.88	8.0	ND	/

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Temp (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
1 – West	Mens RR 11-1	Right sink – In-Line filter	DHW	Distal	Pre-Flush	W115	-	-	-	ND	/
1 – West	Mens RR 11-1	Right sink – In-Line filter	DHW	Distal	Post-Flush	W116	92	0.42	8.5	ND	/
1 – West	Mens RR 11-1	Hose bib	DCW	Near	Pre-Flush	W117	-	-	-	ND	/
1 – West	Mens RR 11-1	Hose bib	DCW	Near	Post-Flush	W118	72	0.74	7.9	ND	/
Roof	DHWST	Drain line	DHW	Near	Post-Flush	W119	121	0.24	8.4	ND	/
Roof	DCW Expansion Tank	Inlet drain	DCW	Distal	Post-Flush	W120	85	0.20	8.6	30.0	LA
Roof West	Exterior Hose Bib	Hose bib	DCW	Distal	Post-Flush	W121	-	-	-	ND	/
W of Bldg, Metropolitan Drive		Municipal Backflow Preventer	City Water	Source	Pre-Flush	W122	-	-	-	ND	/
W of Bldg, Metropolitan Drive		Municipal Backflow Preventer	City Water	Source	Post-Flush	W123	70	2.43	8.0	ND	/

Notes:

DCW = domestic cold water

DHW = domestic hot water

DHWH = domestic hot water heater

ND = not detected

LP = *Legionella pneumophila*, not serogroups 1-6LA = *Legionella anisa* (Blue-white *Legionella* sp.)

Table 5: Water Chemistry and Sampling Data Summary Table – Follow-Up Assessment (July 6, 2023)

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Temp (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
1 - West	Suite 108	Kitchen sink	DCW	Near	Pre-Flush Filter On	W124	-	-	-	ND	/
1 - West	Suite 108	Kitchen sink	DCW	Near	Post-Flush	W125	78	0.13	8.1	ND	/
1 - West	Suite 108: Womens RR	Sink	DHW	Mid	Pre-Flush Filter On	W126	114	0.07	7.9	ND	/
1 - West	Suite 108: Womens RR	Sink	DHW	Mid	Post-Flush	W127	-	-	-	ND	/
1 - West	Suite 108: Mens RR	Sink	DCW	Near	Pre-Flush	W128	-	-	-	ND	/
1 - West	Suite 108: Mens RR	Sink	DCW	Near	Post-Flush	W129	-	-	-	ND	/
1 – West	Janitor Closet J-11	Mop sink	DHW	Mid	Pre-Flush	W130	-	-	-	ND	/
1 – West	Janitor Closet J-11	Mop sink	DHW	Mid	Post-Flush	W131	-	-	-	ND	/
1 – West	Janitor Closet J-11	Mop sink	DCW	Near	Post-Flush	W132	79	-	8.1	ND	/
1 – West	Janitor Closet J-11	Mop sink – POU filter	DCW	Near	Post-Flush Filter On	W133	-	-	-	ND	/
1 – West	Drinking Fountain adj 110-14	Right bubbler	DCW	Near	Post-Flush	W134	67	-	7.9	ND	/
2 – East	Drinking Fountain adj 201-3	Left bubbler	DCW	Mid	Post-Flush	W135	68	-	7.8	ND	/
2 – East	Mens RR 23	Left sink	DCW	Mid	Post-Flush	W136	77	0.10	7.9	15.0	LP
2 – East	Mens RR 23	Left sink	DHW	Near	Post-Flush	W137	-	-	-	65.0	LP
2 – East	Womens RR 24	Right sink	DCW	Mid	Post-Flush	W138	-	-	-	ND	/
2 – East	Womens RR 24	Right sink	DHW	Mid	Post-Flush	W139	109	-	8.3	ND	/
2 – East	Suite 208 Breakroom	Kitchen sink	DCW	Mid	Pre-Flush Filter On	W140	-	-	-	ND	/
2 - East	Suite 208 Breakroom	Kitchen sink	DCW	Mid	Post-Flush	W141	74	0.38	8.0	ND	/
2 – East	Suite 207 Breakroom	Kitchen sink	DCW	Mid	Post-Flush Filter On	W142	-	-	-	ND	/
2 – West	Mens RR 22	Left sink	DHW	Mid	Post-Flush	W143	-	-	-	ND	/
2 – West	Womens RR 21	Right sink	DHW	Mid	Pre-Flush Filter On	W144	-	-	-	ND	/
2 – West	Womens RR 21	Right sink	DHW	Mid	Post-Flush	W145	-	-	-	5.0	LP
2 – West	Drinking Fountain adj 201-17	Left bubbler	DCW	Mid	Post-Flush	W146	-	-	-	ND	/
2 – West	Janitor Closet J-21	Mop sink	DHW	Mid	Post-Flush	W147	107	0.12	8.3	ND	/
2 – West	Janitor Closet J-21	Mop sink	DCW	Mid	Post-Flush	W148	-	-	-	ND	/

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Temp (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
3 – West	Mens RR adj J-32	Center sink	DHW	Distal	Pre-Flush	W149	-	-	-	ND	/
3 – West	Mens RR adj J-32	Center sink	DHW	Distal	Post-Flush	W150	109	0.36	8.3	35.0	LP
3 – West	Womens RR adj J-32	Left sink	DCW	Distal	Pre-Flush	W151	-	-	-	ND	/
3 – West	Womens RR adj J-32	Left sink	DCW	Distal	Post-Flush	W152	-	-	-	ND	/
3 – West	Janitor Closet J-32	Mop sink	DHW	Distal	Pre-Flush	W153	-	-	-	ND	/
3 – West	Janitor Closet J-32	Mop sink	DHW	Distal	Post-Flush	W154	-	-	-	ND	/
3 – West	Drinking Fountain adj 301-32	Left bubbler	DCW	Distal	Post-Flush	W155	69	-	7.8	105.0	LP
3 – East	Drinking Fountain adj 300-5	Right bubbler	DCW	Distal	Post-Flush	W156	-	-	-	ND	/
3 – East	Womens RR adj 300-5	Left sink	DCW	Distal	Pre-Flush Filter On	W157	-	-	-	ND	/
3 – East	Womens RR adj 300-5	Left sink	DCW	Distal	Post-Flush Filter On	W158	-	-	-	ND	/
3 – East	Womens RR adj 300-5	Left sink	DCW	Distal	Post-Flush	W159	78	2.57	8.0	ND	/
Roof	DHWST	Drain line	DHW	Near	Post-Flush	W160	121	-	8.2	ND	/
Roof	DCW Expansion Tank	Inlet drain	DCW	Distal	Post-Flush	W161	84	-	7.9	5.0	LA
1 – East	Womens RR 13-1	Shower	DHW	Mid	Pre-Flush	W162	-	-	-	55.0	LP
1 – East	Womens RR 13-1	Shower	DHW	Mid	Post-Flush	W163	107	0.46	8.3	30.0	LP
1 – East	Womens RR 13-1	Shower	DCW	Mid	Post-Flush	W164	-	-	-	60.0	LP
1 – East	Drinking Fountain adj 100	Left bubbler	DCW	Mid	Post-Flush	W165	-	-	-	ND	/
1 – West	Womens RR 12-1	Right sink	DHW	Mid	Pre-Flush Filter On	W166	-	-	-	ND	/
1 – West	Womens RR 12-1	Right sink	DHW	Mid	Post-Flush Filter On	W167	105	1.36	8.3	ND	/
1 – West	Womens RR 12-1	Hose bib	DCW	Mid	Post-Flush	W168	-	-	-	ND	/
W of Bldg, Metropolitan Drive		Municipal Backflow Preventer	City Water	Source	Pre-Flush	W169	-	-	-	ND	/
W of Bldg, Metropolitan Drive		Municipal Backflow Preventer	City Water	Source	Post-Flush	W170	75	2.68	8.3	ND	/

Floor	Room/ Area	Fixture/ Component	Water Type	System Loc.	Sample Type	Sample #	Tem p (°F)	Ox. (ppm)	pH	Result (CFU/mL)	Types
Notes: DCW = domestic cold water DHW = domestic hot water DHW = domestic hot water heater ND = not detected LP = <i>Legionella pneumophila</i> , not serogroups 1-6 LA = <i>Legionella anisa</i> (Blue-white <i>Legionella</i> sp.)											



Appendix D

Laboratory Reports and Chain of Custody Forms



FINAL REPORT

Forensic Analytical

Corporate
 21228 Cabot Blvd
 Hayward, CA 94545
 P: (510) 266-4600

Account #: 5842
SPL Project ID: 2307-00218
Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Summary

This summary is provided for your convenience. Complete report on the following pages.

Environmental Culture Test-Legionella

Location	Result	Concentration	Species
76066-0706-W124	Not Detected		
76066-0706-W125	Not Detected		
76066-0706-W126	Not Detected		
76066-0706-W127	Not Detected		
76066-0706-W128	Not Detected		
76066-0706-W129	Not Detected		
76066-0706-W130	Not Detected		
76066-0706-W131	Not Detected		
76066-0706-W132	Not Detected		
76066-0706-W133	Not Detected		
76066-0706-W134	Not Detected		
76066-0706-W135	Not Detected		
76066-0706-W136	Positive	15.0 CFU/mL	L. pneumophila, not serogroups 1-6
76066-0706-W137	Positive	65.0 CFU/mL	L. pneumophila, not serogroups 1-6
76066-0706-W138	Not Detected		
76066-0706-W139	Not Detected		
76066-0706-W140	Not Detected		
76066-0706-W141	Not Detected		
76066-0706-W142	Not Detected		
76066-0706-W143	Not Detected		
76066-0706-W144	Not Detected		
76066-0706-W145	Positive	5.0 CFU/mL	L. pneumophila, not serogroups 1-6
76066-0706-W146	Not Detected		
76066-0706-W147	Not Detected		
76066-0706-W148	Not Detected		
76066-0706-W149	Not Detected		

FINAL REPORT

Forensic Analytical

Corporate
 21228 Cabot Blvd
 Hayward, CA 94545
 P: (510) 266-4600

Account #: 5842
SPL Project ID: 2307-00218
Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Environmental Culture Test-Legionella

Location	Result	Concentration	Species
76066-0706-W150	Positive	35.0 CFU/mL	L. pneumophila, not serogroups 1-6
76066-0706-W151	Not Detected		
76066-0706-W152	Not Detected		
76066-0706-W153	Not Detected		
76066-0706-W154	Not Detected		
76066-0706-W155	Positive	105.0 CFU/mL	L. pneumophila, not serogroups 1-6
76066-0706-W156	Not Detected		
76066-0706-W157	Not Detected		
76066-0706-W158	Not Detected		
76066-0706-W159	Not Detected		
76066-0706-W160	Not Detected		
76066-0706-W161	Positive	5.0 CFU/mL	L. anisa (Blue-white Legionella sp.)
76066-0706-W162	Positive	55.0 CFU/mL	L. pneumophila, not serogroups 1-6
76066-0706-W163	Positive	30.0 CFU/mL	L. pneumophila, not serogroups 1-6
76066-0706-W164	Positive	60.0 CFU/mL	L. pneumophila, not serogroups 1-6
76066-0706-W165	Not Detected		
76066-0706-W166	Not Detected		
76066-0706-W167	Not Detected		
76066-0706-W168	Not Detected		
76066-0706-W169	Not Detected		
76066-0706-W170	Not Detected		

Approved by: Jennifer Furlong



Janet E. Stout, Ph.D.
 Laboratory Director, Special Pathogens Laboratory

FINAL REPORT

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 21228 Cabot Blvd
 Hayward, CA 94545
 P: (510) 266-4600

Account #: 5842
SPL Project ID: 2307-00218
Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Location:	76066-0706-W124	Date Collected:	07/06/2023
Sample ID:	2307-00218.001	Sample Type:	Water
		Time Collected:	8:35 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W125	Date Collected:	07/06/2023
Sample ID:	2307-00218.002	Sample Type:	Water
		Time Collected:	8:51 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W126	Date Collected:	07/06/2023
Sample ID:	2307-00218.003	Sample Type:	Water
		Time Collected:	9:02 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/18/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W127	Date Collected:	07/06/2023
Sample ID:	2307-00218.004	Sample Type:	Water
		Time Collected:	9:06 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W128	Date Collected:	07/06/2023
Sample ID:	2307-00218.005	Sample Type:	Water
		Time Collected:	9:11 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		

FINAL REPORT

Forensic Analytical

Corporate
 21228 Cabot Blvd
 Hayward, CA 94545
 P: (510) 266-4600

Account #: 5842
SPL Project ID: 2307-00218
Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Location:	76066-0706-W129	Date Collected:	07/06/2023
Sample ID:	2307-00218.006	Sample Type:	Water
		Time Collected:	9:16 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/18/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W130	Date Collected:	07/06/2023
Sample ID:	2307-00218.007	Sample Type:	Water
		Time Collected:	9:30 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/18/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W131	Date Collected:	07/06/2023
Sample ID:	2307-00218.008	Sample Type:	Water
		Time Collected:	9:32 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/18/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W132	Date Collected:	07/06/2023
Sample ID:	2307-00218.009	Sample Type:	Water
		Time Collected:	9:34 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W133	Date Collected:	07/06/2023
Sample ID:	2307-00218.010	Sample Type:	Water
		Time Collected:	9:37 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/18/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		

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Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Location:	76066-0706-W134	Date Collected:	07/06/2023
Sample ID:	2307-00218.011	Sample Type:	Water
		Time Collected:	9:41 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W135	Date Collected:	07/06/2023
Sample ID:	2307-00218.012	Sample Type:	Water
		Time Collected:	9:47 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W136	Date Collected:	07/06/2023
Sample ID:	2307-00218.013	Sample Type:	Water
		Time Collected:	10:00 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Positive		
Concentration:	15.0 CFU/mL		
Species:	L. pneumophila, not serogroups 1-6		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W137	Date Collected:	07/06/2023
Sample ID:	2307-00218.014	Sample Type:	Water
		Time Collected:	10:03 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Positive		
Concentration:	65.0 CFU/mL		
Species:	L. pneumophila, not serogroups 1-6		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		

FINAL REPORT

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Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Location:	76066-0706-W138	Date Collected:	07/06/2023
Sample ID:	2307-00218.015	Sample Type:	Water
		Time Collected:	10:18 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W139	Date Collected:	07/06/2023
Sample ID:	2307-00218.016	Sample Type:	Water
		Time Collected:	10:21 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W140	Date Collected:	07/06/2023
Sample ID:	2307-00218.017	Sample Type:	Water
		Time Collected:	10:33 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W141	Date Collected:	07/06/2023
Sample ID:	2307-00218.018	Sample Type:	Water
		Time Collected:	10:39 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W142	Date Collected:	07/06/2023
Sample ID:	2307-00218.019	Sample Type:	Water
		Time Collected:	11:06 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		

FINAL REPORT

Forensic Analytical

Corporate
 21228 Cabot Blvd
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Account #: 5842
SPL Project ID: 2307-00218
Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Location:	76066-0706-W143	Date Collected:	07/06/2023
Sample ID:	2307-00218.020	Sample Type:	Water
		Time Collected:	11:27 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W144	Date Collected:	07/06/2023
Sample ID:	2307-00218.021	Sample Type:	Water
		Time Collected:	11:33 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W145	Date Collected:	07/06/2023
Sample ID:	2307-00218.022	Sample Type:	Water
		Time Collected:	11:36 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/18/2023
Result:	Positive		
Concentration:	5.0 CFU/mL		
Species:	L. pneumophila, not serogroups 1-6		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W146	Date Collected:	07/06/2023
Sample ID:	2307-00218.023	Sample Type:	Water
		Time Collected:	11:49 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W147	Date Collected:	07/06/2023
Sample ID:	2307-00218.024	Sample Type:	Water
		Time Collected:	11:48 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		

FINAL REPORT

Forensic Analytical

Corporate
 21228 Cabot Blvd
 Hayward, CA 94545
 P: (510) 266-4600

Account #: 5842
SPL Project ID: 2307-00218
Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Location:	76066-0706-W148	Date Collected:	07/06/2023
Sample ID:	2307-00218.025	Sample Type:	Water
		Time Collected:	11:51 am
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/18/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W149	Date Collected:	07/06/2023
Sample ID:	2307-00218.026	Sample Type:	Water
		Time Collected:	12:09 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W150	Date Collected:	07/06/2023
Sample ID:	2307-00218.027	Sample Type:	Water
		Time Collected:	12:12 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Positive		
Concentration:	35.0 CFU/mL		
Species:	L. pneumophila, not serogroups 1-6		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W151	Date Collected:	07/06/2023
Sample ID:	2307-00218.028	Sample Type:	Water
		Time Collected:	12:18 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W152	Date Collected:	07/06/2023
Sample ID:	2307-00218.029	Sample Type:	Water
		Time Collected:	12:23 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		

FINAL REPORT

Forensic Analytical

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Account #: 5842
SPL Project ID: 2307-00218
Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Location:	76066-0706-W153	Date Collected:	07/06/2023
Sample ID:	2307-00218.030	Sample Type:	Water
		Time Collected:	12:27 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W154	Date Collected:	07/06/2023
Sample ID:	2307-00218.031	Sample Type:	Water
		Time Collected:	12:31 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W155	Date Collected:	07/06/2023
Sample ID:	2307-00218.032	Sample Type:	Water
		Time Collected:	12:39 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Positive		
Concentration:	105.0 CFU/mL		
Species:	L. pneumophila, not serogroups 1-6		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W156	Date Collected:	07/06/2023
Sample ID:	2307-00218.033	Sample Type:	Water
		Time Collected:	12:43 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W157	Date Collected:	07/06/2023
Sample ID:	2307-00218.034	Sample Type:	Water
		Time Collected:	12:47 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		

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Forensic Analytical

Corporate
 21228 Cabot Blvd
 Hayward, CA 94545
 P: (510) 266-4600

Account #: 5842
SPL Project ID: 2307-00218
Project Name: PJ76066
PO Number: 09475
Sampled By: K. Thornton
Date Received: 07/07/2023
Date Final: 07/18/2023

Location:	76066-0706-W158	Date Collected:	07/06/2023
Sample ID:	2307-00218.035	Sample Type:	Water
		Time Collected:	12:49 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W159	Date Collected:	07/06/2023
Sample ID:	2307-00218.036	Sample Type:	Water
		Time Collected:	12:53 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W160	Date Collected:	07/06/2023
Sample ID:	2307-00218.037	Sample Type:	Water
		Time Collected:	1:06 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W161	Date Collected:	07/06/2023
Sample ID:	2307-00218.038	Sample Type:	Water
		Time Collected:	1:11 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Positive		
Concentration:	5.0 CFU/mL		
Species:	L. anisa (Blue-white Legionella sp.)		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		



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Location:	76066-0706-W162	Date Collected:	07/06/2023
Sample ID:	2307-00218.039	Sample Type:	Water
		Time Collected:	1:24 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Positive		
Concentration:	55.0 CFU/mL		
Species:	L. pneumophila, not serogroups 1-6		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W163	Date Collected:	07/06/2023
Sample ID:	2307-00218.040	Sample Type:	Water
		Time Collected:	1:27 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Positive		
Concentration:	30.0 CFU/mL		
Species:	L. pneumophila, not serogroups 1-6		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W164	Date Collected:	07/06/2023
Sample ID:	2307-00218.041	Sample Type:	Water
		Time Collected:	1:30 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Positive		
Concentration:	60.0 CFU/mL		
Species:	L. pneumophila, not serogroups 1-6		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W165	Date Collected:	07/06/2023
Sample ID:	2307-00218.042	Sample Type:	Water
		Time Collected:	1:39 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		



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Location:	76066-0706-W166	Date Collected:	07/06/2023
Sample ID:	2307-00218.043	Sample Type:	Water
		Time Collected:	1:45 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W167	Date Collected:	07/06/2023
Sample ID:	2307-00218.044	Sample Type:	Water
		Time Collected:	1:47 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W168	Date Collected:	07/06/2023
Sample ID:	2307-00218.045	Sample Type:	Water
		Time Collected:	1:50 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W169	Date Collected:	07/06/2023
Sample ID:	2307-00218.046	Sample Type:	Water
		Time Collected:	2:12 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		
Location:	76066-0706-W170	Date Collected:	07/06/2023
Sample ID:	2307-00218.047	Sample Type:	Water
		Time Collected:	2:15 pm
Test Requested:	Environmental Culture Test-Legionella	Status:	Complete 07/14/2023
Result:	Not Detected		
Date Processed:	07/07/2023		
Volume Examined:	0.2 ml of processed sample		



THE LEGIONELLA EXPERTS®
1401 Forbes Ave., Suite 401 Pittsburgh, PA 15219
P: 412-281-5335 F: 412-281-7445
www.SpecialPathogensLab.com

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Corporate
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Hayward, CA 94545
P: (510) 266-4600

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Date Final: 07/18/2023

Approved by: Jennifer Furlong

A handwritten signature in blue ink, appearing to read "Janet Stout".

Janet E. Stout, Ph.D.
Laboratory Director, Special Pathogens Laboratory

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NOTES

Environmental Culture Test-Legionella

- CFU/mL (or swab)=Colony Forming Units per milliliter or swab.
- The limit of detection (LOD)* is approximately - 0.5 - 5 CFU/mL for Potable Water; 5 CFU/mL for Non-Potable Water (Cooling Towers); 0.5 - 5 CFU/mL for Hot Water Tanks; 10 -100 CFU/swab for Swabs.
- * Sensitivity (LOD) may be affected if less than recommended sample volume is submitted for testing and if high concentration of non-Legionella bacteria are present in the sample. LOD values are mathematically derived according to the sample type, volume, and process.
- Results are reported as Not Detected, Positive, or Not Detected*
- Not Detected* The presence of Legionella could not be determined due to overgrowth of non-Legionella bacteria.
- Probable identification. Contact laboratory if further identification by 16S sequencing required.
- Method: ISO 11731:2017 (E). QA/QC performed on the date processed. Turnaround time is 7-10 days.
- Samples should be analyzed within 2 days of collection.
- Accredited by the American Association for Laboratory Accreditation (Cert. No. 2847.01) and CDC ELITE certified.
- Isolates saved upon request. Request must be received 1 week from receipt of report. Extra charges may apply.
- 'Project Name', 'Sampled By', 'Location', 'Date Collected', 'Time Collected' and 'Client Notes' are provided by the customer.

The data and information on this, and other accompanying documents, represent only the sample(s) analyzed. This report is not to be reproduced in whole or in part without the expressed consent of SPL. Results apply to the sample as received.

Appendix E

Centers for Disease Control and Prevention (CDC) and American Industrial Hygiene Association (AIHA) *Legionella* Sample Interpretation Guidance

Centers for Disease Control and Prevention (CDC) Interpretation Guidelines

Figure 1. Routine *Legionella* testing: A multifactorial approach to performance indicator interpretation*^{1,2,3,4}

Concentration indicates that *Legionella* growth appears:

Uncontrolled	Poorly Controlled	Well Controlled	No <i>Legionella</i> detected in a single round of testing	No <i>Legionella</i> detected in multiple rounds of testing	No <i>Legionella</i> detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any <i>Legionella</i> species
≥10 CFU/mL ¹ in potable water OR ≥100 CFU/mL in non-potable water	1.0–9.9 CFU/mL in potable water OR 10–99 CFU/mL in non-potable water	Detectable to 0.9 CFU/mL in potable water OR Detectable to 9 CFU/mL in non-potable water	No <i>Legionella</i> detected in a single round of testing	No <i>Legionella</i> detected in multiple rounds of testing	No <i>Legionella</i> detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any <i>Legionella</i> species

Change in concentration over time indicates that *Legionella* growth appears:

Uncontrolled	Poorly Controlled	Well Controlled	No <i>Legionella</i> detected in a single round of testing	No <i>Legionella</i> detected in multiple rounds of testing	No <i>Legionella</i> detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any <i>Legionella</i> species
100-fold or greater increase in concentration (e.g., 0.05 to 5 CFU/mL)	10-fold increase in concentration (e.g., 0.05 to 0.5 CFU/mL)	<i>Legionella</i> concentration steady (e.g., 0.5 CFU/mL for two consecutive sampling rounds)	No <i>Legionella</i> detected in a single round of testing	No <i>Legionella</i> detected in multiple rounds of testing	No <i>Legionella</i> detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any <i>Legionella</i> species

Extent indicates that *Legionella* growth appears:

Uncontrolled	Poorly Controlled	Well Controlled	No <i>Legionella</i> detected in a single round of testing	No <i>Legionella</i> detected in multiple rounds of testing	No <i>Legionella</i> detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any <i>Legionella</i> species
Detection in multiple locations AND a common source location ² OR Detection across many locations within a water system	Detection in a common source location that serves multiple areas OR Detection in more than one location within a water system	Detection in a few of many tested locations within a water system	No <i>Legionella</i> detected in a single round of testing	No <i>Legionella</i> detected in multiple rounds of testing	No <i>Legionella</i> detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any <i>Legionella</i> species

Type⁴ of *Legionella* (species and serogroup) associated with Legionnaires' disease:

Highly Associated	Less Associated
<i>L. pneumophila</i> serogroup 1; Non-Lp1 <i>L. pneumophila</i> ; Presence of multiple different <i>Legionella</i> species or serogroups	Any non- <i>pneumophila</i> <i>Legionella</i> species including "blue-white" fluorescent <i>Legionella</i>

*This figure is intended for use during routine testing only. Test results are performance indicators and are not a measure of risk of human illness. This figure is not intended for use if a building or device is associated with Legionnaires' disease (LD) cases or an outbreak.

¹See "Routine testing for *Legionella*" for guidance regarding suggested response activities. Comparable results may lead to different suggested response activities when other factors are considered (e.g., if there is evidence of poorly controlled growth at a healthcare facility).

²Considering the type of *Legionella* identified along with other *Legionella* testing performance indicators provides a clearer picture of water system control than the results of any single indicator. For example, facility owners and operators may consider implementing immediate interventions for a healthcare facility with: A. detectable but <10

colony-forming units per milliliter (CFU/mL), B. non-Lp1 *Legionella pneumophila*, C. observed at steady concentrations, but D. detected at multiple distal locations including a central water heater.

³Concentrations expressed as CFU/mL are for test results generated by traditional spread plate culture methods. If other test methods are used, consult testing lab or manufacturer instructions for appropriate interpretation.

⁴Common source location examples include water heaters, hot water returns, storage tanks, and cooling tower basins.

⁵If a facility has a history of associated LD cases, then sequencing isolates obtained during routine testing may provide performance indicators regarding outbreak strain persistence (if that strain is detected).



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

American Industrial Hygiene Association (AIHA) Interpretation Guidelines

Table 3.2: Recommended Actions

Action	Recommended Actions
Humidifiers & Misters, Decorative Fountains & Water Features, Hot Tubs, Whirlpools & Spas	
No Action Required	<ul style="list-style-type: none"> • Continue routine monitoring for <i>Legionella</i> levels, as scheduled per the site-specific plan, based on risk assessment results. • Continue maintaining system and source. • Consider reassessment if conditions change to favor <i>Legionella</i> colonization or amplification.
1 <1 CFU/mL	<p>MONITOR –</p> <ol style="list-style-type: none"> 1. Measure disinfectant levels, where appropriate, to determine if adequate to control <i>Legionella</i> growth; increase to effective control levels, if necessary. 2. Measure temperature, where appropriate, to determine if it is within a range that is permissive for <i>Legionella</i> growth and adjust accordingly. 3. Inspect system components for accumulated sediment, debris, scale, and biofilm. 4. Ensure maintenance and operation procedures are appropriate and are being followed. 5. Reassess treatment practices and consider cleaning and/or disinfection protocols if judged to be necessary. 6. Collect retest samples if any changes to the operation of the system or cleaning or disinfection actions were taken; if re-testing, wait for at least 48 hours, and no more than 7 days, after treatment.
2 1 to <10 CFU/mL	<p>INVESTIGATE & MITIGATE RISKS OF GROWTH –</p> <p>Take the water system component out of service as soon as possible.</p> <ol style="list-style-type: none"> 1. Implement Items 1–4 listed in Action 1 above. 2. Conduct remedial cleaning and/or disinfection protocols. 3. Reestablish normal biocide and pH levels. 4. Collect a retest sample. (Wait at least 48 hours, and no more than 7 days, after treatment to re-test.) 5. Based on professional judgment and the history of the water source, consider increasing the frequency and/or intensity of sampling efforts in order to identify any contributing amplification sources(s). 6. Wait until post-treatment sample results are reported and reviewed by a Competent Professional before returning system to operation. <p>If one or more cases of legionellosis (either LD or PF) are suspected, take the following additional steps:</p> <ul style="list-style-type: none"> • Notify appropriate management and public health authorities (if required) of test results and coordinate further efforts. • Coordinate and implement cleaning and/or disinfection protocols with any proposed testing by public health officials, when applicable.
3 >10 CFU/mL	<p>INVESTIGATE, MITIGATE RISKS OF GROWTH & REMEDIATE GROWTH –</p> <p>IMMEDIATELY take the water system component out of service.</p> <ul style="list-style-type: none"> • Implement Items 1–5 listed in Action 2 above. • Wait until post-treatment sample results are reported and reviewed by a Competent Professional before returning the system to operation. <p>If one or more cases of legionellosis (either LD or PF) are suspected, take the following additional steps:</p> <ul style="list-style-type: none"> • Notify appropriate management and public health authorities (if required) of test results and coordinate further efforts. • Coordinate and implement cleaning and/or disinfection protocols with any proposed testing by public health officials, when applicable.

Table 3.2: Recommended Actions (continued)

Action	Recommended Actions
Incoming Municipal Water	
No Action Required	<ul style="list-style-type: none"> • Continue routine monitoring for <i>Legionella</i> levels, as scheduled per the site-specific plan, based on risk assessment results. • Continue maintaining system and source. • Consider reassessment if conditions change to favor <i>Legionella</i> colonization or amplification.
4 < 1 CFU/mL	<p>MONITOR –</p> <ol style="list-style-type: none"> 1. Measure and document incoming water disinfectant levels and pH at least three times a week (for 1–2 weeks).
5 1 to <10 CFU/mL	<p>INVESTIGATE & MITIGATE RISKS OF GROWTH –</p> <ol style="list-style-type: none"> 1. Measure and document incoming water temperature, disinfectant levels, and pH every other day (for 1–2 weeks). 2. Investigate possible causes of water supply disruption or disturbance, such as water main or service line breaks, and/or nearby construction that may be dislodging deposited sediment, debris, or corrosion. 3. Notify municipal water supplier of findings and request investigation of contributing factors. If low disinfectant levels are determined to be an issue, implement measures to increase them. 4. Based on professional judgment and the history of the water source, consider increasing the frequency and/or scope of sampling efforts IN THE PREMISE PLUMBING in order to identify high-risk sites of amplification source, such as water heaters or low use areas. 5. If disinfectant levels are increased, re-test the incoming water for culturable <i>Legionella</i> after 1–2 months.
6 >10 CFU/mL	<p>INVESTIGATE, MITIGATE RISKS OF GROWTH & ENHANCE CONTROL MEASURES –</p> <ol style="list-style-type: none"> 1. Measure and document incoming water disinfectant levels and pH every other day (for 1–2 weeks). 2. Notify the municipal water supplier of these findings and request investigation of contributing factors. If low disinfectant levels are determined to be an issue, consider adding supplemental disinfectant. 3. IMMEDIATELY examine secondary parameters (pH, residual disinfectant levels, water temperature, etc.) IN THE PREMISE PLUMBING to identify potential effects of elevated <i>Legionella</i> levels in municipal water supply. 4. Carry out a complete <i>Legionella</i> source assessment for at-risk premise plumbing and other building water systems that receive water from this service. Take appropriate actions based on the findings of the building water system assessment. 5. Based on professional judgment and the history of the water source, consider increasing the frequency and/or scope of sampling efforts IN THE PREMISE PLUMBING in order to identify high-risk sites of amplification source, such as water heaters or low use areas. 6. Re-test the incoming water for culturable <i>Legionella</i> after 1 month.

Table 3.2: Recommended Actions (continued)

Action	Recommended Actions
Premise Plumbing Potable Water	
No Action Required	<ul style="list-style-type: none"> • Continue routine monitoring for <i>Legionella</i> levels, as scheduled per the site-specific plan, based on risk assessment results. • Continue maintaining system and source. • Consider reassessment if conditions change to favor <i>Legionella</i> colonization or amplification.
7 1 to <10 CFU/mL	<p>MONITOR –</p> <ol style="list-style-type: none"> 1. Measure disinfectant levels (and pH if necessary) to determine if adequate to control <i>Legionella</i> growth. 2. Measure water temperatures to determine if they are within a range that is permissive for <i>Legionella</i> growth and adjust accordingly. 3. Reassess maintenance, usage patterns, and flushing programs; if existing procedures need improvement or if none exist, implement actions (such as periodic flushing) to improve disinfectant levels and/or alter temperatures to inhibit <i>Legionella</i> growth.
8 10 to <100 CFU/mL	<p>INVESTIGATE & MITIGATE RISKS OF GROWTH –</p> <ol style="list-style-type: none"> 1. Implement Items 1–3 listed in Action 7 above. 2. If multiple sample sites for a water system (hot or cold) are positive for <i>Legionella</i> in this range, implement remedial cleaning or disinfection protocols, considering the following: <ul style="list-style-type: none"> • If disinfectants are low, perform flushing and/or consider adding supplemental disinfectant. • If needed (and possible), adjust temperatures to levels that can better control <i>Legionella</i> growth. • Based on professional judgment, history of the water source, and the sampling data: <ul style="list-style-type: none"> – If the sample results from other locations in the water system indicate systemic growth, implement systemwide remedial cleaning or disinfection protocols, or – If the sample results indicate localized or distal growth, implement localized remedial cleaning, disinfection protocols, or fixture replacement. 3. Re-test the entire water system for culturable <i>Legionella</i> at least 48 hours, and no more than 7 days, after disinfection to assess the effectiveness of corrective actions. 4. Consider increasing the frequency and/or intensity of sampling efforts in order to identify any contributing amplification source(s) or implement preventive cleaning or biocide treatment. 5. Implement follow-up monitoring using a Routine Evaluation strategy. <p>If one or more cases of legionellosis (either LD or PF) are suspected, take the following additional steps:</p> <ol style="list-style-type: none"> 6. Notify appropriate management and public health authorities (if required) of test results and coordinate further efforts. 7. Take immediate steps to prevent further aerosol exposure to occupants, workers, and the public. Interim measures to restrict water use, filter the organism from the water, or prevent aerosolization can effectively prevent exposure until terminal measures are implemented. 8. Coordinate and implement remedial cleaning and/or disinfection protocols with any proposed testing by public health officials. 9. Continue water use restrictions and/or interim measures until post-treatment sample results are received from the laboratory and reviewed by a Competent Professional. <p>All amplification sites identified in the course of further investigation should be remediated and actions taken to monitor for and prevent its recurrence. Perform post-remediation testing to verify and document the effectiveness of remediation protocols.</p>

Table 3.2: Recommended Actions (continued)

Action	Recommended Actions
Premise Plumbing Potable Water	
9 ≥100 CFU/mL	<p>INVESTIGATE, MITIGATE RISKS OF GROWTH & REMEDIATE GROWTH –</p> <p>IMMEDIATELY take steps to prevent further exposure to occupants, workers, and the public.</p> <ul style="list-style-type: none"> • Interim mitigation measures to restrict water use, filter the organism from the water, or prevent aerosolization can effectively prevent exposure until terminal measures are implemented. <ol style="list-style-type: none"> 1. Implement Items 1–3 listed in Action 8 above. 2. Conduct remedial cleaning and/or disinfection protocols. <ul style="list-style-type: none"> • Based on professional judgment, history of the water source, and the sampling data: <ul style="list-style-type: none"> – If the sample results from other locations in the water system indicate systemic growth, implement systemwide remedial cleaning or disinfection protocols, or – If the sample results indicate localized or distal growth, implement localized remedial cleaning, disinfection protocols, or fixture replacement. 3. Re-test the entire water system for culturable <i>Legionella</i> at least 48 hours, and no more than 7 days, after disinfection to assess the effectiveness of corrective actions. 4. Continue water use restrictions and/or interim measures until post-treatment sample results are received from the laboratory and reviewed by a Competent Professional. At least two (2) consecutive sampling events, separated by at least seven (7) days, should be reviewed to determine whether <i>Legionella</i> growth has been remediated. 5. Consider increasing the frequency and/or intensity of sampling efforts in order to identify any contributing amplification source(s) or implement preventive cleaning or biocide treatment. 6. Implement follow-up monitoring using a Routine Evaluation strategy. <p>All amplification sites identified in the course of further investigation should be remediated and actions taken to monitor for and prevent its recurrence. Perform post-remediation testing to verify and document the effectiveness of remediation protocols.</p> <p>If one or more cases of legionellosis (either LD or PF) are suspected, take the following additional steps:</p> <ul style="list-style-type: none"> • Notify appropriate management and public health authorities (if required) of test results and coordinate further efforts. Coordinate and implement remedial cleaning and/or disinfection protocols with any proposed testing by public health officials.
Cooling Towers and Evaporative Condensers	
No Action Required <10 CFU/mL	<p>MONITOR –</p> <ul style="list-style-type: none"> • Verify water treatment procedures and, if necessary, increase biocide treatment levels. Review physical cleaning, biocide, corrosion, and scale control program to determine if it should be enhanced. Continue maintaining system. • Continue routine monitoring for <i>Legionella</i> levels, as scheduled per the site-specific plan, based on risk assessment results. • Consider any state or local statutes requiring specific sampling intervals.
10 10 to <100 CFU/mL	<p>ON-LINE DISINFECTION –</p> <ol style="list-style-type: none"> 1. Perform On-line Disinfection within 24 hours, per recommendations described in the Cooling Technology Institute <i>Legionellosis Guideline: Practices to Reduce the Risk of Legionellosis from Evaporative Heat Rejection Equipment Systems</i> [GDL 159] (2021). <p>Perform post-remediation testing to verify and document the effectiveness of remediation protocols and implement follow-up monitoring using a Routine Evaluation strategy as follows:</p> <ol style="list-style-type: none"> 2. After 3–7 days, re-test cooling tower for culturable <i>Legionella</i> levels. 3. Re-treat and test until <i>Legionella</i> levels are consistently below 10 CFU/mL. 4. If on-line disinfection is considered ineffective by a Competent Professional, shut down and clean the cooling tower within 7 days. 5. Review physical cleaning, biocide, corrosion, and scale control program to determine if it should be enhanced moving forward. 6. Implement follow-up monitoring. <p>Some state and local statutes may require specific sampling intervals, remedial actions, and reporting requirements.</p>

Table 3.2: Recommended Actions (continued)

Action	Recommended Actions
Cooling Towers and Evaporative Condensers	
<p style="text-align: center;">11</p> <p>100 to <1000 CFU/mL</p>	<p>EMERGENCY DISINFECTION –</p> <ol style="list-style-type: none"> 1. Perform <i>Emergency Disinfection</i> within 24 hours, per recommendations described in the Cooling Technology Institute <i>Legionellosis Guideline: Practices to Reduce the Risk of Legionellosis from Evaporative Heat Rejection Equipment Systems</i> [GDL 159] (2021). <p>Perform post-remediation testing to verify and document the effectiveness of remediation protocols and implement follow-up monitoring using a Routine Evaluation strategy as follows:</p> <ol style="list-style-type: none"> 2. After 3–7 days, re-test cooling tower for culturable <i>Legionella</i> levels. 3. Re-treat and test until <i>Legionella</i> levels are consistently below 10 CFU/mL. 4. If on-line disinfection is considered ineffective by a Competent Professional, shut down and clean the cooling tower within 7 days. 5. Review physical cleaning, biocide, corrosion, and scale control program to determine if it should be enhanced moving forward. 6. Implement follow-up monitoring. <p>Some state and local statutes may require specific sampling intervals, remedial actions, and reporting requirements.</p> <p>If one or more cases of legionellosis (either LD or PF) are suspected, take the following additional steps:</p> <ul style="list-style-type: none"> • Notify appropriate management and public health authorities (if required) of test results and coordinate further efforts. Coordinate and implement remedial cleaning and/or disinfection protocols with any proposed testing by public health officials.
<p style="text-align: center;">12</p> <p>>1000 CFU/mL</p>	<p>EMERGENCY DISINFECTION & CLEANING –</p> <ul style="list-style-type: none"> • Perform <i>Emergency Disinfection</i> within 24 hours, per recommendations described in the Cooling Technology Institute <i>Legionellosis Guideline: Practices to Reduce the Risk of Legionellosis from Evaporative Heat Rejection Equipment Systems</i> [GDL 159] (2021). • Follow up with a shut down and cleaning of the cooling tower within 2 days. <p>Perform post-remediation testing to verify and document the effectiveness of remediation protocols and implement follow-up monitoring using a Routine Evaluation strategy as follows:</p> <ol style="list-style-type: none"> 1. After 3–7 days, re-test cooling tower for culturable <i>Legionella</i> levels. 2. Re-treat and test until <i>Legionella</i> levels are consistently below 10 CFU/mL. 3. If on-line disinfection is considered ineffective by a Competent Professional, shut down and clean the cooling tower within 7 days. 4. Review physical cleaning, biocide, corrosion, and scale control program to determine if it should be enhanced moving forward. 5. Implement follow-up monitoring. <p>Some state and local statutes may require specific sampling intervals, remedial actions, and reporting requirements.</p> <p>If one or more cases of legionellosis (either LD or PF) are suspected, take the additional following steps:</p> <ul style="list-style-type: none"> • Notify appropriate management and public health authorities (if required) of test results and coordinate further efforts. Coordinate and implement remedial cleaning and/or disinfection protocols with any proposed testing by public health officials.

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