

Section II

MANAGEMENT PLAN FOR DOMESTIC SERVICES

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1. SCOPE

1.1 Purpose

The purpose of this plan is to implement and maintain an effective management program for the prevention and control of *Legionella* in domestic water services.

1.2 Responsibility

It is the responsibility of the Water Safety Committee (WSC) to ensure all procedures set forth in this document are implemented and updated as outlined herein. Facility personnel will complete the necessary testing and monitoring as outlined. Program tasks may be contracted to qualified service providers, as long as the competency of the contractors are assessed and documented prior to beginning work and on an on-going basis, at least annually. Responsibility for implementing and following this program, however, cannot be transferred to the service provider.

The Management Plan shall be reviewed by the WSC as defined in the following table:

Responsible Person(s)	Title	Role
Sallie A. Houser-Hanfelder	Medical Facility Director	<ul style="list-style-type: none"> - Review of HCA LD Prevention Plan, and submittal to the VISN Director, annually - Ensuring the actions of the HCA LD Prevention Plan are implemented
Bradley McCollam	Chief, FMS	WSC Chair <ul style="list-style-type: none"> - Review of the HCA LD Prevention Plan, annually - Establishing policy for environmental testing of <i>Legionella</i>, Voting Member
Natalie Merckens	Associate Director	Co-WSC Chair, Voting Member
Raymond Marsh	Environmental Engineer	Water Testing for <i>Legionella</i> Lab Contract COR Voting Member
Garry Brust	Facility Operations Supervisor	System Flushing, Temperature Monitoring
Rich Rice	FMS Engineering	Backflow Prevention, System Maintenance Cleaning and disinfecting outlets
Dr. Mary Bessesen	Infectious Diseases	Voting Member
Margie Dole	Infection Control	Voting Member
John Hankins	Safety and Occupational Health	Voting Member
Dr. Daniel Merrick	Pathology and Lab Medicine	Voting Member
Dr. Marvin Goldberg	Hemodialysis	Voting Member
Daniel Kerley	Industrial Hygienist	Voting Member
Dr. Sandra Buseman	Occupational Health	Voting Member
Marsha Joyce	NNU	Nurse Union Representation
Jo Scher	AFGE Local 2430	Union Representation

1.3 References

American Society for Heating, Refrigerating and Air-conditioning Engineers (ASHRAE). Guideline 12-2000. Minimizing the Risk of Legionellosis Associated with Building Water Systems; 2000.

Cooling Technology Institute (CTI). Legionellosis Guideline: Best Practices for Control of Legionella; CTI Guidelines WTB-148 (08), 2008.

Health & Safety Executive (HSE). Legionnaires' Disease: The Control of *Legionella* Bacteria in Water Systems. Approved Code of Practice & Guidance L8; 2000

International Code Council. International Plumbing Code, Chapters 1 through 6 2009 IPC. International Code Council, Inc.; 2007.

Occupational Safety and Health Administration (OSHA). OSHA Technical Manual, Section III: Chapter 7. Legionnaires' Disease. Effective date: January 20, 1999.

World Health Organization (WHO). *Legionella* and the Prevention of Legionellosis; WHO Press 2007.

Department of Veterans Affairs. VHA Directive 1061, Prevention of Healthcare-Associated *Legionella* Disease and Scald Injury from Potable Water Distribution Systems. Effective Date: TBD. (Still in draft form at time of assessment)

2. PROGRAM SPECIFICATION

This section defines specifications for managing risk associated with *Legionella* for domestic water services. Tasks specified shall be implemented and followed by the WSC. This specification applies only to potable water uses such as restrooms, bathing showers, labs, break areas, sinks, janitorial, etc.

Verification Plan Summary

The following plan was adopted from the Hazard Assessment. The WSC reviewed each process step judged to be of significance; and then a plan for verification and validation was outlined as summarized in the following table. This plan was selected based on best practices that were deemed applicable. Specific instruction and corrective action is defined in the sections that follow.

CCP = Critical Control Point

NOTES: *Activities in BOLD are requirements as stated in VHA Directive. All other tasks are recommended best practices.

The following validation plan table has been filled out to reflect the *possible* addition of chlorine dioxide secondary disinfection, while also holding the place for monitoring the existing primary oxidant, total chlorine. Therefore, both primary oxidant residual goals and chlorine dioxide goals are included however only one or the other is necessary to be met at a time.

(A1) RECEIVING	Monitoring Task	Monitoring Method	Control Limit	Frequency
(A1.1) Cold Mains Applies to:	Primary Oxidant Residual	Automated Sampler (Manual field test until sampler installed)	Goal > 0.5 mg/L as total chlorine (Cl ₂) at nearest outlet	Weekly
A1 .1 (A1 .2 when in use)	Water Temperature	Temperature Check	Goal is <67°F <19.4°C) at nearest outlet	Weekly
	Backflow Prevention Check	PM Schedule	Pass/Fail	Annual PM

(A2) CONDITIONING	Monitoring Task	Monitoring Method	Control Limit	Frequency
(A2.2) Booster Pumps Applies to Cold Mains: A1 .1	Pump Rotation & Operating Hours	Rotate and/or operate every 24 hours	Not greater than 24 hours	Continuous
(A2.6) Secondary Disinfection Step, Chlorine Dioxide (Monitoring required by Safe Drinking Water Act – SYSTEM NOT YET INSTALLED) Applies to Cold Mains: A1.1	Secondary Disinfectant Residual, Chlorine Dioxide ³	Automated Sampler	Less than 0.8 mg/L chlorine dioxide (ClO ₂) at outlets	Daily
	Chlorite Ion ³	Automated Sampler	Not more than 0.8 mg/L chlorite ion (ClO ₂ ⁻) at nearest outlet	Daily
	Chlorite Ion ³	Lab test	Not more than 0.8 mg/L chlorite ion (ClO ₂ ⁻) at nearest outlet	Quarterly

(A3) DISTRIBUTION COLD	Monitoring Task	Monitoring Method	Control Limit	Frequency
Applies to Areas: As required	Flushing	As required for known stagnant section or vacant areas.	Not greater than 4 days	Twice per week

(A4) OUTLETS COLD	Monitoring Task	Monitoring Method	Control Limit	Frequency
(A4.1) Bathing Showers CCP Critical Control Point	<i>Legionella</i> Culturing	Lab Culture Test	<i>Legionella</i> <i>Pneumophila</i> Not Detected	Quarterly

(A4) OUTLETS COLD	Monitoring Task	Monitoring Method	Control Limit	Frequency
	Water Temp.	Temperature Check	Goal is <67°F (<19.4°C) within 2-min	Representative Outlets Weekly
	Primary Oxidant Residual	DPD field test	Goal is >0.5 mg/L as total chlorine (Cl ₂)	Representative Outlets Weekly
	Cleaning and disinfection of shower heads	PM Schedule	Clean surfaces and system	At least annually
	Flushing	As required for known irregular use or low-flow outlets	Not greater than 4 days	As required; Twice per week
	Mechanical Condition	Inspection	Pass/Fail	Annual PM
(A4.2) Faucets & Outlets	Legionella Culturing	Lab Culture Test	Legionella pneumophila - Not Detected	Quarterly Sampling and Analysis
	Water Temp.	Temperature Check	Goal is <67°F (<19.4°C) within 2-min	Representative Outlets Weekly
	Primary Oxidant Residual ¹	DPD field test	Goal is >0.5 mg/L as total chlorine (Cl ₂)	Representative Outlets Weekly
	Secondary Disinfectant Residual, Chlorine Dioxide ³	DPD field test	Less than 0.8 mg/L chlorine dioxide (ClO ₂) at outlets	TBD - Weekly
	Cleaning and disinfection of faucet aerators or laminar flow devices	PM Schedule	Clean surfaces	At least annually;
	Flushing	As required for known irregular use or low-flow outlets	Not greater than 4 days	As required; Twice per week
	Mechanical Condition	Inspection	Pass/Fail	Annual PM
(A4.3) Immersion Baths	Cleaning and disinfection of faucet aerators	PM Schedule	Clean surfaces	At least annually;
	Flushing	As required for known irregular use or low-flow outlets	Not greater than 4 days	As required; Twice per week
	Mechanical Condition	Inspection	Pass/Fail	Annual PM

(A5) HOT WATER SYSTEMS	Monitoring Task	Monitoring Method	Control Limit	Frequency
CENTRALIZED - No Storage Instantaneous or Semi-Instantaneous Heater Source Applies to: A5.1, A5.2	Hot Water Supply Temp.	Temperature Check	>130°F (54.4°C)	Weekly
	Hot Water Return Temp.	Temperature Check	>124°F (51°C)	Weekly
Hot Water Systems that supply bathing showers CCP Applies to: A5.1, A5.2	Legionella Culturing	Lab Culture Test	Legionella pneumophila Not Detected	Quarterly

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(A6) DISTRIBUTION HOT	Monitoring Task	Monitoring Method	Control Limit	Frequency
Applies to Areas: As required	Flushing	As required for known stagnant section or vacant areas.	Not greater than 4 days	As required; Twice per week

(A7) OUTLETS HOT	Monitoring Task	Monitoring Method	Control Limit	Frequency
(A7.1) Bathing Showers C C P	<i>Legionella</i> Culturing	Lab Culture Test	<i>Legionella pneumophila</i> - Not Detected	Quarterly Sampling and Analysis
	Water Temp.	Temperature Check	110°F (43.3°C) after 2-min	Selected - Weekly
	Primary Oxidant Residual	DPD field test	Goal is >0.5 mg/L as total chlorine (Cl ₂)	Selected - Weekly
	Cleaning and disinfection of shower heads	PM Schedule	Clean surfaces	At least annually;
	Flushing	As required for known irregular use or low-flow outlets	Not greater than 4 days	As required; Twice per week
	Mechanical Condition	Inspection	Pass/Fail	Annual PM
	Mixing Valves	Test and Service	Pass/Fail	Annual PM
(A7.2) Faucets & Outlets	<i>Legionella</i> Culturing	Lab Culture Test	<i>Legionella pneumophila</i> - Not Detected	Quarterly Sampling and Analysis
	Water Temp.	Temperature Check	110°F (43.3°C) after 2-min	Selected - Weekly
	Primary Oxidant Residual ¹	DPD field test	Goal is >0.5 mg/L as total chlorine (Cl ₂)	Selected - Weekly
	Secondary Disinfectant Residual, Chlorine Dioxide ³	DPD field test	Less than 0.8 mg/L chlorine dioxide (ClO ₂) at outlets	TBD - Weekly
	Cleaning and disinfection of faucet aerators or laminar flow device	PM Schedule	Clean surfaces	At least annually;
	Flushing	As required for known irregular use or low-flow outlets	Not greater than 4 days	As required; Twice per week
	Mechanical Condition	Inspection	Pass/Fail	Annual PM
(A7.3) Immersion Baths	Mixing Valves	Test and Service	Pass/Fail	Annual PM
	<i>Legionella</i> Culturing	Lab Culture Test	<i>Legionella pneumophila</i> Not Detected	Quarterly
	Water Temp.	Temperature Check	< 110°F (43.3°C)	Before and During Bath

Management Plan for Domestic Services

(A7) OUTLETS HOT	Monitoring Task	Monitoring Method	Control Limit	Frequency
	Cleaning and disinfection of faucet aerators	PM Schedule	Clean surfaces	At least annually;
	Flushing	As required for known irregular use or low-flow outlets	Not greater than 4 days	As required; Twice per week
	Mechanical Condition	Inspection	Pass/Fail	Annual PM
	Mixing Valves	Test and Service	Pass/Fail	Annual PM
	Digital Thermometer and Probe Calibration	PM Schedule	Pass/Fail	Per manufacturer specifications

Footnotes:

¹ If primary disinfectant is chlorine, then measure free chlorine; If primary disinfectant is chloramine, then measure total chlorine.

² *Legionella* lab culture testing should be performed by a lab that is CDC-ELITE certified and follows the ISO1 1731 test method. The US-CDC recommends a goal of no detectable *Legionella* as there is no known safe level.

³ 0.8 mg/L is the maximum contaminated level for chlorite ions and chlorine dioxide per the EPA National Primary Drinking Water Regulations

Abbreviations:

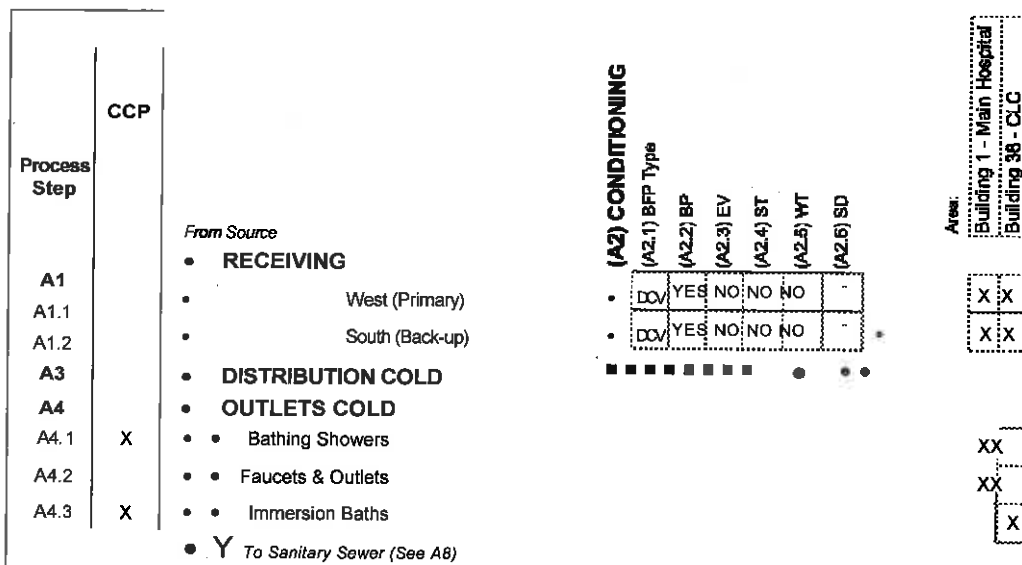
Mg/L= Milligrams per Liter

PM = Preventive Maintenance

2.1 Domestic Services

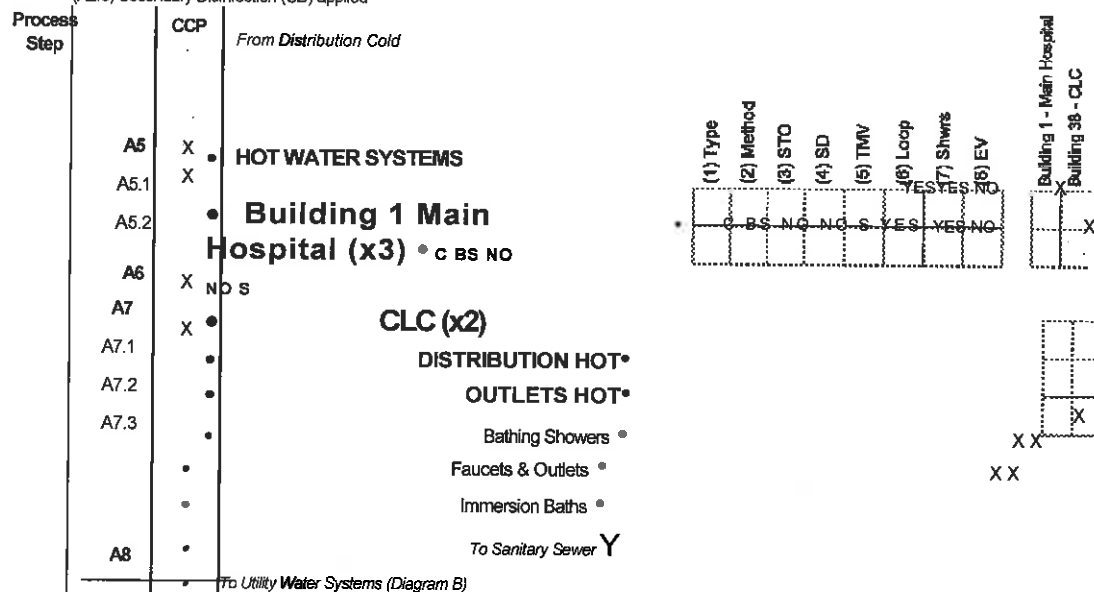
The following simple line diagram shows water uses managed by this specification.

DIAGRAM A
Domestic Water Services



*A chlorine dioxide system is being planned to provide secondary disinfection on the incoming cold water main

(A2.1) Backflow Preventer (BFP) Type: Check Valve (CV), Double Check Valve (DCV), Reduced Pressure Zone (RPZ), Air Gap (AG)
 (A2.2) Booster Pumps (BP)
 (A2.3) Expansion Vessel (EV)
 (A2.4) Storage Tanks (ST)/Cisterns
 (A2.5) Water Treatment (WT) - Filtration (F) or Softening (S)
 (A2.6) Secondary Disinfection (SD) applied



* To Other "At Risk" Systems (See Section 4)

Y SANITARY SEWER

(1) Type: Centralized (C) - Serve multiple floors/areas; Point-of-Use (POU) - Serve a few outlets or a single area
 (2) Heating Method: Gas Fired (GF), Electric (E), Boiler System (BS)
 (3) With storage (STO)
 (4) Secondary Disinfection (SD) applied
 (5) Thermostatic Mixing Valve (TMV) location: at Supply (S), per Zone (Z), at Outlet (O)
 (6) Recirculated Loop (Loop)
 (7) Supplies Bathing Showers (Shwrs)
 (8) Expansion Vessel (EV)

2.2 Program Management

Prevention and control of risk requires the following management practices.

2.2.1 Program Review

ANNUALLY; WSC shall review the Management Plan.

QUARTERLY; Committee meetings will be held to assess, at a minimum, documented verification of policy implementation, any results from water testing for *Legionella*, whether any engineering controls were not within specified limits and why that may have occurred, whether any corrective actions were taken on engineering controls, whether the HCA LD plan needs to be updated, and whether there have been any cases of LD diagnosed at or potentially associated with each building.

AS NECESSARY; WSC will meet to address any non-routine *Legionella* control issues and HCA LD

Ensure the results of the review meetings are communicated to the Medical Facility Leadership team and other local committees as appropriate.

2.2.2 Awareness Training

Awareness training for *Legionella* risk associated with water systems shall be conducted for water system operators or employees with responsibilities pertaining to the domestic water services. Training goals are to improve awareness and understanding of risks associated with *Legionella*.

ANNUALLY; Complete awareness training and document

2.2.3 Records & Documentation

Documentation of monitoring results and remedial actions shall be recorded in respective logs, checklists, or equivalent documentation. Sufficient historical data shall be readily available to the WSC or other interested parties.

Document in the committee meeting minutes any corrective actions that were initiated and the effectiveness of the corrective actions taken.

All data shall be retained according to site policy.

2.2.4 Engineering

Installation of new domestic water services or modifications to existing systems must be designed to aid safe operation that avoids conditions that promote microbial proliferation, limits excessive release of water aerosols, and meets applicable plumbing codes. (See Appendix "A" for specific procedures)

System drawings shall be maintained and updated as necessary.

2.2.5 Operation

The WSC will maintain awareness to operate domestic water services and associated equipment at all times when possible to avoid idle periods. Affected systems shall be flushed when need is identified.

Stagnant situations to be addressed may include but is not limited to:

- (1) dead zones (dead-legs or dead ends which are greater than 6-times pipe diameter),
- (2) infrequently used outlets,
- (3) construction or renovation activity,
- (4) closed or vacant areas
- (5) low occupancy, and
- (6) cross connections

2.2.6 Maintenance

The domestic water services shall be maintained to limit scale, sediment, excessive release of water droplets (water aerosols), and temperatures that favor microbial growth.

Strategies to limit conditions that favor microbial growth may include but is not limited to the following:

- Regular annual inspection of mechanical conditions
- Maintenance of backflow prevention devices per local requirements
- Utilization of approved plumbing materials
- Maintaining hot and cold piping insulation where necessary
- Clean and disinfect outlets as required (e.g., shower heads and aerators)
- Flush outlets as required

All ancillary equipment associated with the domestic water services such as water cooler filters, ice machines or the like shall be maintained per the required preventive maintenance program recommended by the manufacturer. All routine maintenance required by this management plan shall be documented.

Maintain plumbing systems to the VHA Directive and local code to avoid conditions that may support Legionella risk.

2.2.7 New Construction

Newly installed piping and distribution system components shall be flushed of debris and disinfected before commission. Piping and components must be cleaned and protected from accumulation of debris and contamination prior to and during installation. See Appendix A for procedures.

Documentation of flushing and disinfection shall be maintained.

2.2.8 Boil Water Event

The Emergency Planning Committee (EPC) has developed an emergency response plan for "Continuity of Service" (COS) in the event of a water main break or service interruption.

COS plans are reviewed annually.

2.3 Management of Process Steps

23.1 Receiving

The following shall be monitored continuously for each water main entering buildings as directed by the Final Legionella Prevention Directive. Water can be sampled from the backflow prevention device or the nearest outlet.

- Water Temperature
- Oxidant Residual
- Pressure
- Temperature
- Total Dissolved Solids
- pH

23.2 Conditioning

Backflow Prevention Devices: Backflow Prevention Devices shall be tested annually per local code requirements.

Booster Pumps: Booster pumps shall be operated to avoid idle periods greater than 24 hours whenever possible.

Secondary Disinfection

Secondary Disinfection systems shall be operated and maintained as per manufacturer specifications and Colorado State regulations.

The following shall be performed for each secondary disinfection system at the frequency and control limit defined in the program specification. Water should be sampled as per manufacturer specifications.

- Oxidant Residual
- Disinfection By-products

Contingency: Systems treated with secondary disinfection that consistently do not meet the control limits shall be considered for the following corrective action as determined necessary by the WSC:

- Verify System Operation
- Verify Dosing and Monitoring Equipment
- Contact Manufacturer for Troubleshooting, if necessary

23.3 Distribution Cold and Hot

Maintain awareness for identification of cross connections or stagnant conditions due to dead legs, dead zones, vacant areas, low flow, etc.

Contingency: Identified cross connections or stagnant cold and hot water distribution sections shall be considered for the following corrective action as determined necessary by the WSC:

- Removal
- Routine Flushing

2.3.4 Hot Water Systems

The following shall be performed for each hot water system at the frequency and control limit defined in the program specification. Water should be sampled directly from the water heater or the nearest outlet.

- Water Temperature
- *Legionella* Testing

Contingency: Hot water systems that consistently do not meet the control limits shall be considered for the following corrective action as determined necessary by the WSC:

- Routine or Increased *Legionella* Testing
- Routine Flushing
- Increased Cleaning and Disinfection of Storage Tanks
- System Superchlorination or Thermal Disinfection
- Supplemental (Secondary) Disinfection
- Other Supplemental Action

2.3.5 Outlets Cold and Hot

The following shall be performed for a representative number of outlets for each system at the frequency and control limit defined in the program specification. Water should be sampled directly from the outlets. For each hot and cold water source select at least one sample point at a near, mid, and most distal point of the system.

- Water Temperature
- Oxidant Residual
- *Legionella* Testing
- Mechanical Inspection
- Cleaning and Disinfection
 - Faucet Aerators
 - Showerheads
 - ADA Shower Wands
 - Circulated Bathing Tub

*Cleaning and disinfection for high-risk outlets may be performed at a higher frequency as defined in the program specification. High-risk outlets include those in the following areas:

- Intensive Care
- Infusion Clinic

Contingency: Cold and hot outlets that consistently do not meet the control limits shall be considered for the following corrective action as determined necessary by the WSC:

- Verify Water Temperature Set Points
- Routine or Increased *Legionella* Testing
- Routine or Increased Flushing
- Routine or Increased Cleaning and Disinfection of the Outlet
- System superchlorination or Thermal Disinfection
- Supplemental (Secondary) Disinfection
- Point-of-Use (POU) Filtration - Point-of-use (POU) filters can be used in contingency situations for or use at specific outlets (i.e. high-risk outlets) per the VHA Directive draft. Usage is not a requirement.

2.3.6 Immersion Baths

For equipment where full or partial immersion is the means of patient contact with heated water (e.g., bathtubs, whirlpool tubs, and foot baths), the following measures are required for the prevention of scald injury:

1. Mixing valves at the outlet that are capable of blending the hot and cold water supply to hold water temperatures at or below 110°F are required.
2. All patient immersion baths must be equipped with a large digital readout device displaying the bath water temperature. Bath water must not exceed 110°F at the time of patient immersion. The temperature must be verified by taking the temperature of the water with a hand held thermometer (preferable non-mercury containing) and comparing this reading with the reading of the tub thermometer. For tubs with an elevated reservoir tank, a remote temperature-sensing probe that can be submerged into the tank water may be utilized to provide the verification temperature.
3. Thermometers and probes must be calibrated, used and validated in accordance with manufacturer's instructions.

2.4 Monitoring Schedule

The schedule for monitoring applies to events described in Section 2. Temperature, disinfectant residual and mechanical inspection can be performed concurrently with *Legionella* testing performed in accordance with final Directive requirements.

- For each building, monitor at least 5 hot and 5 cold water outlets weekly
- For each building, monitor for temperature, total chlorine residual and pH at every outlet when legionella testing is being performed.

2.5 *Legionella* Culturing & Contingency

Domestic water services shall be tested as determined necessary by the management team for the presence of viable *Legionella* using the culture method. All samples shall be analyzed using a lab that is ISO 9001:2000 certified and is certified by the Centers for Disease Control (CDC) under the ELITE (Environmental *Legionella* Isolation Techniques Evaluation) program. In addition, the testing protocol shall follow the International Organization of Standardization ISO method 11731:1988(E) entitled "Water Quality – Detection and Enumeration of *Legionella*". Results shall be recorded in the program log, service report, or equivalent.

The WSC has final discretion for establishing test points and number of tests to be taken. See Monitoring Schedule (Section 2.5).

Per the VHA Directive, testing of select water outlets of the building hot and cold water distribution system(s) for *Legionella* must be performed quarterly. At least 10 hot water outlets AND 10 cold water outlets will be tested from each building.

VHA Directive 1061 Contingency Plan

The presence of any species of *Legionella* warrants review and possible remedial actions. The following plan shall be followed when control goals for *Legionella* are not met. All corrective actions taken shall be documented.

More rigorous corrective action as deemed necessary by the WSC shall be taken where detection of *Legionella* is persistent.

See Section 2.7 and Appendix A for detailed remediation strategies.

If *Legionella* non-pneumophila species is detected during a sampling event, this shall be construed as a condition that may be conducive to the growth of the pneumophila species. In this event the WSC shall review the data and recommend any required additional monitoring of engineering controls, sampling, and remedial activities per the final VHA Directive 1061.

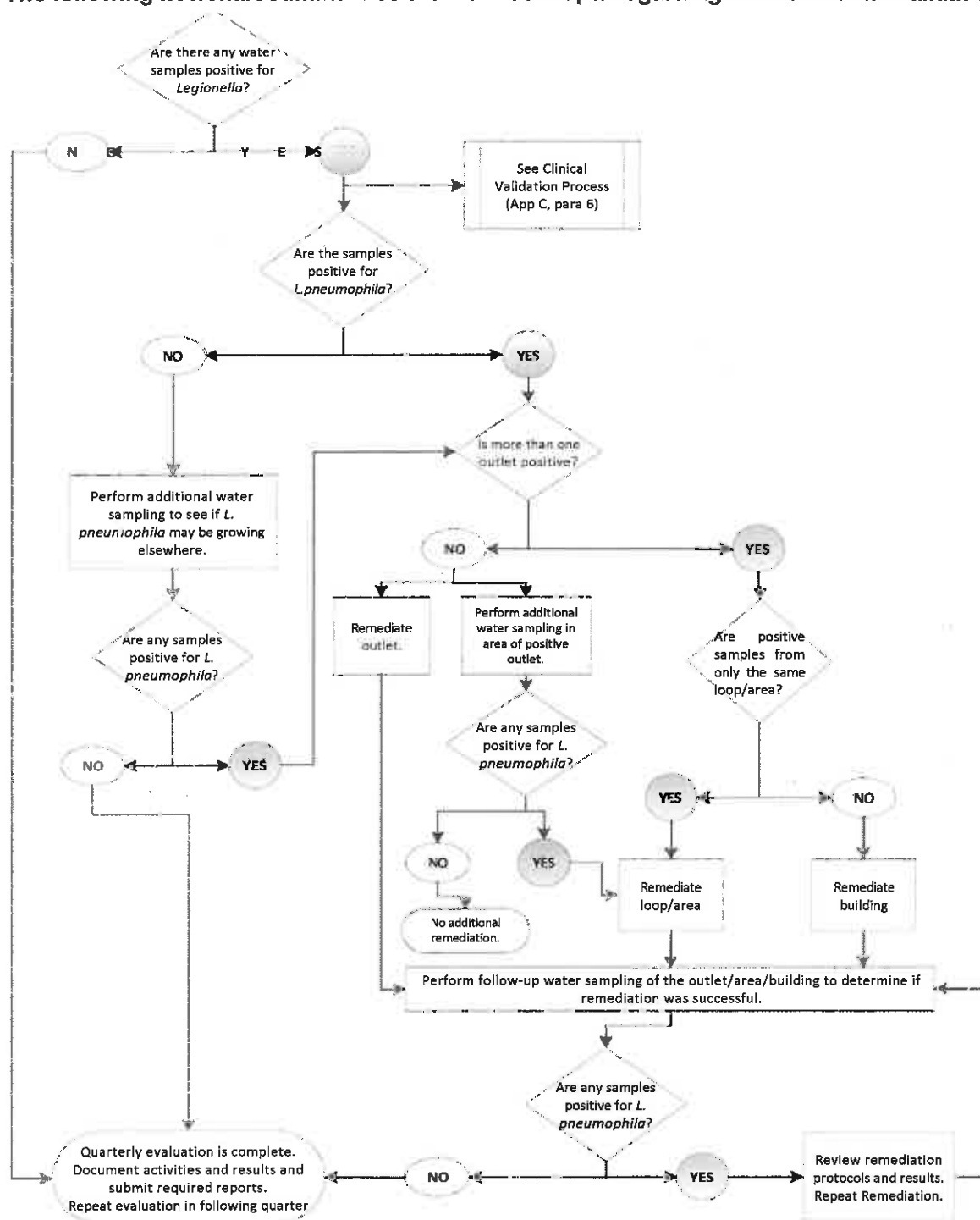
If one outlet is positive for *Legionella* pneumophila, then a determination must be made by the WSC as to which other outlets in the area (on same water distribution section line) must be tested for *Legionella* and if any mitigation of the immediate water distribution loop/section is necessary pending the results of any additional cultures.

(In all instances, the fixture that tested positive for *Legionella* pneumophila must be promptly taken apart, cleaned and disinfected. See Appendix A for procedures on sanitization and descaling of plumbing fixtures.)

If more than one outlet is positive for *Legionella* pneumophila, the WSC must meet and assess the results to determine the subsequent actions as follows:

- If the outlets that tested positive are in the same area of the building or on the same water distribution loop, then conduct emergency remediation of the area or loop as described in Section 2.7 and Appendix A.
- If the outlets that tested positive are in different areas of the building or on different water distribution loops, then conduct emergency remediation of the entire building water system(s) as described in Section 2.7 and Appendix A.
- **Retest** the water in the areas that tested positive for *Legionella* pneumophila to determine if the remediation procedures were successful at reducing *Legionella* to undetectable levels.
- If the remediation procedures were not effective the WSC must meet and, assess the post-remediation results for location of positive samples, and determine subsequent actions. *Consultation with the VHA Water Safety Program is available for guidance on remediation.*

Documentation is required for environmental testing (date, outlets, and results), any assessment of positive results, and remedial action taken, and efficacy of remedial actions. A report of these items will be submitted to the facility WSC.



2.6 Emergency Remediation of the Water Distribution System

If a definite case of HCA LD is identified then emergency remediation of the water distribution system in the building is required. A definite case is when the person has spent 10 or more days continuously in a VHA facility prior to the onset of pneumonia symptoms.

If a possible case of HCA LD is identified, then test the building's water distribution system for *Legionella* and implement emergency remediation if *Legionella* is detected. A possible case is when the person has spent between 2 and 9 days in a VHA facility prior to the onset of pneumonia symptoms.

Remediation Procedures

First, the facility WSC must meet and review data on the implementation of the primary and secondary engineering controls to determine if there were any circumstances (e.g. construction activities, reduced water temperatures, reduced oxidant residual levels) that could have resulted in *Legionella* growth.

Next, Emergency Remediation is to include any or all of the following immediate procedures.

1. Thermal Eradication
2. Shock Chlorination
3. High Level Disinfection

See Appendix A for detailed procedures. *Consultation with the VHA Water Safety Program is available for guidance on remediation.*

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APPENDIX A – Remediation Procedures

During normal operation it is possible for hot and cold water services to become contaminated and disinfection will be required. Remedial cleaning and disinfection are required when one or more of the following occurs:

- Where a system has been altered for major repairs or extensions
- Where a system has not been in regular use or flushed
- Where plumbing, outlets, supply tanks, or water heaters systems are known to contain scale or corrosion deposits, or an accumulation of sludge
- Where a system upset occurs, or where there is suspected biological contamination

Elimination of *Legionella* colonization in a hot water is difficult. Success depends on the design and condition of the system, as well as the remediation methodology used. If a system is old, cleaning and de-scaling is an important component of a *Legionella* control program. As *Legionella* is killed by temperatures over 55°C (131°F), superheating of water (raising of water temperature above the normal set point for the system) within a system may be efficacious. While superheating may result in a reduction in system colonization, *Legionella* is usually not eradicated, and often re-colonizes the system within a matter of weeks, necessitating recurrent superheating cycles. As an alternative to superheating, superchlorination may be performed. Again, this method may only suppress *Legionella*, permitting subsequent re-colonization. Continuous superchlorination has been attempted by several institutions, but is less favorable because of its corrosive effect on plumbing.

(1) Shock Chlorination

Use this procedure for emergency disinfection purposes only. The management team shall have discretion over when this procedure is used. This method involves increasing the chlorine/chlorine dioxide level of the hot and cold water distribution systems to 2 mg/L and maintaining at least that level throughout the system for at least 2 hours (but not exceeding 24 hours).

1. If the cold or hot water system does not have a supply tank, dose the distribution system with chlorine/chlorine dioxide to achieve 2 mg/L of disinfectant. Dosage at the injection tank or line may need to be 20 to 50 mg/L to achieve 2 mg/L at the furthest outlets.
2. Drain superchlorinated water through each discharge valve successively working away from the tank or chlorination point. Note: A chlorination source, be it either a superchlorinated tank or injection point, must not be allowed to fully deplete. Refill as needed, and dose chlorine to achieve 2 mg/L free chlorine/chlorine dioxide.
3. Allow the superchlorinated water to remain in the tank and pipework at 2 mg/L for at least 2 hours.
4. Following disinfection, the tank and pipework should be drained and flushed to waste in accordance with local regulations with clean water until the free residual chlorine concentration at each discharge valve is no greater than that of the supply water.

NOTE: When chemical disinfection is being performed, warning notices must be posted.

(2) High-Level Disinfection

Use this procedure for emergency disinfection purposes only. The management team shall have discretion over when this procedure is used. This method involves increasing the chlorine level of the hot and cold water distribution systems to 50 mg/L and maintaining at least 10 mg/L (free chlorine residual) throughout the system and at outlets for 24 hours; or 200/mg/L for three hours.

1. If the cold water system does not have a supply tank, dose the distribution system with chlorine to achieve either 50 mg/L or 200 mg/L ppm free chlorine.
2. Drain superchlorinated water through each discharge valve successively working away from the tank or chlorination point. Note: A chlorination source, be it either a superchlorinated tank or injection point, must not be allowed to fully deplete. Refill as needed, and dose chlorine to achieve either 10 mg/L or 200 mg/L free chlorine.
3. Allow the superchlorinated water to remain in the tank and pipework for at least 24 hours (at 10 mg/L) or 3 hours (at 200 mg/L).
4. Following disinfection, the tank and pipework should be drained and flushed to waste in accordance with local regulations with clean water until the free residual chlorine concentration at each discharge valve is no greater than that of the supply water.

NOTE: When chemical disinfection is being performed, warning notices must be posted.

(3) Thermal Disinfection

Use this procedure for emergency disinfection purposes only. The management team shall have discretion over when this procedure is used. This procedure involves the temporary resetting of the temperature in the hot water distribution system to 160°F - 170°F (71°C - 77°C) while continuously flushing each outlet in the system for at least 30 minutes. Consideration needs to be given as to the feasibility of implementing thermal eradication depending on the design of the mixing valves in place.

NOTE: When thermal disinfection is being performed, warning notices must be posted. There is significant risk for scalding and care needs to be taken to protect end users of the water distribution system, as well as the employees who are administering the measure.

(4) Sanitizing Plumbing Repairs

Use this procedure for small repairs or replacement of small sections of plumbing. New junctions, fittings, pipes, or other small repairs must be cleared of any debris and disinfected prior to installation by immersing in a bleach solution. The disinfecting solution may also be applied by spray application. If new pipework is installed, remedial cleaning and disinfection are required only on the affected section.

(5) Acid Descale & Sanitize

Acid cleaning is a convenient way of removing hard adherent scale from showerheads. The deposits commonly found in showerheads consist mainly of calcium carbonate (chalk, lime scale), which dissolves easily in most acids.

Health & Safety

Rubber gloves or equivalent

Cleaning Products

Domestic 5.6% chlorine bleach - *Use 4-oz per gallon of water*

Ecolab LIME-A-WAY CLEANER or similar

Equipment Required

Buckets, soft brushes or non-abrasive scrub pad

Procedure

The procedure applies to domestic water outlets such as shower heads, faucet aerators and other similar domestic water fixtures/faucets.

Cleaning is performed as a batch process

1. Remove shower heads and faucet aerators from all the locations at once and replace with new or clean shower heads and faucet aerators.
2. Take all dirty recently removed shower heads and faucet aerators to the shop and perform cleaning.

De-scaling process

3. De-scale shower heads and faucet aerators with Lime-A-Way cleaner (or similar) by soak method in warm water for at least five (5) minutes in a bucket.
4. If needed, scrub with a soft brush or non-abrasive scrub pad.
5. Rinse outlets with potable water.

Sanitizer process

6. Soak outlets for ten (10) minutes in a 1% bleach solution.
7. Rinse outlets with potable water and allow to air dry.
8. Hold outlets in a clean box container until next scheduled cycle. Do not wrap in a plastic bag or store in plastic containers which can trap moisture.

Flush outlets for two (2) minutes after outlet is re-installed.

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APPENDIX B – Monitoring Procedures

(1) Disinfectant Residual

Water can be tested for the presence of total chlorine using an EPA approved DPD test method. A HACH photo spectrometer approved for EPA drinking water testing for chlorine should be used. Follow kit instructions for testing.

(2) Chlorine Dioxide Residual

Water can be tested for the presence of chlorine dioxide using DPD + Glycine test method. A HACH photo spectrometer approved for EPA drinking water testing for chlorine dioxide should be used. Follow kit instructions for testing.

(3) Chlorite Residual

Water can be tested for the presence of chlorite using the DPD test method. An approved EPA drinking water instrument shall be used. Follow kit instructions for testing.

(4) Water Temperature Measurement

Water temperatures should be measured using a calibrated thermometer or equivalent. Water temperature may be determined directly from a flowing water stream or from water collected in a sample container. Water temperature CANNOT be measured using an infrared thermometer due to inaccuracy of measuring temperature of translucent fluids.

(5) Mechanical Inspection

Outlets shall be inspected for the following mechanical conditions:

- Evidence of excessive scale
- Discolored water
- Odors
- Leaks
- Mechanical function
- Stagnation

Contingency Plan:

- Outlets shall be replaced, repaired or other corrective action shall be taken as determined necessary by the management team and documented

(6) Legionella Culturing

Analysis of domestic water samples for the presence of *Legionella* is a valuable tool for monitoring health-related risks associated with domestic water services and to verify that control practices remain effective.

All samples shall be analyzed using a CDC-ELITE certified lab and follow the International Organization of Standardization ISO method 11731:1988(E) entitled "Water Quality – Detection and Enumeration of Legionella". Specialized testing is the only means by which to detect and enumerate *Legionella*. Test results require up to 14 days for confirmation.

All testing requires a minimum 250-mL sample size and will have a detection limit of 0.1 CFU/mL.

Procedure:

Follow Laboratory instructions.

1. Use sample containers and packing materials provided by the lab.
2. DO NOT RINSE CONTAINERS! Sample bottles contain sodium thiosulfate to neutralize oxidant.
3. Store and preserve samples according to testing laboratory guidelines.
4. Collect water samples using aseptic technique directly into the sample container. Place the open container just under the water surface, or sample directly into container.
5. Label each sample

Sample Shipping

1. Follow lab instructions.
2. Ensure bottle cap is securely tightened.
3. Protect samples from freezing, heat, and sunlight.
4. Use an appropriate shipping container to send the samples to the lab.
5. Preserve the samples (if required) in accordance with the testing laboratory guidelines.
6. Transport/ship samples immediately.

Reporting

Analytical results will be reported as colony forming units per milliliter (CFU/mL) of sample. See *Legionella* control criteria in the management plan for further guidance on control goals.

Recommendation:

ECHCS Director to approve Heath Care Associated (HCA) Legionnaires Disease Prevention Plan for Eastern Colorado Health Care System for the VA Medical Center and Community Living Center, Denver, Colorado.

Approve / ~~Disapprove~~


Sallie A. Houser-Hanfelder, FACHE
Director

Dated: