# Legionella Response Guidance

for

# Navy Medicine

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# ACRONYMS AND ABBREVIATIONS

| Acronym/ Abbreviation | Definition/Meaning |
|---|---|
| **%** | Percent |
| **° C** | Degrees Celsius |
| **° F** | Degrees Fahrenheit |
| **µL** | Microliter (volume measurement) |
| **µm** | Micrometer (size measurement) |
| **A2LA** | American Association for Laboratory Accreditation |
| **AB** | Accrediting Body |
| **AFNOR** | Association Française de Normalisation |
| **AIHA** | American Industrial Hygiene Association |
| **ATP** | Adenosine Triphosphate |
| **AWWA** | American Water Works Association |
| **BCYE** | Buffered Charcoal Yeast Extract |
| **BCYE** | Buffered Charcoal Yeast Extract without Cysteine |
| **BUMED** | Bureau of Medicine and Surgery |
| **CDC** | Centers for Disease Control and Prevention |
| **cfu/cm$^2$** | Colony Forming Unit per Square Centimeter (surface area measurement) |
| **cfu/cm$^3$** | Colony Forming Units per Cubic Meter (surface area measurement) |
| **cfu/L** | Colony Forming Units per Liter (volume measurement) |
| **cfu/mL** | Colony Forming Units per Milliliter (volume measurement) |
| **$CO_2$** | Carbon Dioxide |
| **CMS** | Centers for Medicare and Medicaid Services |
| **DFA** | Direct Fluorescent Antibody |
| **DNA** | Deoxyribonucleic Acid |
| **e.g.** | Exempli gratia (for Example) |
| **ECDC** | European Centre for Disease Prevention and Control |
| **ELITE** | Environmental *Legionella* Isolation Techniques Evaluation |
| **EMA** | Ethidium monoazide |
| **EMLAP** | Environmental Microbiology Laboratory Accreditation Program |
| **et.al.** | and others |
| **etc.** | and so forth |
| **EU** | European Union |
| **GmbH** | Company with Limited Liability (English translation from German) |
| **GU** | Genomic units |
| **GVPC** | BCYE media containing glycine, vancomycin, Polymyxin B and cycloheximide for recovery of *Legionella* from water |
| **HPC** | Heterotrophic Plate Count |
| **i.e.** | Id est (that is) |

| | |
|---|---|
| **IEC** | International Electrotechnical Commission |
| **IFA** | Immunofluorescent Antibody |
| **IL** | Illinois |
| **Inc.** | Incorporated |
| **ISO** | International Standards Organization |
| **KII** | Key Informant Interviews |
| **L** | Liter (volume measurement) |
| **LD** | Legionnaires' Disease |
| **Lpsg 1** | *Legionella pneumophila* serogroup 1 |
| **Lpsg 2-14** | *Legionella pneumophila* serogroups 2 -14 |
| **Ltd.** | Limited Company |
| **ME** | Maine |
| **min** | Minutes |
| ***mip*** | Macrophage Infectivity Potentiator |
| **MIQE** | Minimum Information for Publication of Quantitative Real-Time PCR Experiments |
| **mL** | Milliliter (volume measurement) |
| **mm** | Millimeter (size measurement) |
| **MPN**<br>**MTF** | Most Probable Number<br>Medical Treatment Facility |
| **MWY** | Modified Wadowsky and Yee agar for recovery of *Legionella* from water |
| **n** | Number of Samples |
| **NELAC** | National Environmental Laboratory Accreditation Conference |
| **NY** | New York |
| **ON** | Ontario |
| **OPPP** | Opportunistic Premise Plumbing Pathogen |
| **PA** | Public Address |
| **PCR** | Polymerase Chain Reaction |
| **PCTE** | Polycarbonate Track-etched |
| **PMA** | Propidium monoazide |
| **POE** | Point of Entry |
| **POU** | Point of Use |
| **PT** | Proficiency Test |
| **PVC** | BCYE agar supplemented with Polymyxin B, Vancomycin and Cyclo-heximide for recovery of *Legionella* from water |
| **$PVC_c$** | Chlorinated Polyvinyl Chloride |
| **PVT** | Phigenics Validation Test |
| **QA/QC** | Quality Assurance/Quality Control |
| **qPCR** | Quantitative Polymerase Chain Reaction |
| **RNA** | Ribonucleic Acid |
| **rRNA** | Ribosomal Ribonucleic Acid |

| | |
|---|---|
| **RT** | Room Temperature |
| **SCADA** | Supervisory Control and Data Acquisition |
| **SOP** | Standard Operating Procedure |
| **Spp.** | Species |
| **SWTR** | Surface Water Treatment Rule |
| **THAB** | Total Heterotrophic Aerobic Bacteria |
| **TNI** | The NELAC Institute |
| **TOC** | Total Organic Carbon |
| **TS** | Technical Specifications |
| **UK** | United Kingdom |
| **US** | United States |
| **US EPA** | United States Environmental Protection Agency |
| **VBNC** | Viable but Not Culturable |
| **WHO** | World Health Organization |
| **WMP** | Water Management Plan |
| **WSHL** | Wisconsin State Hygienic Laboratory |
| ***wzm*** | Gene specific to *L. pneumophila* serogroup 1 |
| **x g** | g-force |
| **α** | alpha |

# TECHNICAL ASSISTANCE

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# PURPOSE AND SCOPE

This document was developed to provide guidance on:

- Assessment, management and communication of health risks associated with *Legionella* bacteria in Navy medical treatment facilities (MTFs) and
- appropriate response to incidents such as Legionnaires' disease (LD) cases (suspected, confirmed or perceived to be) connected with Navy and Marine Corps installation drinking water systems or detection of *Legionella* bacteria in building water systems as well
- as the roles and responsibilities of supporting MTFs when working with the installation Public Works Department on *Legionella* issues.

This document employs two approaches to the topic of *Legionella* and LD which are not reflected in other US guidance. This is because new information is available from non-US health organizations which greatly improves control of *Legionella* in water systems. These approaches include:

1) the use of numerical standards of *Legionella* concentration in water to understand when to take action for control, and

2) the use of *L. pneumophila* vs *Legionella spp.* as the target pathogen for testing methods and remediation. This history and current status of drinking water treatment and regulation for *Legionella* control is explained below.

First, this guidance introduces recommended numerical standards for use in building water system management. In the US, *Legionella* has been regulated as a primary drinking water contaminant by treatment technique under the Safe Drinking Water Act's (SDWA) Surface Water Treatment Rule (SWTR, US EPA, 1989). This means *Legionella* is not specifically tested for during routine SDWA compliance testing. Using the best science and data at the time the rule was developed, the US EPA believed that if *Giardia* cysts and viruses were removed/inactivated, according to the *treatment techniques* in the SWTR, *Legionella* would also be controlled (US EPA, 2009).

The preventive barriers approach that public water systems maintain for *L. pneumophila* management and management of other contaminants include:

- Covering open water storage facilities to prevent environmental cross contamination,
- American Water Works Association (AWWA) Standard C-651 for disinfection of water main installations and repairs, and when disinfection is needed,
- Programs for cross connection control to prevent backflow and contamination,
- Total coliform/chlorine residual sampling representative of the distribution system with requirements for follow-up sampling and find-and-fix,
- Corrosion control programs where needed,
- A requirement to provide a detectable chlorine residual throughout the distribution system, and
- Rigorous requirements for disinfection of water mains prior to release into service.

Over the years, this approach has been shown to be effective, as the concentrations of *Legionella* found in drinking water distribution systems are low and intermittent.

The US EPA has chosen not to regulate *Legionella* in water supplies using a numerical standard, such as a maximum contaminant level (MCL), in part due to issues with the specificity and sensitivity of the available analytical testing methods (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#Microorganisms). There is no known level of *Legionella* that can be used to assess risk in drinking water since *Legionella* is not transmitted from ingestion, but through inhalation. Following the outbreaks of Legionnaires' disease in New York City in 2015, the city and the state of New York enacted regulations for cooling towers that specify monitoring frequencies and *Legionella* levels that require action (New York City Department of Health And Mental Hygiene, 2016; New York Codes, Rules and Regulations, 2016). To date, no other regulation of *Legionella* using bacterial concentrations found in water is in place in the US.

Note that requirements for the control and prevention of *Legionella* does exist in some European Union countries where we have DoD installations such as Italy, Germany and Spain. Germany has put these requirements in the Final Governing Standards. Some of these requirements do require annual monitoring for Legionella in buildings while using measured concentrations of Legionella to determine what risk management actions are required.

In the absence of US or Navy regulatory guidance, this document relies upon the European guidance (ECDC, 2017) and has also been developed to use measured concentrations of *Legionella* in building water systems to determine when action is warranted and what actions and health risk communications are appropriate. Without specific guidelines on *Legionella* concentrations in a building water system, it is difficult, if not impossible, to understand and interpret testing data, trigger appropriate corrective actions when needed and to make other decisions to protect public health. To understand whether a given level of *Legionella* is a health risk in any building it needs to be viewed in the context of overall building water quality management through water management planning as discussed in detail later in this document.

*Without specific guidelines on Legionella concentrations in a building water system, it is difficult, if not impossible, to understand and interpret testing data, trigger appropriate corrective actions when needed and to make other decisions to protect public health.*

Secondly, using a widely adopted approach, the target pathogen of concern is *L. pneumophila*, not *Legionella spp.* because *L. pneumophila* is the most significant causative agent of legionellosis. *L. pneumophila* caused 97% of Legionnaires' disease cases in Europe since 2009. In Japan 98% of cases since 2008 were caused by *L. pneumophila* and in the US, *L. pneumophila* has been the cause of 99% of cases and 100% of deaths from outbreaks.

Where *Legionella* is referred to in literature references, this document uses "*Legionella*" in the text; *L. pneumophila* is used where it is referenced as such in the literature and *L. pneumophila* is recommended to support the monitoring program discussed in this document. Legionellosis includes two diseases caused by *Legionella*, Legionnaires' disease which is the more serious from resulting in a sometimes-fatal pneumonia, and Pontiac fever, a relatively mild respiratory disease that generally needs no treatment and medical help is rarely sought. This document focuses on Legionnaires' disease and uses the term legionellosis only when this is referenced in other documents.

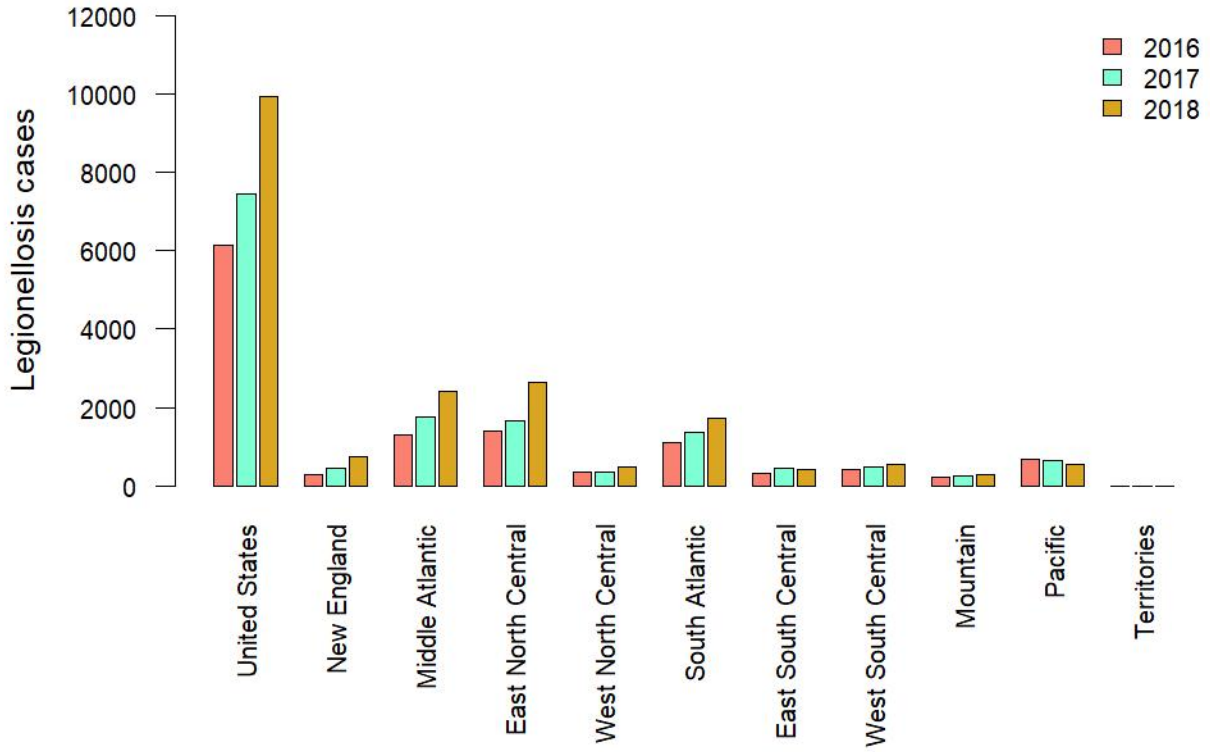
# SECTION 1 – BACKGROUND INFORMATION

This section provides basic background information on Legionnaires' disease and its causative agent *Legionella pneumophila*.

## 1.1 Legionnaires' Disease: An Important Waterborne Illness in the United States

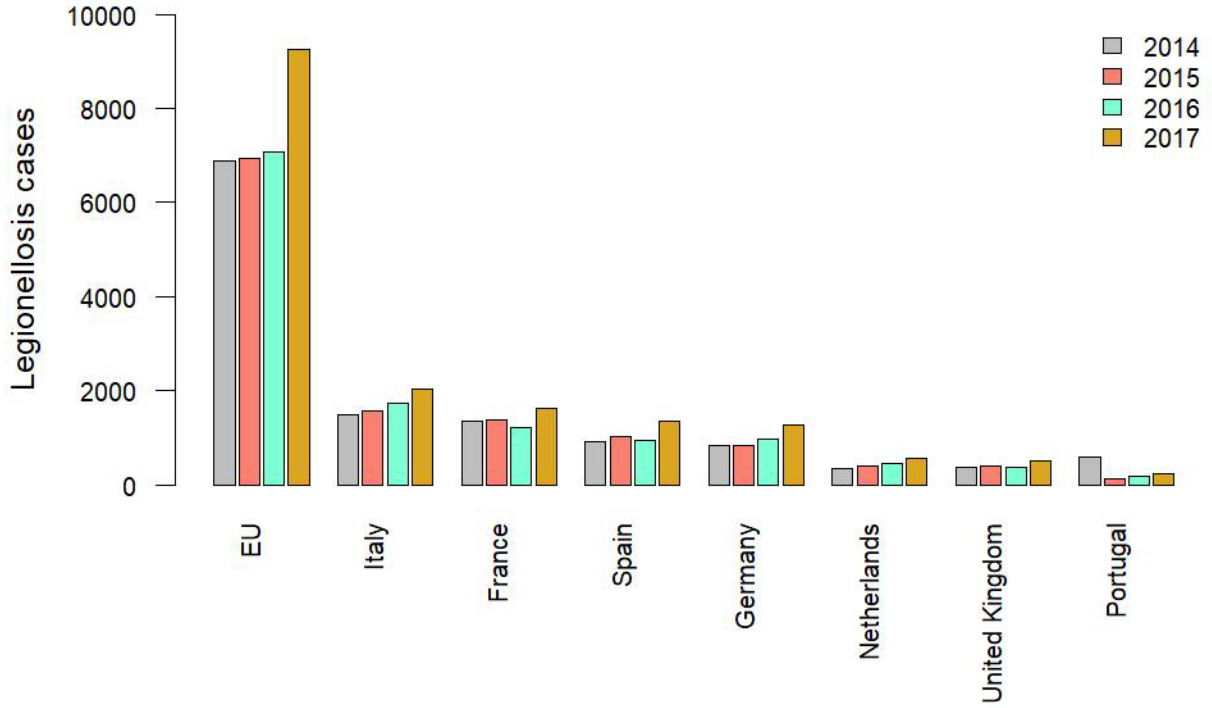
Legionnaires' disease[1] (LD) is an important disease in the United States and worldwide because of its increasing incidence and because LD can have severe health outcomes. Almost all reported LD patients require hospitalization, nearly half require intensive care, and the case fatality rate is approximately 9% (Dooling *et al*, 2015; Cooley *et al*, 2020). Recent data for the US (CDC, 2016, Figure 1) and the European Union (ECDC, 2020,Figure 2) demonstrate that LD is widespread and is increasing dramatically.

*Figure 1: Legionellosis Cases in the United States, by Region, 2016-2018*




[1] The bacterium *Legionella pneumophila* and several other *Legionella* species can cause Legionnaires' disease and a milder illness called Pontiac fever. Those two diseases are termed legionellosis. The primary concern with *Legionella* is Legionnaires' disease and that term is used throughout this report, except when data are reported as legionellosis.

*Figure 2: EU Legionellosis Cases, 7 Top Countries, 2014-2017*




## 1.2 *Legionella pneumophila*: An Environmental, Opportunistic Pathogen

*Legionella pneumophila*, the bacterium that causes the majority of cases of LD, occurs naturally in soils and water and is one of a group of pathogens referred to as Opportunistic Premise Plumbing Pathogens (OPPPs). OPPPs are environmental organisms that do not need human or animal hosts or intermediates to survive and grow. They thrive in some niche environments such as building water systems. Building water systems are not hospitable for many other organisms because they tend to be low in nutrient content, often have disinfectants like chlorine in them and can be operated at temperatures high enough to kill most organisms. OPPPs can proliferate under these conditions with reduced competition from less resistant organisms.

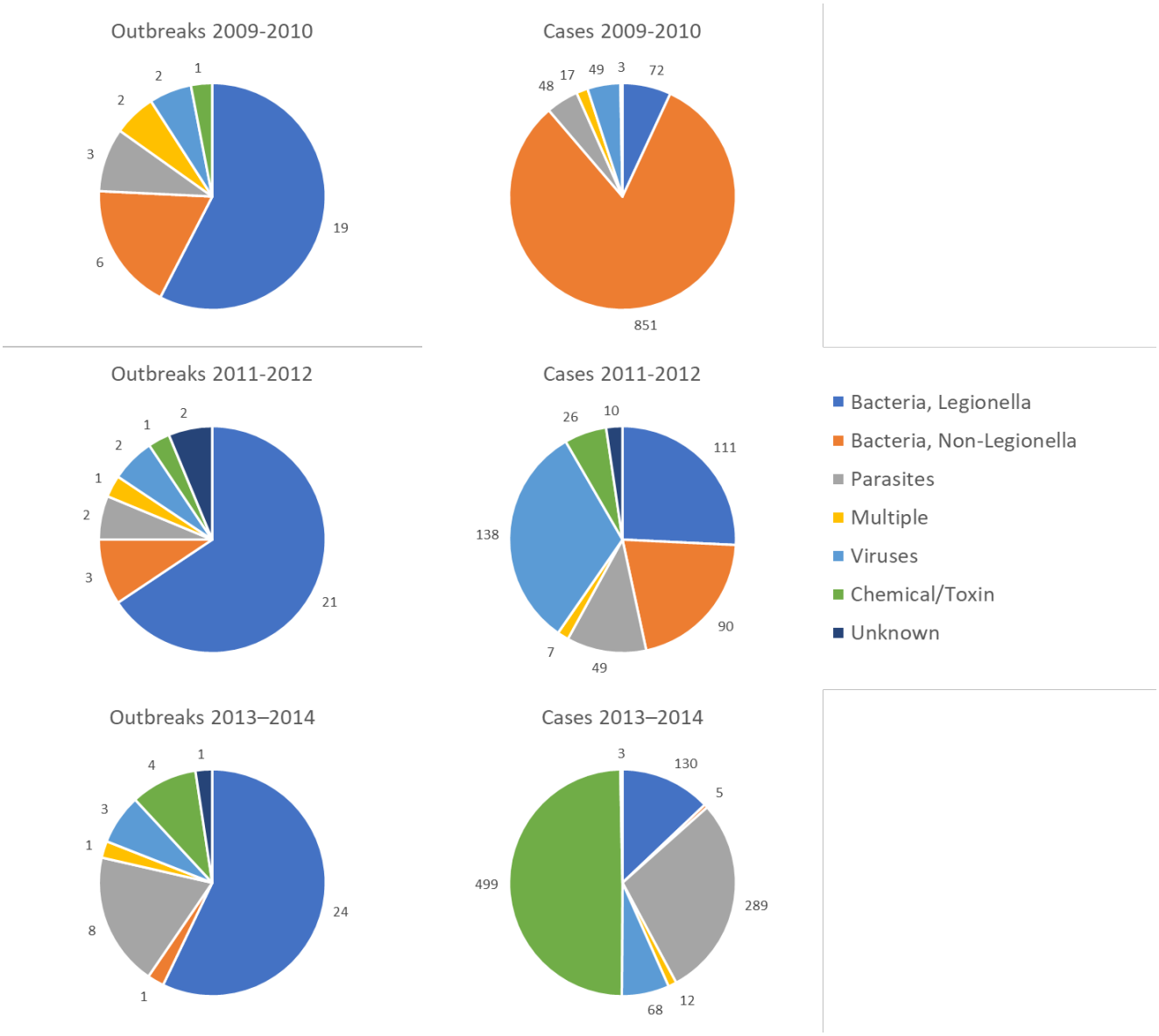
Approximately 25 Legionella species have been associated with human disease. A single species of Legionella, L. pneumophila, causes approximately 95% of all documented cases of LD. While there are 15 serogroups of L. pneumophila, roughly 85% of all LD cases are caused by serogroup 1.

LD cases can be classified as outbreak-associated or community acquired (sporadic). Outbreaks and sporadic LD cases can both be difficult to trace to a specific source, since *Legionella* bacteria

are common in the water and soil environments, and people may be exposed to aerosols from many sources on a daily basis. Orkis *et al* (2018) found that the source for most sporadic cases could not be definitively determined, and that residential potable water and large building water systems appeared to contribute to a substantial proportion of sporadic Legionnaires' disease. They also inferred that cooling towers are a potentially significant source, though linkage to sporadic cases was difficult.

The CDC has developed methods for attributing reportable diseases to drinking water, recreational water exposure and other sources of exposures. The etiologies of US drinking water outbreaks and cases for the most recent six years are shown in Figure 3 (Data from CDC, 2020).

*Figure 3: Drinking Water Outbreak and Case Etiologies (CDC, 2020)*



Note that the CDC includes outbreaks and cases for buildings and non-community drinking water systems among drinking water outbreaks and the data shown in Figure 3 should not be taken as an indication that well-run public water systems are the direct cause of LD. Over the time period for which data are available, *Legionella* was the most frequent cause of outbreaks and for two out of three of the time periods was associated with the most cases. Together, the graphs illustrate that LD is increasing in occurrence, is often associated with building water systems and can have severe consequences.

## 1.3 Risk Factors

Table 1 identifies three categories of LD acquisition and associated risk factors (WHO, 2007). The profiles (modes of transmission, reservoirs, and risk factors) for the three categories differ somewhat, though all modes generally involve inhalation exposure, higher risk for older persons, smokers, and people with certain underlying conditions or that are immunosuppressed. Building water systems that pose the greatest risk are those that experience intermittent use and irregular management and complex hospital systems (for nosocomial or hospital-acquired LD).

## 1.4 Survival and Growth in Environmental and Built Systems

While occurrence of *Legionella* and other OPPPs may be inevitable for many building water systems, their growth can be monitored and controlled, and understanding the conditions that favor their presence and growth is the first step to managing them. Based on *Legionella*'s ability to grow in oligotrophic (lakes) treated drinking waters, de Vos *et al* (2005) determined that "…in

*The survival and growth of L. pneumophila is optimal within amoebae and other free-living protozoa that are associated with biofilms. A biofilm is a community of microorganisms embedded in a slimy extracellular matrix attached to moist, solid surfaces in contact with water. Biofilm communities growing on pipes can include bacteria/archaea, fungi, and higher organisms, such as amoeba (National Academies of Sciences, Engineering, and Medicine 2020) Academies of Sciences, Engineering, and Medicine 2020).*

order to control *Legionella* in the environment, focus should be on the eradication of microbial hotspots in which *L. pneumophila* resides [rather than limiting nutrients]." Several studies have identified either hotspots or water quality conditions in premise plumbing systems that are associated with high *L. pneumophila* occurrence and abundance. Those studies are reviewed in this section and inform the selection and design of control strategies.

A study of water samples from 211 houses in Quebec City (1991) identified use of electrical water heaters (rather than oil or gas) as an important determinant of the occurrence of *Legionella spp.* in premise plumbing systems. Factors associated with occurrence of *Legionella* in electric water heaters and connected plumbing systems included age of water heater (old water heaters were associated with higher incidence of *Legionella spp.*) and water heater temperature (low water heater temperature was associated with higher likelihood of detecting *Legionella spp.*), but not water heater volume. Other researchers also found *Legionella* concentration is associated with fixture age (in this case, shower head age) and that fixtures used more frequently tended to have lower *Legionella* concentrations in first draw samples, irrespective of fixture age (Collins *et al*, 2016; Hayes-Phillips *et al*, 2019). Despite finding differences in concentration, those same studies did not find significant differences in the frequency at which *Legionella* was present among the showers tested.

*Table 1: LD Exposure Modes and Risk Factors, by WHO Category*

| | **Community acquired** | **Travel-Associated** | **Nosocomial** |
|---|---|---|---|
| **Mode of transmission** | Inhalation of contaminated aerosol | Inhalation of contaminated aerosol | Inhalation of contaminated aerosol, aspiration, wound infection |
| **Sources of *Legionella*** | Cooling towers; hot and cold-water systems; spa pools, thermal pools, springs; humidifiers; domestic plumbing; potting mixes and compost | Cooling towers; hot and cold-water systems; spa pools, thermal springs, and pools; humidifiers | Cooling towers; hot and cold-water systems; spa pools, natural pools, thermal springs; respiratory therapy equipment; medical treatment |
| **Reservoir of *Legionella*** | Industrial sites, shopping centers, restaurants, clubs, leisure centers, sports clubs, private residences | Hotels, cruise ships, camp sites, shopping centers, restaurants, clubs, leisure centers, sports clubs | Hospitals, medical equipment |
| **Environmental risk factors** | Proximity to sources of transmission, poor design or poor maintenance of cooling water systems, inadequate staff training | Stay in accommodation designed for short stays and seasonal use; intermittent room occupancy and water use; intermittent water supply and fluctuating water temperature control; complex water systems; lack of trained staff to manage water systems | Complex water distribution system, long pipe runs, poor water temperature control, low water flow rates |
| **Personal risk factors** | Age >40 years; male; underlying disease such as diabetes; chronic heart disease; smoking; immunosuppression (especially with glucocorticosteroids and chronic debilitating illness); structural pulmonary comorbidity; chronic renal failure; recent travel; hematological malignancy; iron overload; other immunosuppression | Age >40 years; male; heavy smoking, alcohol abuse; change in lifestyle; underlying disease such as diabetes; chronic heart disease, other immunosuppression | Age >25 years; transplant patient; other immunosuppression; surgery, especially head and neck; cancer, including leukemias/lymphomas; diabetes; treatment with respiratory devices; chronic heart/lung disease; smoking, alcohol abuse |

Numerous studies have documented the importance of stagnation periods in growth of organisms in building water systems. For example, Lautenschlager *et al*. (2010) observed dramatic increases in bacterial cell concentrations (planktonic; measured by flow cytometry), heterotrophic plate count (HPC) and biomass (measured as adenosine triphosphate [ATP] concentration) after overnight stagnation. Samples were collected from 10 cold water taps of houses with an unchlorinated water supply. HPC varied widely among first flush samples following stagnation periods and frequently exceeded 300 colony forming units (cfu)/mL (the guideline value for Switzerland). HPC was much less variable in samples collected after a five-minute flush and no samples exceeded 300 cfu/mL. Similar results were observed in a study of three homes in Tucson, Arizona (Pepper *et al*, 2004). Flushing consistently reduced HPC, sometimes by as much as one log.

Serrano-Suárez *et al*. (2013) collected and analyzed 213 samples from hotel and nursing home hot water recirculation systems to determine the factors associated with presence of *L. pneumophila*. Two sets of samples were collected at each location – first flush and after running taps for 3 min. HPC samples incubated at 22°C, HPC at 37°C and room temperature were significantly different for samples with and without *Legionella* detection, whereas *Pseudomonas*, pH, turbidity, total organic carbon (TOC), iron, zinc and copper were not. There was a significant negative correlation between temperature and *Legionella* concentration and positive correlations between *Pseudomonas* and *Legionella* concentration for all samples (first drawn and after 3 min) and between HPC at 22°C incubation for samples after 3 min flushing.

Rogers *et al* (1994) found that the combination of temperature and pipe material determined the ability of *Legionella* to grow in biofilms maintained in dechlorinated filter-sterilized tap water. In general, growth of all organisms and *L. pneumophila* were higher for plastics than copper and the highest growth *L. pneumophila* growth occurred at 40°C (104 F), irrespective of material. For experiments conducted at 20°C (68 F), *L. pneumophila* were not detected (detection limit 10 cfu/mL) for model systems containing copper but were detected for systems containing plastics (polybutylene and chlorinated polyvinylchloride, PVCc). At 20°C, several amoeba species, including *Hartmanella vermiformis*, were present. Amoebae and protozoa detected at 20°C were not detected at 40°C or 50°C.

Van Heijnsbergen *et al*. (2015) conducted a literature survey to identify potential reservoirs of *Legionella* with a significant likelihood of causing infection. The authors excluded showers and faucets in their study because those sources are the focus of ongoing regulatory efforts in the Netherlands and already established as important reservoirs and routes of infection. Potential reservoirs connected in some way to drinking water supplies and premise plumbing systems include:

- Baths
- Fountains
- Room humidifiers
- Mist machines (at grocery stores)

- Ice/ice machines
- Cooling liquid for machinery
- Foot baths,
- Dental units and
- Water used for cleaning

The level of evidence associating these reservoirs with LD was variable. For all of these reservoirs, the most effective risk management is likely to be improved usage and maintenance of the reservoir, rather than some change in premise plumbing system management or operations.

## 1.5 Detecting and Quantifying *L. pneumophila* in Environmental Samples

### *1.5.1 Comparison of Recovery and Detection Methods*

Numerous methods have been developed for detecting and quantifying *L. pneumophila* in environmental water and biofilm samples. Broadly, they are 1) culture methods that involve a step, in which organisms are grown selectively and 2) molecular methods in which genetic material from the target organism is selectively amplified (replicated) and detected. Culture methods remain the gold standard for environmental monitoring because their results are more readily interpreted and can be compared with standards that, to date, are all based on outcomes of culture assays. The primary methods used for quantifying *L. pneumophila* and their advantages and disadvantages are presented in Table 2.

Whiley and Taylor (2016) outlined the advantages and disadvantages of culture and quantitative polymerase chain reaction (qPCR) measurement of *L. pneumophila* concentration. Culture determinations can be slow and are subject to overgrowth of plates by organisms other than the target (*L. pneumophila*). Molecular methods (primarily qPCR), but also sequencing target genes such as 16S ribosomal ribonucleic acid (rRNA), and metagenomic analyses in which all the deoxyribonucleic acid (DNA) for all cells in a sample are identified are faster, more sensitive and potentially more specific. However, these methods count genetic material from dead/nonviable cells and their results are difficult to interpret and cannot be compared against any available standard. A relatively new culture method – Legiolert – has been used successfully in studies of *L. pneumophila* in drinking water (Barrette, 2019; LeChevallier, 2019a, 2019b; Mapili, 2019; Mapili *et al*, 2020; Pretrisec, 2018; Spies *et al*, 2018) and non-potable water (Rech *et al*, 2018). Legiolert is similar to other familiar assays such as Colilert and Enterolert and uses defined substrate and specially designed templates for developing most probable number (MPN) estimates of viable *L. pneumophila* concentration. The Legiolert assay requires far less expertise than traditional culture methods (e.g., incubation on BYCE agar). All published studies to date indicate that Legiolert results are comparable to results for other culture assays at low concentration and perhaps outperforms the traditional assays when *L. pneumophila* count in a sample is high.

The CDC does not recommend qualitative or quantitative routine environmental *Legionella* sampling in the absence of an outbreak (Parr *et al*, 2015). Additionally, the CDC does not recommend

using *Legionella* counts as an assessment for determining if remediation is necessary, although some states recommend quarterly sampling of hospitals. Given the existence of requirements to conduct *Legionella* sampling in some cases rapid and reliable detection of the pathogen is essential. However, both culture-based and molecular based methods still have significant analytical challenges, which lead to challenges in decision-making.

*Table 2: Advantages and Disadvantages of L. pneumophila Detection and Quantification Methods*

| Technique | Advantages | Disadvantages |
|---|---|---|
| **Culture (BCYE)** | • Measures viable, culturable organisms (organisms of verifiable public health significance).<br>• Gold standard in measurement and produces concentrations that can be compared with standards (all of which are expressed in terms of culture concentrations). | • Does not detect viable but nonculturable (VBNC) organisms (potential undercount).<br>• Subject to overgrowth by non-target organisms (potential undercount).<br>• Requires specialized expertise for sensitive and accurate assays. |
| **Legiolert** | • Much simpler to conduct than other culture assays.<br>• Appears to have better performance than other culture assays (e.g., plating on BYCE agar) for high-concentration samples.<br>• Results comparable to other culture methods & appropriate to compare against standards. | • Relatively new and unfamiliar to the drinking water community.<br>• Possibly subject to undercounting VBNC organisms (though some reports indicate Legiolert is less prone to undercounting VBNC organisms compared with methods such as plating on BYCE agar. |
| **Molecular (qPCR)** | • Rapid (compared with culture)<br>• More sensitive than culture methods<br>• Detects genetic material from viable but non-culturable bacteria. | • Does not discriminate between genetic material from live and dead cells (likely overcount).<br>• Subject to inhibition by substances in water samples (potential for assay to be invalidated).<br>• Only very small samples volumes, e.g. microliters, can be analyzed.<br>• Results are not readily interpretable. |

### *1.5.2 The Role of Amoebae and Implications for Recovery and Detection*

The role of amoebae in the survival of *Legionella spp.* as an intracellular parasite in the environment needs to be considered in the context of analytical methods. The CDC method recommends incubating a volume of water at 35°C for up to 6 weeks and plating for *Legionella* every 2 weeks. *Legionella* are ingested by feeding trophozoites in the environment which provide a protective

environment for the *Legionella*. When environmental conditions are unfavorable for amoebae, they encyst to ensure survival. Intracellular *Legionella* cells are also protected during the encystment of the amoebae and furthermore, when released from the amoebae they are more resistant to disinfectants and more virulent.

### *1.5.3 Laboratory Accreditation and Quality Assurance and Control*

Water samples collected for *Legionella* analysis should be sent to accredited environmental laboratories specifically assessed as qualified for *Legionella* analysis. The laboratory should be able to provide a certificate that identifies *Legionella* as an accredited analyte, and indicates the field of accreditation as water, potable water, or drinking water. There are three major accreditation bodies that perform assessments of environmental laboratories and includes The NELAC Institute (TNI), the American Industrial Hygiene Association (AIHA) and the American Association for Laboratory Accreditation (A2LA).

- TNI is a national accreditation organization (https://nelac-institute.org/) that is widely recognized in the US. On the TNI website (https://lams.nelac-institute.org/) a searchable database can be used to find the most current list of laboratories that have been assessed and accredited for *Legionella pneumophila*. The listing provides contact information for the laboratory as well as a list of parameters and fields of accreditation.
- AIHA Laboratory Accreditation Programs, LLC is a third-party accrediting body (AB). The AIHA website (https://www.aihaaccreditedlabs.org/lab-accreditation-programs/find-an-accredited-lab) also has a searchable database for finding the current listing of laboratories that are accredited for *Legionella* analysis. To search for the laboratories, choose the Environmental Microbiology Laboratory Accreditation Program (EMLAP) program in the search directory.
- A2LA is an independent third-party AB (https://a2la.org). A2LA is also recognized as a non-governmental AB that can assess laboratories that want to be accredited through TNI. The A2LA website also has a searchable database for finding the most current listing of accredited laboratories at https://cabportal.touchstone.a2la.org/index.cfm?event=directory.index.

Many laboratories claim to be an ELITE laboratory. The Environmental *Legionella* Isolation Techniques Evaluation (ELITE) Program (https://wwwn.cdc.gov/elite/Public/MemberList.aspx) is not a laboratory accreditation program. It issues documentation of proficiency to laboratories that have demonstrated the ability to isolate *Legionella* from simulated environmental samples by culture. Initially, the CDC managed the program providing proficiency test (PT) samples to the participants. As the number of participating laboratories increased, CDC handed the responsibility to the Wisconsin State Hygienic Laboratory (WSHL). WSHL is an AIHA-approved PT provider so these samples may be used for PT samples for accreditation. WSHL prepares and ships the PT samples to the laboratories, laboratories report their results on the WSHL website and CDC maintains the list of the successful participating laboratories.

There are 157 laboratories located in the US, Mexico, Canada, Europe, and the Caribbean that participate in the ELITE program. A majority of the laboratories participating in the ELITE program have not been accredited for *Legionella* but are likely ISO/IEC or TNI accredited for other analytes and therefore the basic quality control/quality assurance practices are in place.

# SECTION 2 – BUILDING WATER MANAGEMENT

Under an effective water management plan (WMP), potential and existing hazardous conditions in the building water system are identified, means of control are selected, and a process is instituted to execute the controls and demonstrate their efficacy. While a major emphasis of a water management plan is to minimize risk of infection by *Legionella*, conditions favoring *Legionella* are also conducive to the growth of other opportunistic pathogens, including nontuberculous *Mycobacterium*, *P. aeruginosa*, and Acanthamoeba. Amoebae that can harbor *Legionella* and thereby promote its occurrence also benefit from water quality conditions present in unmanaged systems.

## 2.1 Occurrence and Growth of *Legionella* in Building Water Systems

A recent consensus report on *Legionella* in building water systems prepared by the National Academy of Sciences, Engineering and Medicine (2020) provides the frank assessment that "Wherever there are water and pipes eventually one can find *Legionella* including in many human-made building water systems. However, its exact niche and the factors influencing it to bloom are only now being elucidated." Given the high likelihood that *Legionella* and other pathogens are present in a given building water system, staff operating building water systems need to be aware of the conditions that can promote *Legionella* growth, need to control their system to minimize the chance that *Legionella* grow to large numbers, and need to monitor their system to ensure controls are operating properly and are limiting *Legionella* growth.

*Legionella* may be present in well-maintained water supplies and can enter building plumbing systems either as free-living (planktonic) organisms or within amoebae. Pathways for entering building water systems include:

- Main breaks in public water supply
- Decline in public water supply quality
- Building construction
- Building plumbing/maintenance events
- Backflow/cross-contamination

*Legionella* in a plumbing system can rapidly multiply given the right circumstances, with peak concentrations in biofilms occurring on the order of days. One trait of *Legionella* in biofilm is its resistance to disinfection. Factors that favor *Legionella* amplification include:

- Established biofilm
- Ideal temperature
- Low disinfectant
- Water stagnation (which favors biofilm formation)
- Water velocity/pressure changes

*Wherever there are water and pipes eventually one can find Legionella including in many human-made building water systems.*

- Sediment build-up
- Time (water age)

The exposure route leading to infection is via aerosolization and inhalation of *Legionella* released from the plumbing. Exposure to sloughed biofilm in water is thought to be a significant cause of infection as the levels of *Legionella* and its virulence may be enhanced by protection in biofilms. Points in a building water system that are likely to release aerosols containing *Legionella* include:

- Showers
- Hot tubs
- Splashing in sinks
- Decorative water features
- Ice machines (via aspiration of contaminated ice)

See Appendix A (NMCPHC Exposure Pathways Fact Sheet) for a Fact Sheet on exposure pathways.

*The exposure route leading to infection is via aerosolization and inhalation of Legionella released from the plumbing.*

## 2.2 Water Management Plan (WMP) Development

In the course of undertaking a water management plan, potential and existing hazardous conditions in the building water system that may lead to the growth and dissemination of *Legionella* are identified, means of control are selected, and a process is instituted to execute the controls and demonstrate their efficacy, and document and communicate all aspects of the program.

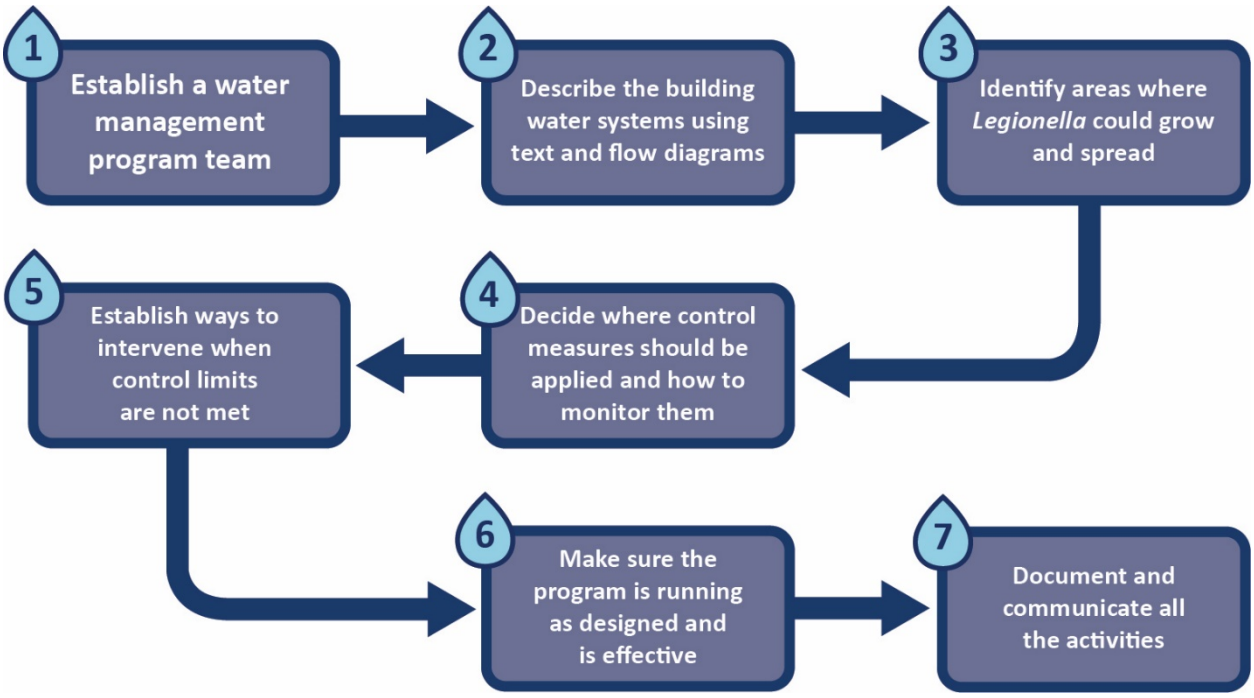
WMPs serve the following purposes:

- Reduce risk of infections
- Identify locations where *Legionella* could grow
- Identify locations where *Legionella* could be aerosolized and disseminated
- Establish management team to control *Legionella*
- Establish processes and procedures to control growth and dissemination of *Legionella*.
- Monitor control actions
- Establish interventions where controls are not working

The CDC's overview of WMP elements is shown in Figure 4. Two elements of the process – establishing interventions and communication – tend to be underdeveloped in WMPs despite their

critical importance in responding to detections of *L. pneumophila* or to cases of LD with suspected association with a building water system. To be effective in a response, interventions must be established during WMP development and before the response. Therefore, complete WMPs should include specific plans for the most common interventions: flushing and disinfection. WMPs should also include specific information regarding communication, including audiences, key messages, and preferred communication channels. The elements of WMP development are described in greater detail in the following sub-sections.

*Figure 4: CDC Water Management Plan Development Steps*




### *2.2.1 Building Water System Roles and Responsibilities at Navy and Marine Corps Facilities*

The Department of the Navy has three principal components: The Navy Department (i.e., the executive offices), the operating forces (Naval forces, Marine Corps, reserve components), and the shore establishment. The shore establishment provides support to the operating forces in the form of various facilities. The Bureau of Medicine and Surgery (BUMED), Navy Installations Command (CNIC) and Naval Facilities Engineering Command (NAVFAC) are the principal shore establishment entities overseeing drinking water systems and programs.

The Chief of Naval Operations Instruction (OPNAVINST) 5090.1E (3 September 2019) requires that all Navy commands comply with the provisions of the Environmental Readiness Program Manual (OPNAV M-5090.1). Marine Corps Order (MCO) 5090.2 (11 June 2018) provides environmental policy and guidance for Marine Corps installations. These policies require drinking water compliance with all applicable federal, state, and local laws, regulations, executive orders and Marine Corps, Navy, and Department of Defense (DoD) policies. In the US, the National Primary

Drinking Water Regulations (Title 40 Code of Federal Regulations Part 141) have been adopted by most states, and they apply to DoD water systems in the US. DoD Instruction 4715.05 with Change 2 (31 August 2018) governs environmental compliance overseas based on country-specific Final Governing Standards or the Overseas Environmental Baseline Guidance Document (OEBGD).

CNIC is the US Navy's designated Executive Agent (EA) for drinking water quality ashore worldwide. BUMED and its subordinate commands, the Navy-Marine Corps Public Health Center (NMCPHC) and Preventive Medicine Authorities (PMAs) at Medical Treatment Facilities (MTFs), are responsible for serving in an advisory public health role to installation Public Works and Environmental staffs. In addition, for installations with overseas drinking water (ODW) systems (not under EPA jurisdiction), the PMAs are members of the Installation Water Quality Boards (IWQBs) and Regional Water Quality Boards (RWQBs). BUMED and NMCPHC are also members of the Water Quality Oversight Council (WQOC). The WQOC serves as the entity responsible for management of US Navy Overseas Drinking Water Program Ashore compliance.

Navy and Marine Corps water systems are operated by the Public Works Departments and Facilities Directorates, respectively. See Appendix B for an organizational chart for CNIC FY 20 Shore Bases by Region, CNIC Regional Facilities and Environmental, and NAVFAC Installation PWD Environmental. Marine Corps installations are organized into three regions, Marine Corps Installations East, Marine Corps Installations West, and Marine Corps Installations Pacific. It is the operator's responsibility to perform compliance monitoring in accordance with drinking water regulations. BUMED Instruction (BUMEDINST) 6240.10C (18 September 2018 – Department of the Navy Medical Drinking Water Program) assigns roles and responsibilities for medical personnel in the Department of the Navy Drinking Water Programs. The installation's PMA must provide public health advice and consultation to the installation commanding officer and public works on health aspects of drinking water quality and advise when water consumption may present health risks. The PMAs also develop, maintain, and execute a public health drinking water surveillance plan in accordance with the Manual of Naval Preventive Medicine (NAVMED) P-5010-5 (Chapter 5 – July 2019 - Water Quality for Shore Installations). In addition, the installation PMA is required to immediately consult with NMCPHC in the event of a Navy exceedance of a drinking water maximum contaminant level (MCL), action level, health advisory, or other issued drinking water quality standards in the United States and overseas per BUMEDINST 6240.10C.

### *2.2.2 Establishing a WMP Team*

The first step in the process of developing a WMP is for the facility manager/owner to establish a cross-functional team with authority, responsibility, and accountability. Within the WMP team there must be a strong, working knowledge of the water system(s), to be able to effectively carry out the following functions:

- Oversee the WMP program
- Knowledge about the water system

- Identify control locations and limits
- Identify and take corrective actions
- Monitor and document program performance
- Confirm program performance
- Communicate about the program in a timely manner

A team representing installation (and building) public works department (PWD), public affairs, and medical treatment facility will have the skills needed to produce and execute an effective WMP. Team members may include:

- Installation utilities and environmental staff
- Installation/Building Public Affairs personnel
- Building owner
- Building manager/administrator
- Building maintenance or engineering employees
- Equipment or chemical suppliers
- Contractors/consultants (e.g., water treatment professionals)
- MTF PMA, which could be a Preventive Medicine Technician/Officer (PMT/PMO), Environmental Health Officer (EHO), Industrial Hygiene Office (IHO), Occupational and Environmental Medicine (OEM) physician or Preventive Medicine Officer
- NAVFAC Region Environmental

### *2.2.3 Water System Description*

The team works together to describe how water enters the building and is processed at the facility. A summary describing the water system should include:

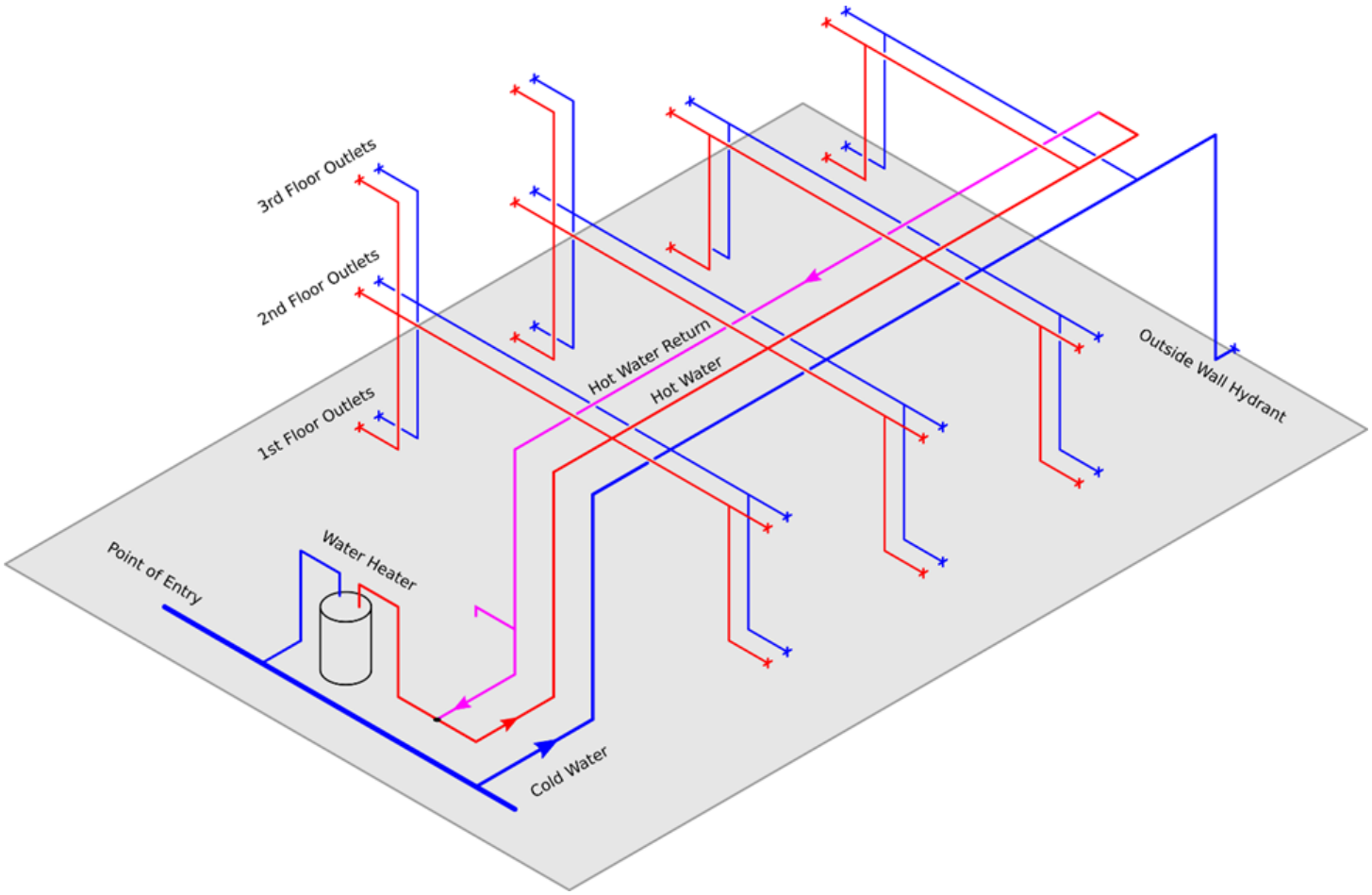
- Point-of-entry (POE). Details to include:
  - Location at which service line enters property
  - Location at which service line enters building
  - Pipe diameter
  - Description of backflow preventer if present
  - General routing from POE, i.e., to:
    - cold domestic supply
    - fire suppression
    - water heating
    - other processes
- Cold water distribution listing types of points-of-use (POU)
- Water heater location and characteristics
- Hot water distribution, also listing types of POU
- Hot water return
- Wastewater piping to sanitary sewer

The description of the building water system should also be represented schematically in a process flow diagram of piping from POE to POU, showing:

- Cold water supply
- Fire suppression
- Irrigation (landscape watering)
- Backflow preventers
- Water heaters
- Hot water supply and return
- Storage tanks
- Special use fixtures such as
  - decorative water features
  - hot tubs, pool
  - ice machines
  - drinking fountains
  - showers

Figure 5 provides an example of an isometric plumbing diagram for a multi-story building (or zone within a larger building) with a hot water recirculation system (AH Environmental Consultants, Inc., 2020).

*Figure 5: Example Isometric Diagram of a Building Water System*




### *2.2.4 Identifying Locations of Potential Hazards*

The team must perform a systematic hazard analysis of the building water systems to identify the location of potential hazards. Fully understanding the locations to be included here may best be achieved following a site assessment that includes a survey of pipe and feature locations, water temperatures and disinfectant levels throughout the system. On the diagram, the team then should mark points where *Legionella* may amplify under conditions such as:

- Optimal temperature: *Legionella* grows well when water temperatures are in the range of 20°C and 50°C (68°F and 122°F)
  - hot water lines that are too cool
  - cold water lines that are too warm
- Stagnant water: disinfectant in standing water will gradually diminish; in the absence of influx of fresh water, *Legionella* may proliferate.

- Low disinfectant
  - low disinfectant residual in incoming water supply
  - low use piping
  - hot water pipes in systems disinfected with free chlorine

On the diagram, the team should also mark points where *Legionella* may be disseminated, such as:

- Lawn watering
- Showers
- Kitchen spray faucets
- Hot tubs
- Decorative water features with splashing, misting
- Ice machines (from aspiration of melted ice by patients)
- Cooling towers

Furthermore, the team should indicate on the diagram where patients (if an MTF) may be particularly susceptible to infection:

- Intensive care
- Cancer units

### *2.2.5 Application of Control Measures*

The building water management team will assess the significance of the hazards to make a risk assessment, prioritizing where controls are most needed. Note that not all hazards pose a risk. Risk is the probability of an event occurring multiplied by the severity of the outcome. Hazards will be scored as low, moderate and high risk, with all high and some moderate risks selected for control. Control points, the locations where measures are applied, may include:

- POE
- Backflow preventers
- Water heaters
- Water features
- Special water processes

Control measures are the actions to be taken. The team must determine what hazard control is being applied or could be applied to mitigate the risks identified above. Control actions will result in improved conditions at the control point or at upstream (flushing) or downstream (temperature setting change) locations. Control actions may include:

- Cleaning hot tubs
- Increasing recirculation flow rate
- Increasing water heater temperature setting
- Increasing tempering valve temperature setting

- Flushing water lines
- Cleaning (or eliminating) decorative features

Monitoring of control limit parameters may occur at a different location than the control point, i.e., measure water temperature at POU when temperature is controlled at water heater or tempering valve. Parallel disinfectant monitoring at the POE will inform residual target levels at downstream POUs. Monitoring may involve:

- Visual observation
  - Sediment at bottom of decorative fountain pool
  - Slime (biofilm) on walls of pool or hot tub
- Chemical water quality parameters
  - Disinfectant residual
    - Free chlorine
    - Total chlorine for buildings supplied with chloraminated water
  - pH
- Physical water quality parameters
  - Turbidity
  - Specific conductance (conductivity)
  - Water temperature
    - In-line temperature gauges on hot water supply and return lines
    - Grab sample and hand-held thermometer readings at POU taps
    - Infrared sensor readings on piping

Monitoring may be conducted manually using commercially available test kits, or remotely, using in-line sensors and supervisory control and data acquisition (SCADA)-based display panels.

Control limits established for each control point will allow the monitoring program to determine if control measures are being properly executed. These are a minimum to maximum ranges within which chemical or physical parameters must be maintained at a control point to reduce the likelihood of hazardous conditions. Examples of control limits follow:

- Hot water temperature 125°F at outlet of water heater
- Chlorine residual at cold water POU taps 75% of residual at POE after 1-minute flush, measured as free or total chlorine, depending on disinfectant used by public water supply.
- Hot water POU tap temperature 110-115°F after 1-minute flush
- Hot water 110-115°F at recirculation loop return

Standard operating procedures (SOPs) for each control action and monitoring process will ensure application of consistent methods. SOPs describe steps to be included in the procedures, frequency of application, responsible parties. They also include performance standards that specify the control limits for each monitored parameter.

### *2.2.6 Corrective Actions or Interventions*

Corrective actions may include more frequent application of control measures. SOPs are prepared for all corrections identified.

- Low-use POU disinfectant residual does not reach minimum limit after monthly flushing for 5 minutes. Possible actions:
  - Increase flushing duration to 10 minutes
  - Increase flushing frequency to weekly
- Slime (biofilm) visible in decorative fountain four days after biweekly cleaning
- Increase cleaning frequency to weekly

Corrective actions may involve further adjustment of water processes

- Hot POU tap water does not reach minimum temperature after 1-minute flush
- Increase water heater temperature setting
- Increase tempering valve temperature setting

### *2.2.7 Water Management Plan Validation*

Verification answers the question "are you doing it?" and involves assuring that all aspects of the WMP have been appropriately implemented and is independent of water system monitoring results. A system of records review will confirm that all plan activities have been undertaken as scheduled. Records to be checked by an individual other than the party responsible for the original records may include:

- Daily water heater temperature gauge checks
- Weekly POU temperature readings
- Daily disinfectant measurements
- Weekly/monthly flushing events
- Annual backflow preventer maintenance
- Weekly decorative fountain cleaning

Validation answers the question "is it working?" and characterizes the effectiveness of the WMP controls at reducing the risk of growth and dissemination of *Legionella* by the building water system. Validation may include sampling and analysis for the presence of *L. pneumophila* and associated microorganisms. After initial establishment of existing or baseline occurrence, ongoing monitoring will quantify microbiological spatially and over time in the building water system.

### *2.2.8 Document and Communicate All Program Activities*

A management plan that cannot be documented or communicated cannot have ongoing value in protecting public health. Essential needs to be recorded and made available to the facility staff and external auditors include:

- Program team: who is it, what do they do?

- Building description, including location, age, uses, and occupants and visitors
- Water system description, general summary, types of uses, special uses and concerns
- Control measures, including critical points and control critical limits and monitored approach
- Verification processes and validation procedures
- Laboratory documentation: chain of custody, analytical methods, and results

### *2.2.9 Key Information Sources*

Many resources are available online for Developing Water Management Plans and for Control of *Legionella*. Key information sources are provided in Table 3.

## 2.3 Flushing

### *2.3.1 General Considerations*

Experience in flushing and maintaining buildings has shown that there are some general principles for an effective flushing strategy. In general,

- Flushing should proceed unidirectionally, that is from the service entrance to the periphery of the plumbing system (distal points).
- Flushing should be performed first on large trunk lines and high-flow outlets, like outside wall hydrants or hose bibbs.
- The duration of flushing should be sufficient to displace the stagnant water in the building. Minimum flushing times can be estimated based on pipe dimensions on plumbing drawings.
- Some buildings have water treatment systems such filters and water softeners at the point of entry. Those treatment systems were installed for a reason and should not be bypassed. Those treatment systems need to be cleaned, flushed, and maintained as part of bringing the building back into use.
- Building water systems may have a variety of places where water is stored. At a minimum, they should all be identified, drained, and flushed with clean cold water, after the building cold water service is properly restored. These include, but are not limited to:
  - Hot water storage (some buildings have more than one type of heating system and hot water storage),
  - Hot water recirculating loop(s),
  - Humidifiers,
  - Ice machines,
  - Dishwashers,
  - Cooling towers, and
  - Ultrapure water storage (membrane filtration).

*Table 3: Key Resources for WMP Development and Legionella Control*

| Organization | Title or Brief Description | URL |
|---|---|---|
| **CDC** | Toolkit for water management plan development | https://www.cdc.gov/legionella/wmp/toolkit/index.html |
| **CDC** | Healthcare Water Management Program FAQs – *Legionella* | https://www.cdc.gov/legionella/wmp/healthcare-facilities/healthcare-wmp-faq.html |
| **CDC** | Legionnaires' Disease Fact Sheet | https://www.cdc.gov/legionella/downloads/fs-legionnaires.pdf |
| **ASHRAE** | Guidance to Help Minimize the Risk of Legionellosis (requires purchase) | https://www.ashrae.org/technical-resources/bookstore/ansi-ashrae-standard-188-2018-legionellosis-risk-management-for-building-water-systems |
| **ASHRAE** | Guideline 12-2020 – Managing the Risk of Legionellosis Associated with Building Water Systems (requires purchase) | https://www.techstreet.com/ashrae/standards/guideline-12-2020-managing-the-risk-of-legionellosis-associated-with-building-water-systems?product_id=2111422 |
| **USEPA** | Examples of WMPs EPA has developed for EPA facilities | https://www.epa.gov/greeningepa/epas-water-management-plans |
| **EU** | European Technical Guidelines for the Prevention, Control, and Investigation of Infections Caused by *Legionella* species | https://www.ecdc.europa.eu/en/publications-data/european-technical-guidelines-prevention-control-and-investigation-infections |
| **World Health Organization** | *Legionella* and the prevention of legionellosis | https://www.who.int/water_sanitation_health/publications/legionella/en/ |
| **World Health Organization** | Water Safety in Buildings | https://www.who.int/water_sanitation_health/publications/2011/9789241548106/en/ |
| **Health Protection Surveillance Centre, Ireland** | National Guidelines for the Control of Legionellosis in Ireland, 2009 | https://www.hpsc.ie/abouthpsc/scientificcommittees/publications/File,3936,en.pdf |
| **Naval Facilities Engineering Command** | Legionnaires Technical Alert, 2016 | |

Assuming a WMP is in place, the WMP team will have sketches and a characterization of their building water system. If there is not a WMP, before flushing, sketch out the building water system to the best of your ability and identify:

- The water supply,
- Zones or branches with a common water supply (e.g., a branch to a wing of a building or a set of branches served by the same riser),
- The faucet nearest the starting point of the zone and the most distant faucet or use for each zone,
- Water heaters and recirculating heated water loops, and
- Appliances and water-using features (e.g., hot tubs).
- Parts of the water system that are most important to flush because they have the greatest opportunity to make people sick include:
- Faucets used for drinking water or food preparation,
- Drinking fountains,
- Ice machines and refrigerators with ice makers,
- Showers,
- Kitchen sink sprayers,
- Water features that generate aerosols,
- Parts of the water system that are used by children, and
- Components of the water system used by elderly people and susceptible people.

However, it is also important to identify and flush as many other water outlets as possible - utility sinks, hose taps, piping in place to serve any future installations, removed water taps - to remove contamination in the piping.

### *2.3.2 Full Building Flushing and Cleaning*

Circumstances triggering full building flushing include commissioning or recommissioning a building water system, resumption of use after a period of stagnation (e.g., COVID-19), and flushing in response to a contamination event such as contamination of the building supply.

A full building flush clears out contaminants that accumulated during stagnation or that entered the building water system in the water supply and draws in fresh, high-quality water to the piping. Cleaning of fixtures removes contaminants from the complex internal structures at the point of discharge. A general protocol for a full building flush is provided below. Note that building water systems are diverse and that the protocol is general to make it applicable to most building water system.

- Clean fixtures.
  - Clean or replace showerheads.
  - Replace/maintain point of use filters.

- Flush zone-by-zone. Zones are branches of the building water system with a common source or parts of the building water system served by a common riser.
- The first zone to flush is the one nearest the building supply. Flush zones progressively outward from the supply.
- In each zone, flush the cold water plumbing first and hot water second.
- Begin flushing at the point of use (POU) nearest to the origin of the zone. Aerators and other flow restrictors are removed at the POU nearest the beginning of the zone and the tap is opened wide.
- Open other taps on the same branch, moving from faucet nearest the origin to the most distant POU. Continue flushing until the final POU is flushed for at least 5 minutes AND the cold-water temperature at the final POU is steady. Multiple taps may be flushed at the same time provided the water flow is not significantly reduced as additional taps are flushed.

Drain hot water tanks on the first flush after resumption of flow after periods of stagnation or during commissioning/recommissioning. If that is not possible, hot water flushing time depends upon the size of water heater tank.

Specific guidance for flushing after resumption of use after a period of stagnation, such as for return to work following COVID-19 is available in Appendix C (Building Water Quality and Coronavirus: Flushing Guidance for Periods of Low or No Use – 3 April 2020 – Espri Institute and AH Environmental), Appendix D (CNIC Flushing of Water Systems Message – 30 April 2020), and Appendix E (NAVFACENGOM Technical Advisory Message May 2020).

### *2.3.3 Routine Flushing*

Routine building flushing is a typical component of a comprehensive WMP. Routine flushing can reduce biofilm growth and can promote formation of protective scale on pipe surfaces. Re-stabilizing scale and controlling biofilms after periods of stagnation or other destabilizing events is an ongoing process. In the best case, ongoing flushing is conducted for about 12 weeks – the duration needed for protective scale to re-stabilize and for lead particles to be thoroughly washed from the plumbing system. This is the duration recommended in an industry standard on flushing related to lead. In some cases, longer flushing duration might be required. Monitoring for problematic organisms like *Legionella pneumophila* and for lead and copper and for disinfectant are the best ways to assess whether flushing is working and how long it should continue. Even when a building water system has recovered from a lengthy stagnation, flushing is a best practice, is easy and it has proven water quality benefits. Recommendations for ongoing flushing include:

- Make sure each POU is opened at least once per day. Some POUs are used frequently during normal building operation. Others might be used less frequently and might need to be opened intentionally.

- Flush the full building once per week during ongoing flushing. Full building ongoing flushes proceed the same as the initial flush except water tanks do not need to be drained and hot water flushing times are the same as cold water flushing times. Still flush the cold and hot water systems separately – cold first and hot second.
- During ongoing flushing, it is a good idea to measure the water quality of the drinking water coming into the building and at some taps in the building.
  - The most important measurements to make are the concentration of disinfectant (chlorine) in the building supply and the concentration of disinfectant in the cold water of the most distant tap of each zone after that tap is fully flushed. By comparing the disinfectant in the distant taps to the disinfectant in the building supply, you can tell whether the disinfectant is protecting the whole plumbing system. There is no benefit to measuring the disinfectant in the hot water system. At elevated temperature, disinfectant dissipates.
  - There are many other water quality measurements that can be made. These are not recommended unless there is a compelling reason and unless you can understand what the results mean and what to do about them.

### *2.3.4 Maintenance Personnel Safety*

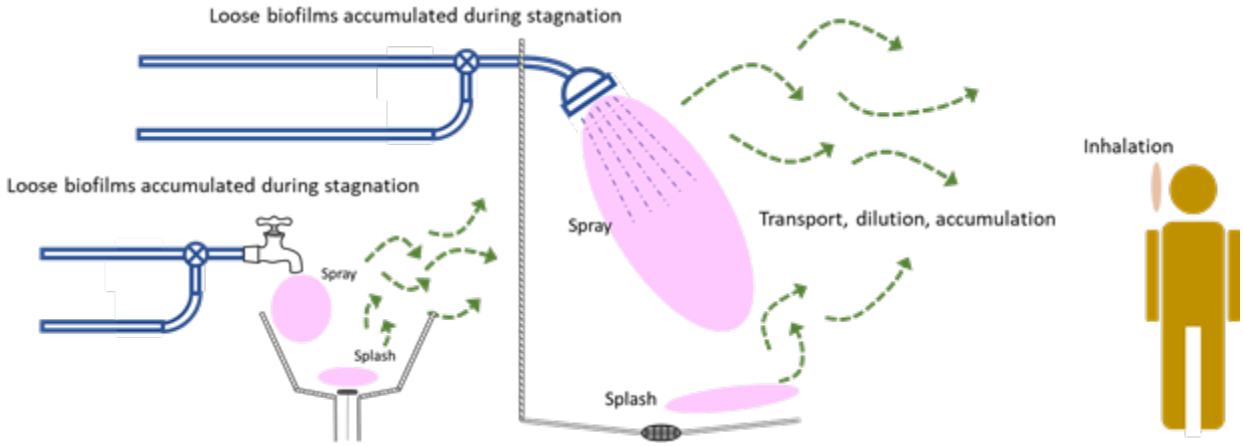
When staff flush buildings, they and other people in the buildings might be exposed to aerosol droplets from spraying and splashing water. Those aerosol droplets could contain microorganisms like *Legionella* that could make them sick if they breathe them. Federal agencies including the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) have developed guidelines and recommendations for working in environments where *Legionella* bacteria might be present. Reviewing materials from those agencies is the best starting point for developing a strategy for reducing risks during flushing.

According to OSHA (https://www.osha.gov/SLTC/legionnairesdisease/control_prevention.html), "Preventing exposure to *Legionella* in the workplace starts with awareness about water systems in which the bacteria could grow, and continues with water system maintenance to prevent growth and checking for unexpected growth in case preventative measures fail." OSHA continues "When *Legionella* hazards cannot be controlled with engineering and administrative controls and safe work practices, personal protective equipment (PPE) may also be needed to prevent worker exposures and infections. Although there are no OSHA standards specific to *Legionella* or other non-bloodborne, biological hazards, several existing requirements may apply to occupational exposure to *Legionella*." An example of PPE suggested in some cases when working with domestic water is the use of N95 respirators.

Figure 6 shows how staff conducting flushing, or other people who enter rooms where flushing is being conducted, might be exposed to harmful bacteria. The bacteria we are concerned about may be present in some (but not all) building water systems. When building water systems are not managed effectively, bacteria including *Legionella* can grow to dangerous numbers as water

sits stagnant in both hot and cold building plumbing. Hot water plumbing is considered particularly problematic because the disinfectant in the building water supply decays faster in warmer water and is often absent in hot water plumbing. The bacteria in the hot and cold water may make people sick when small droplets of water containing *Legionella* are breathed in. The small droplets are generated from sprays and streams of water as it splashes in the bottoms of sinks, shower stalls, tubs, and other places where water drains. Some droplets are small enough to be carried by air and inhaled. The more aerosols and bacteria that are inhaled, the greater the odds that the person who is exposed could become infected if there are *Legionella* in the water. Note that not all water in buildings will have *Legionella*, but there is some risk.

*Figure 6: Legionella Exposure Control*




Drinking water treatment and distribution uses a "multiple barrier" approach for risk reduction. The multiple barriers approach entails understanding the chain of events required (exposure route) for a pathogen such as *Legionella* to reach a person using the water, then adding barriers to the pathogen at multiple key parts of the exposure route. An ideal way to interfere with the chain of events that could lead to infection during flushing of building water systems is to reduce the production of small water droplets.

## 2.4 Routine Monitoring

The current policy CNIC and NAVFAC policy is to not conduct routine monitoring for *Legionella* in drinking water systems. However, if the decision is made by the WMP team to sample for *Legionella* due to specific circumstances (e.g., response to documented occurrence of LD), routine monitoring for *Legionella* bacteria can serve two essential roles in water management – development of intelligence on system water quality and WMP validation. Single measurements of *Legionella* are difficult if not possible to interpret because they have limited context and cannot be used to know whether a portion of the system is persistently contaminated, newly contaminated or experiencing an upset. The first round of monitoring provides a baseline view of water

quality in the building water system and a means for assessing the adequacy of controls as additional sample rounds are conducted.

Validation efforts certify performance of the water management program for maintaining safe water quality for the following:

- Hot water temperature management, and disinfectant residual maintenance, if applicable (i.e., chloraminated water systems).
- Cold water disinfectant residual maintenance

The testing results will also validate that the tap flushing program is effective in producing protective conditions in the water systems for the hot and cold-water supplies at POU locations.

The recommendation for initial validation testing is to undertake a survey of *Legionella* at:

- Building Point-of-entry (POE)
- Storage tank outlets
- Hot water supply (i.e., water heater(s) out)
- Hot water return(s)
- Hot and cold water POU.

Suggested locations for POU sample are:

- Distal taps at end-of-piping runs (plumbing drawings used during or developed for WMP preparation should identify these)
- Any tap with known history of positive *Legionella*, or representative tap of building sector suspected of being source of disseminated *Legionella*
- Low-use taps
- High-risk units (MTF ICU, cancer units, etc.)

At least 20% of all hot and all cold POU taps should be sampled. For smaller facilities, a minimum of 10 hot and 10 cold taps should be sampled, in addition to the POE, tanks, hot water supply and return locations. First draw samples should be tested for *L. pneumophila*. Although not recommended for all systems, if there is justification and if there is a plan for reacting to results, the following additional parameters may be assayed in post 1-minute flush samples (these may be collected in the same container):

- *Pseudomonas aeruginosa*
- Heterotrophic plate count bacteria (HPC)
- Nontuberculous mycobacteria (NTM)

Immediately after collecting microbiological samples, collect a bulk sample for field measurements of temperature, disinfectant residual, pH, and turbidity. Monitoring of additional chemical parameters may be warranted based on the following conditions:

- If there is evidence of corrosion (e.g., discolored water), measure the concentrations of trace metals (copper, lead, zinc, nickel) and iron. Corrosion scales can accelerate and/or aggravate biofilm formation and cause further degradation of microbiological water quality.
- If the water supplier uses chloramines for disinfection, measure monochloramine, nitrate, nitrite, and free ammonia. As chloramines decay, they will release ammonia that can be oxidized to nitrite and nitrite by microorganism. The resultant pH decrease can aggravate corrosion issues.

After results of the initial survey are available, a sampling plan would be drawn up. This plan would entail:

- Quarterly sampling of the same locations, as well as samples from at least one of the taps near each positive sample in the initial survey
- Continued quarterly sampling of all positive sites, nearby sites, and upstream supply (POE if any cold samples are positive, hot water supply and return if any hot taps are positive)
- Annual sampling of all locations that are negative for both the initial and the quarterly sampling

# SECTION 3 – RESPONDING TO INCIDENTS

## 3.1 General Guidelines

The two most likely building water system events that spur a response are (1) detecting *L. pneumophila* in building water system samples that were taken for some reason, and (2) suspicion or allegation that a case of LD could be associated with a building water system. Though responses to the two events differ in some respects, there are several general principles and practices common for both events.

The first general principle is that good outcomes favor the prepared. Responses made up on the fly and not coordinated with other involved stakeholders will fall short, whereas responses following a developed SOP and that have clear delineation of roles, responsibilities and risk communication are more likely to succeed. An exemplary program is the Department of the Navy's "Lead in Priority Areas" (LIPA) program, which aims at minimizing the risk of childhood lead exposure occurring through the consumption of drinking water (OPNAV M-5090.1, MCO 5090.2). It prescribes a sampling and testing approach, provides an action level, mandates appropriate response actions and coordination between installation PWD and the supporting MTF preventive medicine personnel, and includes sensible and standardized risk communication templates and strategies. BUMED has further developed the roles and responsibilities of the MTF preventive medicine personnel by requiring each medical region ensure each MTF identifies a point of contact knowledgeable of the policy and program, trained and/or experienced in risk communication that can answer questions from interested stakeholders (BUMED Memo 6010 Ser M3B25/14UM30126 of Aug 22 2015 – Sampling and Testing for Lead in Drinking Water in Priority Areas). BUMED, NMCPHC, Navy Medical Regions and their MTFs have similar cooperative/shared responsibilities with CNIC and NAVFAC in other program areas such as the Navy Radon Assessment and Mitigation Program (NAVRAMP) and Perfluoroalkyl Substances (PFAS) in Drinking Water.

The most important preparation for a building water system event involving *Legionella* is establishing, maintaining, and documenting a robust WMP. WMPs are not currently required under DoD policies. However, there are federal policies mandating that Medicare and Medicare/Medicaid certified healthcare facilities have water management policies and procedures to reduce the risk of growth and spread of *Legionella* and other opportunistic pathogens in building water systems (US Department of Health and Human Services, 2017). Likewise the Veterans Health Administration has an established policy for the prevention and control of healthcare-associated *Legionella* disease in VHA-owned buildings (VHA Directive 1061 August 13 2014 - *Prevention of Healthcare-Associated Legionella Disease and Scald Injury from Potable Water Distribution Systems* - www.va.gov/vhapublications/viewpublication.asp?pub_id=3033).

A robust WMP includes

- Routine monitoring for water quality parameters including control parameters and *L. pneumophila* (note not currently Navy policy),
- Developing protocols for response to events, including building-specific flushing protocols and building-specific disinfection protocols,
- Establishing a central point of contact (responsible person) for the building water system,
- Identifying building water system stakeholders (operators, building occupants, chain of command) and maintaining a list of points of contact and contact information for key stakeholders, and
- Development of communication strategies for the two types of events, including lists of audiences, key messages, and draft communication tools (Fact Sheets, FAQs, Public Affairs Guidance, All Hands emails, command intranet, etc.).

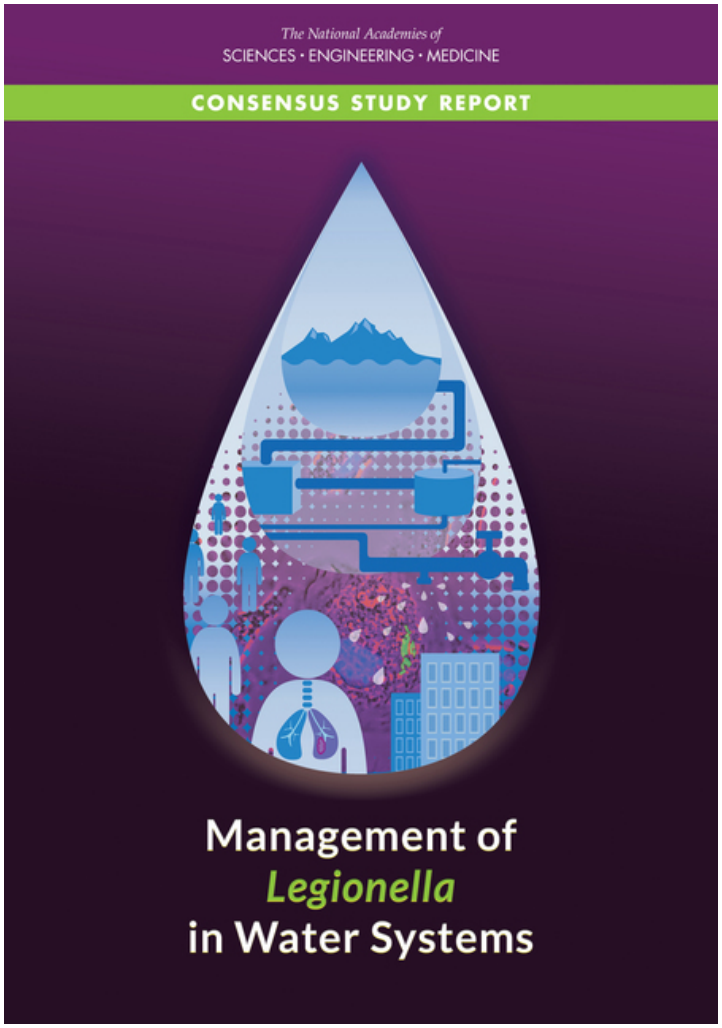
The second general principle is, above all, do no harm. Responses to prior events have included unproductive activities that have made circumstances (water quality and public health) more challenging. Activities to avoid in a response include:

- Stopping water use or interrupting the water supply,
- In the case of suspected or confirmed LD, reflexively sampling for *Legionella* in the building water system,
- Bypassing or discontinuing treatment,
- Conducting activities such as shock chlorination or superheating without first assessing the potential for damage to the building water system,
- Ignoring or downplaying the event,
- Not communicating with stakeholders what is happening and
- Overreacting to the event or mischaracterizing/underplaying the risk associated with the event when communicating with stakeholders.

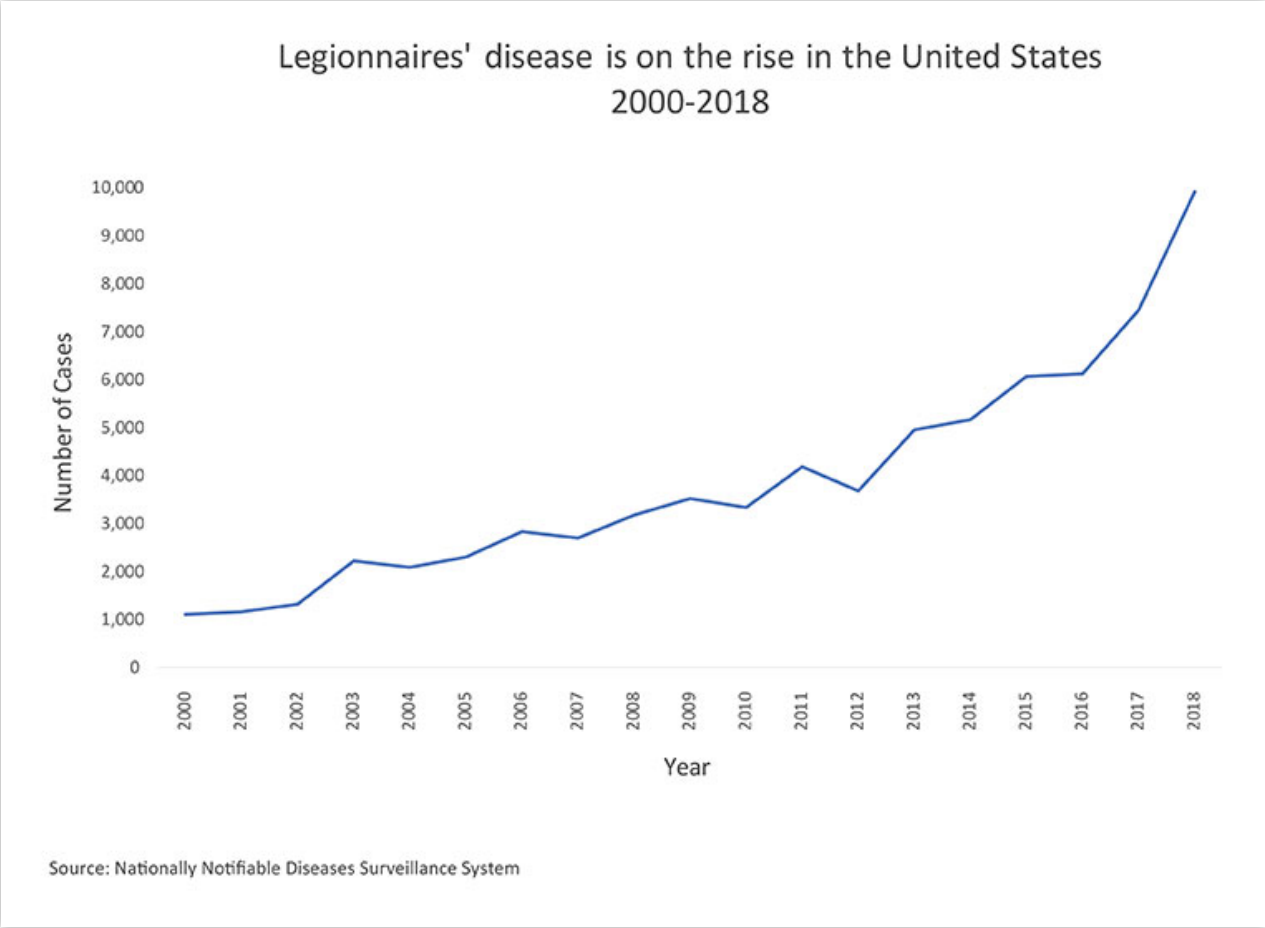
The third general principle is to pay attention to information collection, documentation and sharing. For both types of events the first action on the part of building water system operators is collection of additional information. That information includes water quality data including compliance or non-compliance results, information from public health authorities including local agencies and the supporting MTF, or other entities not directly involved with operation of the building water system and with building occupants. It is critical to record and document all information collected and steps taken, since in the eyes of most authorities an undocumented action is no different from no action. Documenting data, decisions and other information also facilitates sharing the data with other authorities such as public health officials and stakeholders.

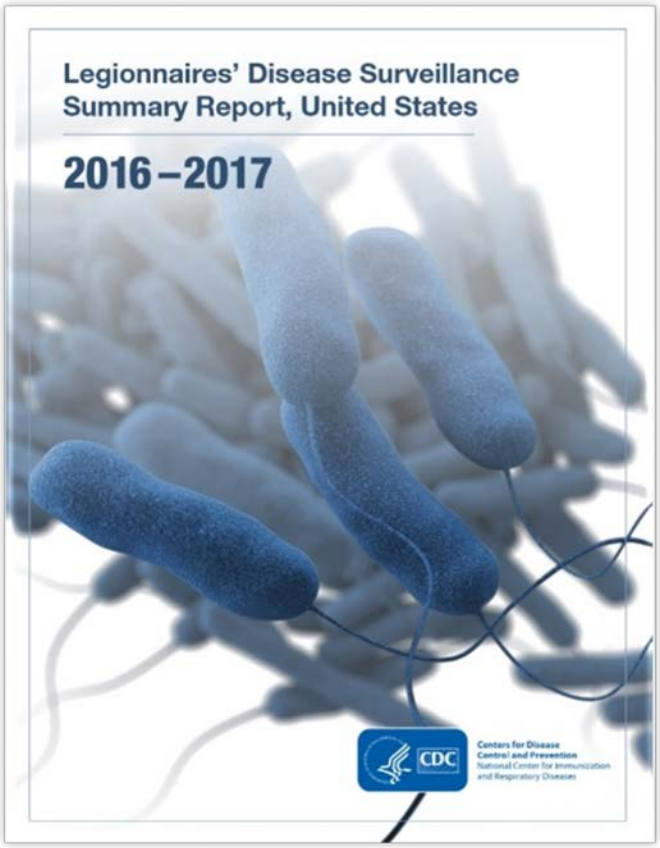
### 3.1.1 Surveillance and Medical Event Reporting for Legionnaires' Disease (Legionellosis)

Since its dramatic arrival during the 1976 outbreak at the American Legion convention in Philadelphia, and now more recently in the community outbreaks at healthcare facilities in Flint Michigan and Quincy, Illinois veterans home, legionellosis is back in the national headlines. In fact, over the past several decades, legionellosis cases have increased. This has compelled the National Academies of Sciences, Engineering and Medicine to publish *Management of Legionella in Water Systems (2020)* which provides an in-depth discussion about the state of the science with regard to Legionella to include the different surveillance systems in the United States.

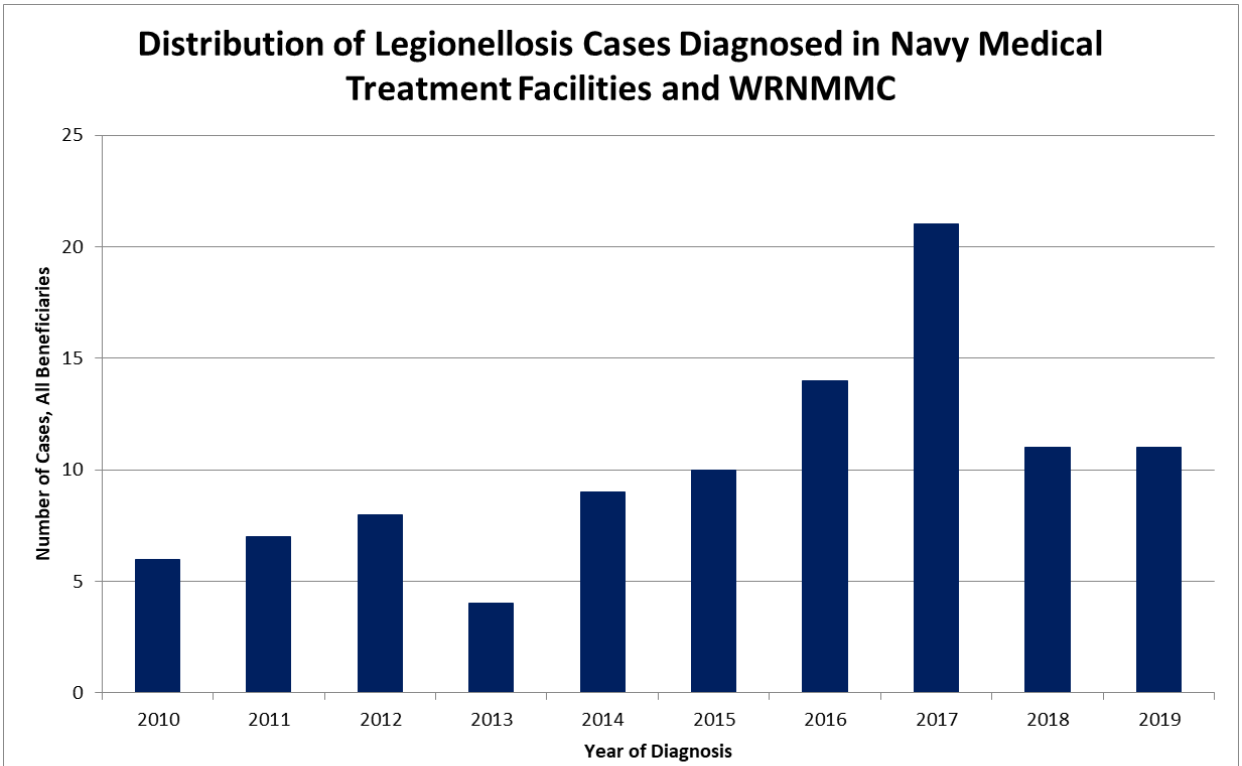



The CDC's latest Legionnaires' Disease Summary Report from 2016-2017 provides further context for the growing importance of the disease.


Legionnaires' disease is on the rise in the United States
2000-2018
Number of Cases
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
Source: Nationally Notifiable Diseases Surveillance System



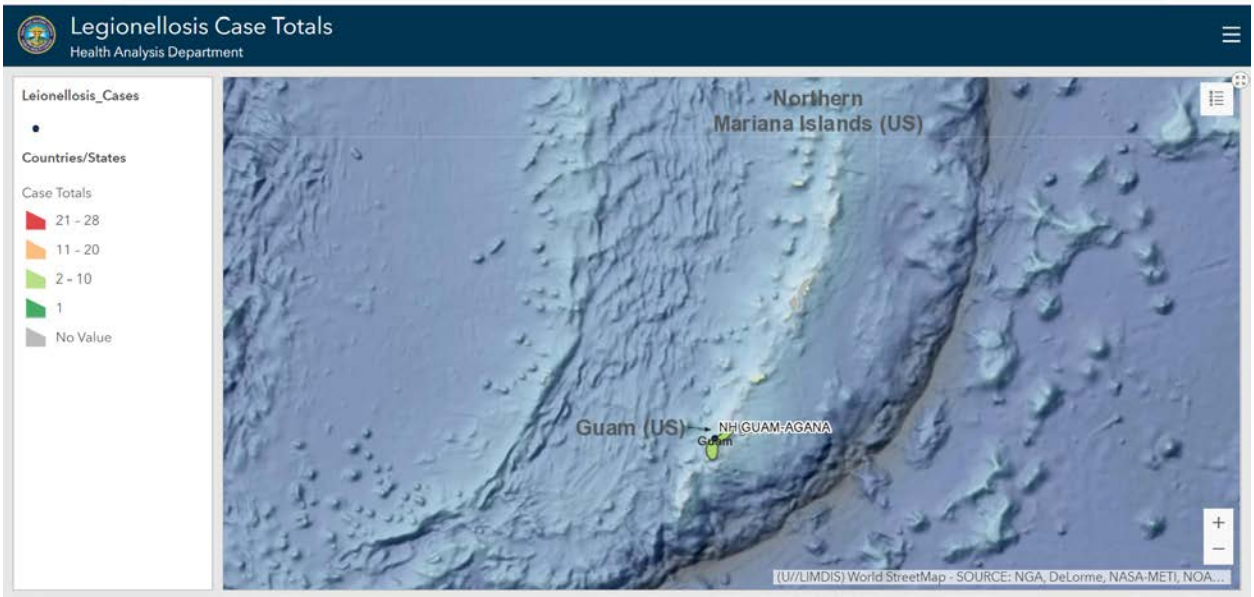

Legionellosis also continues to be an important military public health threat with 101 diagnosed cases over the past ten years by a Navy medical treatment facility (MTF) or Walter Reed National Military Medical Center. Two reported outbreak investigations of legionellosis were also documented in the past ten years, both of which demonstrate the difficulties of confirming the etiologic agent. One outbreak investigation occurred in 2011 when an Army reservist with respiratory symptoms tested positive for legionellosis by urinary antigen test following potential exposure at a joint installation supported by a Navy MTF. Out of 16 other potential Army reservists exposed, three members noted malaise for a few days. The positive member had a history of multiple co-morbidities and passed away as a result of declining health status. The second outbreak occurred on an underway U.S. Navy carrier in 2016 with 31 suspected cases all diagnosed with pneumonia, 8 of which were confirmed by chest x-ray. Symptom presentation included cough, difficulty breathing, chills, fever and chest pain due to persistent cough. While urine and blood samples were collected, lab testing showed no relevant etiology. Navy and Marine Corps installations worldwide have been affected.




Data Sources: A case was defined as any of the following: (1) anyone reported for Legionellosis in DRSi, (2) anyone with a Legionellosis related ICD-10 in HS inpatient data, and/or (3) anyone with a Legionellosis positive antigen, PCR, or culture.


Legionellosis Case Totals
Health Analysis Department
Leionellosis_Cases
Countries/States
Case Totals
21 - 28
11 - 20
2 - 10
1
No Value
North Sea
Baltic Sea
Bay Of Biscay
Spain
NH ROTA
Black Sea
Mediterranean Sea
(U//LIMDIS) World StreetMap - SOURCE: NGA, DeLorme, NASA-METI, NOA...


Legionellosis Case Totals
Health Analysis Department
Leionellosis_Cases
Countries/States
Case Totals
21 - 28
11 - 20
2 - 10
1
No Value
Sea Of Okhotsk
Sea Of Japan
Yellow Sea
East China Sea
NH OKINAWA
South China Sea
Philippine Sea
(U//LIMDIS) World StreetMap - SOURCE: NGA, DeLorme, NASA-METI, NOA...




### Notifiable Diseases (also known as Reportable Medical Events)

Notifiable diseases (known as reportable medical events in the military) are events, usually disease or etiologic agent specific, which may pose an inherent, significant threat to public health and military operations. They have the potential to affect large numbers of people, to be widely transmitted within a population, to have severe/life threatening clinical manifestations, and/or to disrupt military training and deployment. In addition, control measures (many of which are codified in policy) exist to prevent or limit their occurrence.


**Approximately 10–15% of people with Legionnaires' disease will have traveled during their period of possible exposure.**

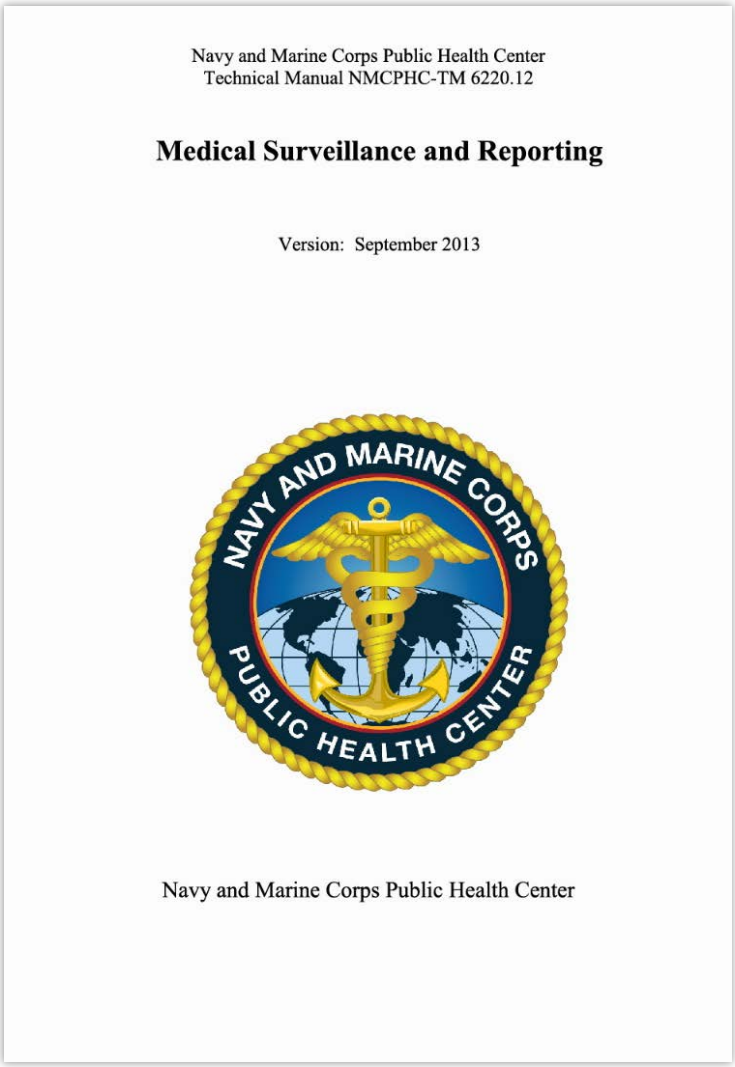
Each U.S. state/territory, country, and military service publishes their own list of reportable events in support of national and international public health efforts as well as local public health threats, needs, and priorities. Legionellosis represents an inherent, significant threat to public health and military operations. Thus surveillance for the disease has been conducted since the disease's recognition in 1976. Legionellosis (Legionnaires' disease and Pontiac Fever) is a nationally notifiable disease for U.S. states, territories and jurisdictions. Legionellosis is

also on the Navy's List of Reportable Medical Events or RMEs (https://www.med.navy.mil/sites/nmcphc/Documents/program-and-policy-support/PreMed-Brochure-final.pdf). The Navy's RME list includes RMEs that were chosen from the Centers for Disease Control and Prevention (CDC) and the Council of State and Territorial Epidemiologists (CSTE) list of national notifiable diseases by a Tri-Service consensus. Additional diseases which potentially pose a significant threat to military forces are also included in the Navy's list. Reporting is mandatory (supported by laws and regulations) for diagnosed cases of Legionnaires' disease and Pontiac fever (a milder form of Legionnaires' disease) by healthcare providers and/or clinical laboratories to public health; cases must be reported within a short time period from diagnosis, usually within one to seven days depending on the state or military service.

These cases, when reported, are collected into surveillance systems that then can be analyzed to uncover trends and inform programmatic and policy decisions. In the U.S., there are two national surveillance systems maintained at the CDC - the National Notifiable Disease Surveillance System (NNDSS) and the Supplemental Legionnaires' Disease Surveillance System (SLDSS). Separately, CDC has regulatory authority over the cruise ship industry, which must report all cases of Legionnaires' disease to the CDC. In the Navy, the Disease Reporting internet (DRSi) archives reported cases of legionellosis as well as outbreaks and provides Navy medical departments the opportunity to examine local disease occurrences and trends. It is important to note that to be counted as a case, a person with legionellosis must seek medical care or be assessed as part of an outbreak. A clinical specimen (e.g., urine, respiratory) must be submitted for testing, and the specimen must be tested for the presence of *Legionella*. This in turn requires that the laboratory be able to identify *Legionella*. Laboratory diagnostic capabilities have been limited in Navy MTFs and many supporting civilian public health labs though the newly developed antigen testing platforms are now being adopted within the Military Health System (MHS). As a result of these limitations, the number of cases actually reported in existing surveillance systems is likely to be an underestimate of the true incidence of legionellosis by as much as eight- to ten-fold (Dooling et al., 2015; Mercante and Winchell, 2015; Phin et al., 2014; St-Martin et al., 2013; von Baum et al., 2008).

### U.S. Navy Reportable Medical Events

Despite these limitations with reporting, when a case is reported preventive medicine personnel conduct an active case investigation and, through this, may uncover additional cases. When identified cases are clustered in time and space, an outbreak may be identified. Effective outbreak control relies on a coordinated reporting posture that promotes timely response. To this end, as a Navy RME, legionellosis is required to be reported by Navy medical departments within 7 days of diagnosis via the DRSi in accordance with BUMEDINST 6220.12 (Medical Surveillance and Medical Event Reporting). A supplemental technical manual for reporting (NMCPHC-TM-6220.12, titled Medical Surveillance and Reporting) provides implementing guidance to fulfill the requirements laid out in BUMEDINST 6220.12 and can be found at https://www.med.navy.mil/sites/nmcphc/Documents/program-and-policy-support/NMCPHC-TM-6220.12-Med-Surveillance.pdf



Navy and Marine Corps Public Health Center
Technical Manual NMCPHC-TM 6220.12

**Medical Surveillance and Reporting**

Version: September 2013

Navy and Marine Corps Public Health Center

## Case Definition for Reporting of Legionellosis

A surveillance case definition is a set of uniform criteria used to define a disease for public health surveillance. Surveillance case definitions enable public health officials to classify and count cases consistently across reporting jurisdictions. Surveillance case definitions are not intended to be used by healthcare providers for making a clinical diagnosis or determining how to meet an individual patient's health needs. Every four years the military service public health components meet to agree upon standard case definitions for the DoD list of reportable events. These are then published in the Armed Forces Reportable Medical Events Guidelines and Case Definitions (also known as the Armed Forces Guide) which can be accessed at: https://www.med.navy.mil/sites/nmcphc/Documents/program-and-policy-support/Armed-Forces-RME-Guidelines-and-Case-Definitions.pdf. Navy medical departments report cases of legionellosis if they meet the published clinical and/or laboratory criteria as shown below.

## Legionellosis (*Legionella* species)

COMMON NAME: Legionnaire's Disease, Pontiac Fever

### Background

| | |
|---|---|
| Causative Agent | *Legionella* species |
| Travel Risks | N/A |
| Clinical Description | Legionellosis is associated with two clinically and epidemiologically distinct illnesses:<br>Legionnaires' disease: Characterized by fever, myalgia, cough, and clinical or radiographic pneumonia.<br><br>Pontiac fever: A milder illness without pneumonia characterized by dry cough or sore throat, fever, chills, fatigue, headache, myalgia. |

### Case Classification

Suspected:

A case that meets any of the clinical descriptions as described above with any of the following:

- Seroconversion from a negative antibody titer followed by a positive antibody titer that is at least four-fold higher than the first titer and is against specific species or serogroups of *Legionella* other than *L. pneumophila* serogroup 1 (example: *L. micdadei*, *L. pneumophila* serogroup 6) or
- Seroconversion from a negative antibody titer followed by a positive antibody titer that is at least four-fold higher than the first titer and is against multiple species of pooled *Legionella* antigens or
- *Legionella* positive antigen by DFA or other similar method from respiratory secretions, lung tissue, or pleural fluid or
- Histopathologic identification of specific *Legionella* antigen by IHC or other similar method from respiratory secretions, lung tissue, or pleural fluid or
- *Legionella* species nucleic acid (DNA) detected from any clinical specimen.

Confirmed:

A case that meets any of the clinical descriptions as described above with any of the following:

- *Legionella* identified by culture from a respiratory specimen, lung tissue, or other normally sterile fluid (example: blood or CSF or, less commonly, joint, pleural, or pericardial fluid) or
- *L. pneumophila* serogroup 1 positive antigen from urine or
- Seroconversion from a negative antibody titer followed by a positive antibody titer that is at least a four-fold higher than the first titer and is against *L. pneumophila* serogroup 1

### Critical Reporting Elements

Specify the clinical form of the disease.

Document relevant travel and deployment history occurring within the incubation period.

### Comments

None.

Source: Armed Forces Reportable Medical Events Guidelines and Case Definitions, January 2020

### Navy Medical Event Reporting Methods - The Navy Disease Reporting System Internet (DRSi)

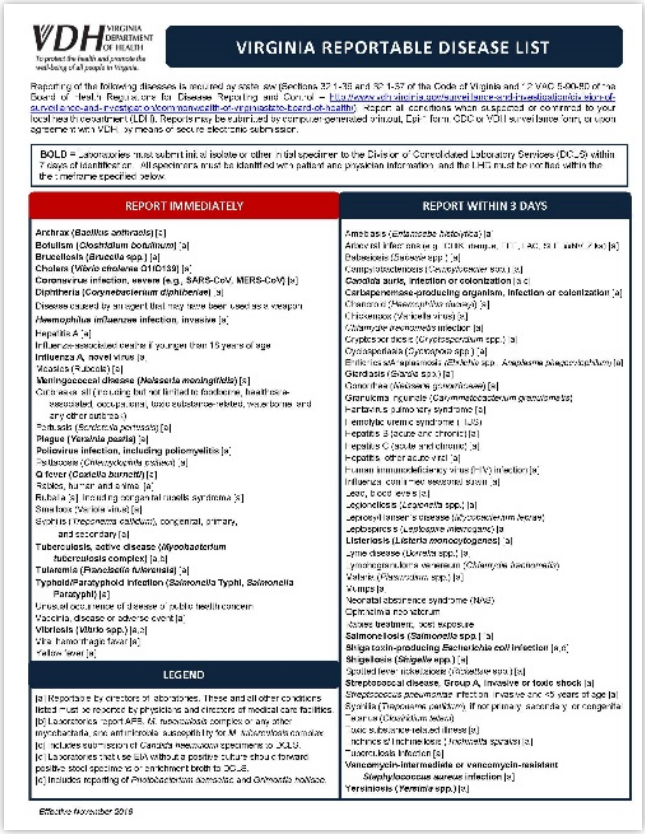
Navy DRSi, an internet-based system, is the Navy's official system for reporting of medical events. It allows for submission, viewing and tracking of current and historical medical event reports (MERs). All Navy medical departments (shore based military treatment facilities as well as operational units) with internet capability are required to use it. To obtain a DRSi account, contact the Navy DRSi helpdesk at usn.hampton-roads.navmcpubhlthcenpors.list.nmcphc-ndrs, COMM: 757-953-0737, DSN: (312) 377-0737 or follow the detailed instructions available at NMCPHC's web site, http://www.med.navy.mil/sites/nmcphc/program-and-policy-support/drsi/Pages/default.aspx. Navy medical personnel without internet access may submit MERs by phone, naval message, or e-mail to their nearest Navy and Environmental Preventive Medicine Unit (https://www.med.navy.mil/sites/nmcphc/field-activities/Pages/default.aspx.).


### State and Local Reporting Requirements

Regulations promulgated by the Chief, Bureau of Medicine and Surgery in the Navy's Manual of the Medical Department mandate that all Navy Medical Officers will cooperate with the Public Health Service and other Federal, State, and local agencies for the prevention of disease and reporting of communicable diseases. Therefore, Senior Medical Department representatives should ensure that their unit has processes in place to report medical events deemed reportable by the laws of the State where their unit is based or home ported. Ships and other deployable

units are generally exempt from their home State's reporting requirements while deployed unless there is a public health reason to report.

MTF Public Health/Preventive Medicine personnel should be familiar with the state reporting requirements and interface with the local and/or state health department (or epidemiologists) on a reported case of an active duty, civil service, or contractor working in buildings on a Naval Installation. Civilian health departments often have special resources that can standardize response in the local area.



VDH VIRGINIA DEPARTMENT OF HEALTH

VIRGINIA REPORTABLE DISEASE LIST

REPORT IMMEDIATELY

Anthrax (*Bacillus anthracis*) [c]
Botulism (*Clostridium botulinum*) [a]
Brucellosis (*Brucella* spp.) [a]
Cholera (*Vibrio cholerae* O1/O139) [a]
Coronavirus infection, severe (e.g., SARS-CoV, MERS-CoV) [a]
Diphtheria (*Corynebacterium diphtheriae*) [a]
Disease caused by an agent that may have been used as a weapon
*Haemophilus influenzae* infection, invasive [a]
Hepatitis A [a]
Influenza-associated death if younger than 18 years of age
Influenza A, novel virus [a]
Measles (Rubeola) [a]
Meningococcal disease (*Neisseria meningitidis*) [a]
Occupational illness (including but not limited to fatalities, healthcare-associated, occupational, toxic substance-related, hearing loss and any other cases) [a]
Pertussis (*Bordetella pertussis*) [a]
Plague (*Yersinia pestis*) [a]
Poliovirus infection, including poliomyelitis [a]
Psittacosis (*Chlamydophila psittaci*) [a]
Q fever (*Coxiella burnetii*) [c]
Rabies, human and animal [a]
Rubella [a] (including congenital rubella syndrome [a])
Smallpox (*Variola virus*) [a]
Syphilis (*Treponema pallidum*), congenital, primary, and secondary [a]
Tuberculosis, active disease (*Mycobacterium tuberculosis complex*) [a,b]
Tularemia (*Francisella tularensis*) [a]
Typhoid/Paratyphoid infection (*Salmonella* Typhi, *Salmonella* Paratyphi) [a]
Unusual occurrence of disease of public health concern
Vaccinia, disease or adverse event [a]
Vibriosis (*Vibrio* spp.) [a,b]
Viral hemorrhagic fever [a]
Yellow fever [a]

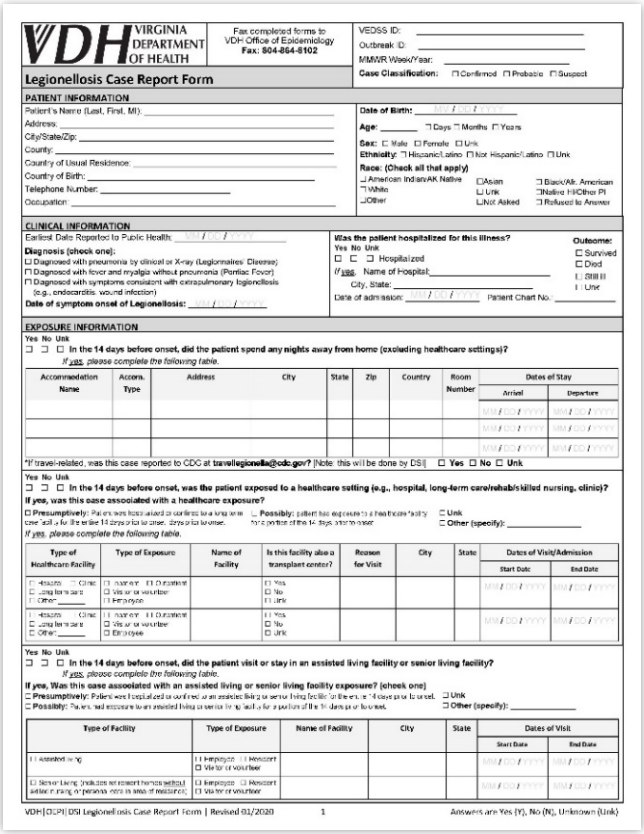
REPORT WITHIN 3 DAYS

Amebiasis (*Entamoeba histolytica*) [a]
Arboviral infection (e.g., CDC-designated [a] or [c])
Babesiosis (*Babesia* spp.) [a]
Campylobacteriosis (*Campylobacter* spp.) [a]
Candida auris, infection or colonization [a,c]
Carbapenemase-producing organism, infection or colonization [a]
Chancroid (*Haemophilus ducreyi*) [a]
Chickenpox (*Varicella* virus) [a]
*Chlamydia trachomatis* infection [a]
Cryptosporidiosis (*Cryptosporidium* spp.) [a]
Cyclosporiasis (*Cyclospora* spp.) [a]
Ehrlichiosis/anaplasmosis (*Ehrlichia* spp., *Anaplasma phagocytophilum*) [a]
Giardiasis (*Giardia* spp.) [a]
Gonorrhea (*Neisseria gonorrhoeae*) [a]
Granuloma inguinale (*Calymmatobacterium granulomatis*)
Hantavirus pulmonary syndrome [a]
Hemolytic uremic syndrome (HUS)
Hepatitis B (acute and chronic) [a]
Hepatitis C (acute and chronic) [a]
Hepatitis, other acute viral [a]
Human immunodeficiency virus (HIV) infection [a]
Influenza, confirmed associated death [a]
Lead, blood level [a]
Legionellosis (*Legionella* spp.) [a]
Leptospirosis/Weil's disease (*Leptospira interrogans*)
Leishmaniasis (*Leishmania mexicana*) [a]
Listeriosis (*Listeria monocytogenes*) [a]
Lyme disease (*Borrelia* spp.) [a]
Lymphogranuloma venereum (*Chlamydia trachomatis*)
Malaria (*Plasmodium* spp.) [a]
Mumps [a]
Neonatal abstinence syndrome (NAS)
Ophthalmia neonatorum
Rabies treatment, post exposure
Salmonellosis (*Salmonella* spp.) [a]
Shiga toxin-producing *Escherichia coli* infection [a,c]
Shigellosis (*Shigella* spp.) [a]
Spotted fever rickettsiosis (*Rickettsia* spp.) [a]
Streptococcal disease, Group A, invasive or toxic shock [a]
*Streptococcus pneumoniae* infection, invasive and <5 years of age [a]
Syphilis (*Treponema pallidum*), if not primary, secondary or congenital
Tetanus (*Clostridium tetani*)
Toxic substance-related illness [a]
Trichinosis (*Trichinella spiralis*) [a]
Tuberculosis infection [a]
Vancomycin-intermediate or vancomycin-resistant *Staphylococcus aureus* infection [a]
Yersiniosis (*Yersinia* spp.) [a]

LEGEND

[a] Reportable by directors of laboratories. These and all other conditions listed must be reported by physicians and directors of medical care facilities.
[b] Laboratories report AFB. *M. tuberculosis* complex or any other mycobacteria, and antimicrobial susceptibility for *M. tuberculosis* complex.
[c] Includes submission of Candida auris/isolate specimens to DCLS.
[d] Laboratories that use EIA without a positive culture should forward positive stool specimens or enrichment broth to DCLS.
[e] Includes reporting of *Pseudomonas aeruginosa* and *Salmonella bongori*.

*Effective November 2018*



VDH VIRGINIA DEPARTMENT OF HEALTH

Fax completed forms to VDH Office of Epidemiology Fax: 804-864-8102

VEDSS ID:
Outbreak ID:
MMWR Week/Year:
Case Classification: ☐Confirmed ☐Probable ☐Suspect

Legionellosis Case Report Form

PATIENT INFORMATION

Patient's Name (Last, First, MI):
Address:
City/State/Zip:
County:
Country of Usual Residence:
Country of Birth:
Telephone Number:
Occupation:

Date of Birth: MM / DD / YYYY
Age: ☐Days ☐Months ☐Years
Sex: ☐Male ☐Female ☐Unk
Ethnicity: ☐Hispanic/Latino ☐Not Hispanic/Latino ☐Unk
Race: (Check all that apply)
☐American Indian/AK Native ☐Asian ☐Black/Afr. American
☐White ☐Unk ☐Native HI/Other PI
☐Other ☐Not Asked ☐Refused to Answer

CLINICAL INFORMATION

Earliest Date Reported to Public Health: MM / DD / YYYY

Diagnosis (check one):
☐ Diagnosed with pneumonia by clinical or X-ray (Legionnaires' Disease)
☐ Diagnosed with fever and myalgia without pneumonia (Pontiac Fever)
☐ Diagnosed with symptoms consistent with extrapulmonary legionellosis (e.g., endocarditis, wound infection)
Date of symptom onset of Legionellosis: MM / DD / YYYY

Was the patient hospitalized for this illness? Yes No Unk
☐ ☐ ☐ Hospitalized
If yes, Name of Hospital:
City, State:
Date of admission: MM / DD / YYYY Patient Chart No:

Outcome:
☐ Survived
☐ Died
☐ Unk

EXPOSURE INFORMATION

Yes No Unk
☐ ☐ ☐ **In the 14 days before onset, did the patient spend any nights away from home (excluding healthcare settings)?**
*If yes, please complete the following table.*

| Accommodation Name | Accom. Type | Address | City | State | Zip | Country | Room Number | Dates of Stay: Arrival | Dates of Stay: Departure |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | MM / DD / YYYY | MM / DD / YYYY |
| | | | | | | | | MM / DD / YYYY | MM / DD / YYYY |
| | | | | | | | | MM / DD / YYYY | MM / DD / YYYY |

*If travel-related, was this case reported to CDC at travellegionella@cdc.gov? [Note: this will be done by DSI] ☐ Yes ☐ No ☐ Unk

Yes No Unk
☐ ☐ ☐ **In the 14 days before onset, was the patient exposed to a healthcare setting (e.g., hospital, long-term care/rehab/skilled nursing, clinic)?**
**If yes, was this case associated with a healthcare exposure?**
☐ **Presumptively:** Patient was hospitalized or confined in a long-term care facility for the entire 14 days prior to onset. ☐ **Possibly:** patient has exposure to a healthcare facility but not the entire 14 days prior to onset. ☐ Unk ☐ Other (specify):
*If yes, please complete the following table.*

| Type of Healthcare Facility | Type of Exposure | Name of Facility | Is this facility also a transplant center? | Reason for Visit | City | State | Dates of Visit/Admission: Start Date | Dates of Visit/Admission: End Date |
|---|---|---|---|---|---|---|---|---|
| ☐ Hospital ☐ Clinic ☐ Long-term care ☐ Other: | ☐ Patient ☐ Visitor/volunteer ☐ Employee | | ☐ Yes ☐ No ☐ Unk | | | | MM / DD / YYYY | MM / DD / YYYY |
| ☐ Hospital ☐ Clinic ☐ Long-term care ☐ Other: | ☐ Patient ☐ Visitor/volunteer ☐ Employee | | ☐ Yes ☐ No ☐ Unk | | | | MM / DD / YYYY | MM / DD / YYYY |

Yes No Unk
☐ ☐ ☐ **In the 14 days before onset, did the patient visit or stay in an assisted living facility or senior living facility?**
*If yes, please complete the following table.*
**If yes, Was this case associated with an assisted living or senior living facility exposure? (check one)**
☐ **Presumptively:** Patient was hospitalized or confined in an assisted living or senior living facility for the entire 14 days prior to onset. ☐ Unk
☐ **Possibly:** Patient had exposure to an assisted living or senior living facility for a portion of the 14 days prior to onset. ☐ Other (specify):

| Type of Facility | Type of Exposure | Name of Facility | City | State | Dates of Visit: Start Date | Dates of Visit: End Date |
|---|---|---|---|---|---|---|
| ☐ Assisted living | ☐ Employee ☐ Resident ☐ Visitor or volunteer | | | | MM / DD / YYYY | MM / DD / YYYY |
| ☐ Senior Living (indicates all resident homes without assisted living or personal care in area of residence) | ☐ Employee ☐ Resident ☐ Visitor or volunteer | | | | MM / DD / YYYY | MM / DD / YYYY |

VDH-[CLP] DSI Legionellosis Case Report Form | Revised 01/2020 1 Answers are Yes (Y), No (N), Unknown (Unk)

As an example, for the state of Virginia and the Virginia Department of Health (VDH), the MTF should be familiar with the following information:

**VDH Legionellosis Webpage:**

https://www.vdh.virginia.gov/surveillance-and-investigation/legionellosis/

**Virginia Reportable Disease List:**

https://www.vdh.virginia.gov/content/uploads/sites/13/2018/11/Reportable_Disease_List.pdf

**VDH Conditions Reportable by Directors of Laboratories:**

https://www.vdh.virginia.gov/content/uploads/sites/13/2018/11/Lab_Poster.pdf

Virginia Monthly Morbidity Surveillance Reports

https://www.vdh.virginia.gov/surveillance-and-investigation/virginia-reportable-disease-surveillance-data/virginia-monthly-morbidity-surveillance-report-2018/

**VDH Waterborne Hazards Control – Recreational Water Illnesses:**

https://www.vdh.virginia.gov/environmental-epidemiology/waterborne-hazards-control/legionella/

**Legionellosis:**

https://www.vdh.virginia.gov/content/uploads/sites/13/2018/03/Legionellosis2016.pdf

**Office of Epidemiology:**

https://www.vdh.virginia.gov/environmental-epidemiology/contact-us/

**VDH Local Health Districts:**

https://www.vdh.virginia.gov/local-health-districts/

### International Reporting Requirements

In areas outside the United States and its territories, U.S. military units rarely report directly to host nation militaries or foreign governments. Routine medical event reporting to foreign governments or militaries should be consistent with the requirements of applicable formal agreements (e.g., Final Governing Standards) with foreign governments, or allied forces.

Refer to Navy and Marine Corps Public Health Center Technical Manual NMCPHC-TM-PM-6220.12, Medical Surveillance and Reporting, for more specific information on Navy reporting.

DEPARTMENT OF THE NAVY
BUREAU OF MEDICINE AND SURGERY
2300 E STREET NW
WASHINGTON DC 20372-5300

IN REPLY REFER TO
BUMEDINST 6220.12C
BUMED-M3/5
27 Sep 2011

BUMED INSTRUCTION 6220.12C

From: Chief, Bureau of Medicine and Surgery

Subj: MEDICAL SURVEILLANCE AND MEDICAL EVENT REPORTING

Ref: (a) Sections 5131 and 5132 of Title 10, United States Code
(b) DoD Directive 6490.02E, "Comprehensive Health Surveillance," August 24, 2009
(c) BUMEDINST 3440.10
(d) DoD Instruction 6200.03, "Public Health Emergency Management Within the Department of Defense," March 5, 2010
(e) NMCPHC-TM-PM 6220.12
(f) BUMEDINST 5040.2C

1. Purpose. To define Department of the Navy (DON) policy and guidance for medical surveillance and medical event reporting. This is a complete revision and should be read in its entirety.

2. Cancellation. BUMEDINST 6220.12B.

3. Scope. This directive applies to all Navy Medicine personnel assigned to any command within the DON. It is issued under the authority granted to the Bureau of Medicine and Surgery (BUMED) via reference (a) to make health care policy for the DON.

4. Background

a. The monitoring, analysis, and reporting of significant medical events that may adversely affect mission accomplishment are critical to the commanders' ability to make force health protection decisions. These activities are essential for evaluation, planning, and implementation of public health practice, disease prevention, and emergency response as indicated in references (b) through (d).

b. The specific duties and responsibilities of Navy Medicine personnel relating to medical surveillance and medical event reporting are defined in Chapters 2 and 22 of the Manual of the Medical Department. For the purpose of this instruction, *medical surveillance* is defined in reference (b).

c. The specific responsibilities of medical treatment facilities to conduct surveillance, respond to public health emergencies, and to use the Electronic Surveillance System for the early notification of community-based epidemics, appear in references (c) and (d).

Additional reporting information and resources are available at:

- To access the current Armed Forces Guide, go to http://go.usa.gov/cSSQ3
- To download and print the current Navy Reportable Events List, go to https://go.usa.gov/xx2Bx
- To find Navy regulations and technical manuals on reporting, go to: http://go.usa.gov/cSSQ3
- For information on DRSi including how to get an account, go tohttp://go.usa.gov/xx2Bx
- To access training on reporting and surveillance, visit our archived disease surveillance trainings at http://go.usa.gov/xx2XV

### Case Investigations

All cases of legionellosis should be investigated to identify any further cases that have been missed and examine potential sources of infection that may cause further illnesses. To enable a thorough and efficient investigation, a standardized case report form should be used to interview all cases. The form or questionnaire will address potential water exposures at a case's home, workplace, and other visited locations. Local civilian counterparts may have good forms/questionnaires that can be modified for military installation needs. A suggested Navy public health questionnaire for legionellosis cases can be found in Appendix I and can be modified for local needs. Filled out questionnaires should be stored locally and a copy forwarded to the NMCPHC to promote collation and analysis throughout the enterprise.

**Legionnaire's Disease (clinical legionellosis and related health effects) reporting template.** Page 1 of 2.

This document is designed to help guide and standardize preventive medicine department patient investigation activities to ensure timely identification of public health threats. *Please complete according to the most accurate information available to you. If unknown, mark as such or leave blank.*

**Patient Demographics and Personal Information**

1. Today's date (DD/MM/YYYY) _____ / _____ / _____
2. Name (last, first) _____
3. DoD ID _____
4. Date of birth _____ / _____ / _____ (month day year)
5. Gender (biological sex) ☐ Male ☐ Female
6. Race ☐ White ☐ Black ☐ Hispanic ☐ Asian ☐ Other
7. Street address _____
8. City _____ 9. State _____ 10. Postal code _____ 11. Country _____
12. Housing type ☐ Private residence ☐ Government housing ☐ PPV housing ☐ Shipboard ☐ Other _____
13. Status ☐ Active Duty ☐ Reservist ☐ Civilian ☐ Contractor ☐ Dependent/family member ☐ Other _____
14. Medical record in AHLTA or Genesis? ☐ Yes ☐ No
15. Phone number (_____) _____ 16. Email _____@_____

**Workplace or School**

17. Name of command or school where patient worked or studied at time of illness _____
18. Street address where patient worked or studied at time of illness _____
19. City _____ 20. State _____ 21. Postal code _____ 22. Country _____

**Clinical Information**

23. Date of symptom onset _____ / _____ / _____ (month day year) ☐ Unknown
24. Check all symptoms experienced by this patient.
    - ☐ Fever
    - ☐ Myalgias
    - ☐ Cough
    - ☐ Sore throat
    - ☐ Fatigue
    - ☐ Headache
    - ☐ Other (list): _____
25. Date that patient first sought medical care for symptoms consistent with legionnellosis _____ / _____ / _____ (month day year) ☐ Unknown
26. Diagnosis (check only one)
    - ☐ Legionnaires Disease (pneumonia diagnosis clinically or on X-ray) ☐ Pontiac Fever (fever and myalgia without pneumonia)
    - ☐ Extrapulmonary legionellosis only (endocarditis, wound infection, sepsis)
27. Date of diagnosis _____ / _____ / _____ (month day year)
28. Laboratory confirmation? ☐ Urine antigen positive
    - ☐ Culture positive (☐blood ☐sputum ☐BAL fluid ☐pleural fluid ☐lung biopsy ☐other_____)
    - ☐ Four-fold rise serum antibody to ***L. pneumophila*** serogroup 1
    - ☐ Four-fold rise to antibody other than ***L. pneumophila*** serogroup 1
    - ☐ Direct fluorescent antibody or immunohistochemistry positive (☐blood ☐sputum ☐BAL fluid ☐pleural fluid ☐lung biopsy ☐other_____)
    - ☐ No lab confirmation
29. Was the patient hospitalized for this illness? ☐ Yes ☐ No
30. If hospitalized, name and state of hospital _____
31. If hospitalized, date of admission _____ / _____ / _____ (month day year)
32. Outcome ☐ Survived full recovery ☐ Survived with sequelae ☐ Still sick ☐ Died ☐ Unknown
33. Date illness reported to Public Health or Preventive Medicine _____ / _____ / _____ (month day year) (enter today's date if not previously reported)

02 October 2020

**Legionnaire's Disease (clinical legionellosis and related health effects) reporting template.** Page 2 of 2.

This document is designed to help guide and standardize preventive medicine department patient investigation activities to ensure timely identification of public health threats. *Please complete according to the most accurate information available to you. If unknown, mark as such or leave blank.*

## Exposure Information

34. List any overnight travel, hospitalizations, medical procedures, clinic visits, and group gatherings the patient participated in during the 14 days prior to symptom onset.

| | Place of Potential Exposure | Type (home, hotel, hospital, etc.) | Street address (including Country, if OCONUS) | Room number (if any) | Arrival date mm/dd/yyyy | Departure date mm/dd/yyyy |
|---|---|---|---|---|---|---|
| 1. | | | | | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |

35. In the 14 days before illness onset, did the patient use, participate in, or be exposed to the following? For all that apply, circle the number(s) corresponding to the rows in the above table, use H for exposures at home, use B for local businesses.

- **1 2 3 4 H B** Hot tub or jetted tub
- **1 2 3 4 H B** Cooling tower
- **1 2 3 4 H B** Dental water lines
- **1 2 3 4 H B** Evaporative condenser
- **1 2 3 4 H B** Fountain
- **1 2 3 4 H B** Grocer's fresh vegetable mist
- **1 2 3 4 H B** Humidifier
- **1 2 3 4 H B** Swimming or wading pool
- **1 2 3 4 H B** Shower
- **1 2 3 4 H B** Steam room or wet sauna
- **1 2 3 4 H B** Convention, party, or other gathering
- **1 2 3 4 H B** Construction or remodeling
- **1 2 3 4 H B** Natural soil, peat, or potting soil
- **1 2 3 4 H B** Gardening/gardening center
- **1 2 3 4 H B** Landscaping
- **1 2 3 4 H B** Treatment of sleep apnea or breathing condition

Type of water used in the device, if any:
☐ Bottled ☐ Distilled ☐ Sterile
☐ Tap ☐ Unknown

## Follow-up and Investigation

36. Date local health department contacted to notify or confirm awareness _____ / _____ / _____ ☐ Not contacted
(month / day / year)

37. Does the patient know of similarly ill persons? ☐ Yes (specify _____) ☐ No

38. Is this patient's case associated with a known or suspected outbreak (cluster)? ☐ Yes (specify_____) ☐ No

39. Patient's primary care manager (PCM) is aware of the diagnosis and is assuming care for the patient as confirmed by
☐ Documentation from PCM ☐ PCM contacted ☐ PCM not aware ☐ Unknown

40. Date awareness of PCM confirmed _____ / _____ / _____ ☐ Not confirmed
(month / day / year)

41. Date the overseer of the suspected source (municipal structure, housing authority, landlord, business, homeowner, etc.) was contacted to inform or confirm awareness of the potential exposure source _____ / _____ / _____ ☐ Not contacted
(month / day / year)

42. Environmental (e.g., water) sampling performed? ☐ Yes ☐ No ☐ Unknown

43. Identifying information of samples (laboratory, samples, collector, codes, location, storage, etc.) if obtained

_____

_____

_____

_____

44. Investigator name (last, first) _____

45. Investigator phone (_____) _____ 46. Investigator email _____ @ _____

47. Date completed _____ / _____ / _____ 48. Investigator's UIC (for contractors, UIC of hiring command) _____
(month / day / year)

02 October 2020

### 3.1.2 Risk Communication

Health risk communication together with information preparation and dissemination is critical to an organized, informed and productive response to a *Legionella* incident. Uniformed and under-informed stakeholders, to include leadership and building staff, have a greater potential for mis-interpreting health risk and for making unproductive decisions. The general approach for establishing communication protocols prior to events and for communicating effectively and productively during events are described below.

Before *Legionella* is detected or an LD case is suspected or perceived to be potentially associated with the building water system, a review of how information is given to and received from key people working with building water systems and, more generally, all staff in buildings, should be conducted to ensure proper pathways and protocols are in place as needed. This assessment should include one-way and two-way channels for communication and how to access them. These communication channels should be operational during and after an event has occurred. Two-way communication with all stakeholders is essential to:

- Ensure individuals are aware of health risks and can protect themselves against them
- Ensure installation and building managers are aware of health risks and have all the information they need to take the appropriate corrective actions and
- Take advantage of on-the-ground insights of how systems are working – what helps them operate as safely as possible and what obstacles there are to mitigate risks.

Once *Legionella* is detected or public health authorities suspect a LD case could be associated with the building water system, all communication needs to be tailored to precise audiences. The following are audiences that might need key information delivered via communication pathways as soon as contamination is found or LD is confirmed, and depending upon the severity of the event or the probability that the building water system was involved:

- Staff directly working with the building water system (the WMP team)
- Building public affairs and water system managers
- Regional Commander, Installation Commanding Officer, Public Works Officer
- BUMED chain of command (Naval Medical Forces Atlantic/Pacific, NMCPHC, MTF public health)
- MTF Public Health officials
- Building occupants and users
- Media (intra-agency communication and/or external communication).

A protocol for a two-way exchange of information is especially important for staff directly working with the water system or who work in the affected building(s). A two-way information exchange should occur pre- during- and post-event/investigation and should seek insights into problems contributing to heightened risk of contamination and recommendations for system or operation changes that could improve risk mitigation or response.

To be as effective and efficient as possible, instructions about how to prevent contamination and respond should it occur, need to be field-tested with target audiences before an incident. Field tests with target audiences should ask whether instructions are clear, how the audience member perceives them, what factors may make it difficult for the audience member to follow the instructions, and what other information they would find useful on contamination prevention and response. The instructions can be disseminated after the content field test is done and adjustments are made. Two-way communication channels should be kept open and publicized even after instructions are disseminated so as to constantly update information and ensure it reflects on-the-ground realities. Possible two-way communication channels include:

- Key informant interviews (KIIs)
- Focus Group Discussions
- A telephone hotline or POC "office hours"
- Survey
- All Hands emails and/or meetings or text message
- Action Officer designated when contamination detected.

One-way information can be disseminated via:

- Email
- Text message
- Navy Intranet group
- Posters in office buildings
- Public Service Announcements over building PA systems
- Newsletters

General messaging for WMP personnel, health officials and BUMED chain of command should include the *Legionella* detection and/or LD report and background information that helps them interpret it. Specific attention should be paid to what not to do (i.e., do not suppress information, do not shut off water, do not reflexively sample and do not overstate the severity). If sampling for Legionella has already occurred, be prepared to share those results, to include the actual laboratory analysis reports, adding interpretation and context where needed.

***If sampling for Legionella has already occurred, be prepared to share those results, to include the actual laboratory analysis of reports, adding interpretation and context where needed.***

If the WMP team is not prepared to share information in this open and transparent fashion, do not conduct sampling, otherwise the WMP team is setting the basis for allegations of hiding or cover-up of information. For personnel working in the impacted building, general information on *Legionella* bacteria, LD, what was found, what is being done and how they can limit their risk should be communicated. Additional communication tips before, during and after a crisis include the following:

- Research shows that an effective way to promote stakeholders' embrace of new behaviors and actions is to listen to stakeholders' needs and challenges in following preventive and response recommendations, then create messaging and information that gives technical information and reflects what people have told you;
- For sharing of messaging and information, rely where possible on external (to the chain of command) third party subject matter experts and organizations (e.g., CDC).
- Avoid jargon and acronyms
- Convince yourself – because it is true – that clarity in communication makes you seem smarter, trusted and credible.
- Use multiple communication formats and channels to get your message across so that every stakeholder has an accessible way to obtain information.
- Use established communication formats and channels if available; otherwise use formats and channels that stakeholders have told you they prefer.

**Health Risk Communication Materials**

MTF Public Health and Installation/Command Public Affairs

Both of these entities need to work closely with the WMP Team to develop a *Legionella* Briefing Card and Frequently Asked Questions (FAQs) specific to the individual event in the building(s) of concern. Preferably a generic draft can be built ahead of time since the chances of a case of LD, or *Legionella* detect in a building on a Navy or Marine Corps installation is inevitable. Appendices F and G provide a generic template from which a tailored version can be developed for the installation/building of concern.

There are a number of reputable government agencies and professional organizations that have developed guidelines and standards and include:

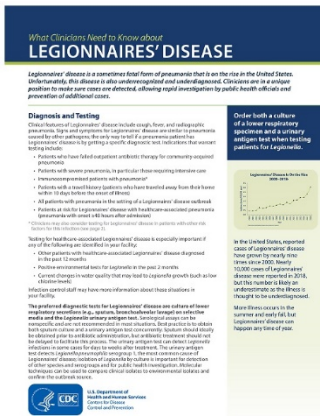
- Centers for Disease Control and Prevention (CDC)
- Occupational Safety and Health Administration (OSHA)
- Environmental Protection Agency (EPA)
- American Industrial Hygiene Association (AIHA)

- European Union
- World Health Organization

In terms of depth and breadth of Legionella communication materials the CDC website is highly recommended:

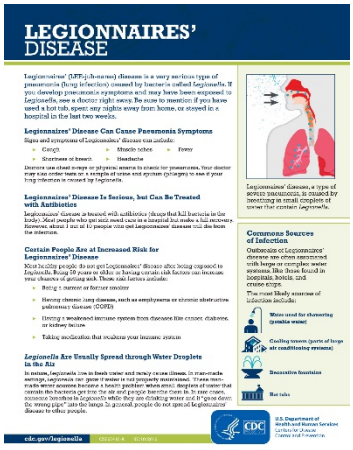
https://www.cdc.gov/legionella/

Specific communication resources such as:




- Fact Sheets
- Videos
- infographic
- Graphics
- Photos
- Podcasts
- Public Service Announcements
- Blogs
- Toolkits
- Trainings

are found at: https://www.cdc.gov/legionella/health-depts/communications-resources.html




## Fact Sheets

Legionnaires' Disease pdf [1 page]
This fact sheet describes what Legionnaires' disease is, its symptoms, how it's spread and treated, and who is at increased risk.

What Clinicians Need to Know about Legionnaires' Disease pdf [2 pages]
This 2-page fact sheet describes diagnosis, testing, treatment, reporting, etiology,

transmission, risk factors, common sources of infection, and prevention of Legionnaires' disease.

## Legionnaires' disease


2016 Vital Signs: Legionnaires' Disease Outbreaks pdf [6.24 MB, 4 pages]
This 4-page fact sheet describes the most common settings for Legionnaires' disease outbreaks that CDC investigated between 2000 through 2014, explains the reasons for those outbreaks occurring, and provides tips for what can be done to help prevent Legionnaires' disease. Also see Vital Signs.


2017 Vital Signs: Legionnaires' Disease in Healthcare Facilities pdf [3.55 MB, 4 pages]
This 4-page fact sheet describes the problem of Legionnaires' disease in healthcare facilities and how effective water management programs can prevent it, with an emphasis on establishing a team approach. Also see Vital Signs.


Legionnaires' Disease Prevention:
Making a Splash with Safe Water pdf [2 pages]

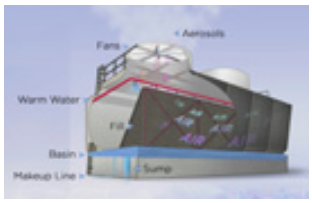
Disinfection of Hot Tubs that Contain *Legionella* pdf [2 pages]
This 2-page fact sheet explains the steps you should take if *Legionella* is found in your hot tub.


## Infographic

How *Legionella* Affects Building Water Systems and People Learn four key steps that can lead to *Legionella* growing in building water systems and spreading to people.

## Graphics

Illustration of *Legionella pneumophila*, the bacterium that causes the majority of Legionnaires' disease cases and outbreaks.
Download this graphic image (22.8 MB, 300 dpi resolution)




Cooling towers, which are often part of the air conditioning systems of large buildings, are a common source of *Legionella* exposure in outbreaks. Cooling towers need to be properly maintained in order to prevent Legionnaires' disease.

Download this graphic image (5.37 MB, 96 dpi resolution)

## Notification Letter Templates

In notification letters, you want to convey what you know about the situation, who is at risk, and what you are doing to protect against further illness. Consider addressing the following elements when drafting notification letters:

- Who is the intended audience (i.e., hotel/travel accommodation guests, healthcare facility staff, patients and their families, community members)?
- What do you know about the case exposures (i.e., does the available epidemiologic information point to a given setting or device as the source of exposure)?
    - How many cases have common exposures?
    - What type of exposures are potentially implicated?
    - How tightly clustered in time were the cases?
- What do you know about the environment (i.e., the level of certainty that the implicated setting was the source of exposure)?
    - Have you already performed environmental sampling? Were any samples positive for *Legionella*?
    - Have you already obtained and characterized clinical and environmental isolates in order to confirm the exposure source?

- What measures have been taken so far or will be taken to prevent further cases (e.g., shutting down/draining hot tubs, remediating the hot water system, water restrictions, installation of point-of-use filters)?
- How can those at risk protect themselves (i.e., who is at increased risk, how is it spread and treated, where can more information be found [include contact information for the appropriate public health jurisdiction])?

For travel outbreaks, consider

- Whether past guests who may have unrecognized or incubating infections should be notified about possible exposures that may have already occurred
- Whether future guests should be notified of the potential for exposure prior to or upon arrival so that they have an opportunity to find another accommodation if they are at increased risk

Below are customizable letter templates for use during Legionnaires' disease outbreaks. Public health officials can adapt these templates according to individual circumstances, preferences, and available resources.

### 3.1.2 Healthcare Facilities

- Notification letter template to healthcare facility staff regarding a single possible healthcare-associated Legionnaires' disease case
  Word [1 page] | PDF [1 page]

  https://www.cdc.gov/legionella/downloads/notification-letter-single-possible.pdf

- Notification letter template to healthcare facility staff regarding a single definite healthcare-associated Legionnaires' disease case, when a full investigation is warranted
  Word [1 page] | PDF [1 page]

  https://www.cdc.gov/legionella/downloads/notification-letter-single-definite.pdf

### 3.1.3 Sample Letters

Below are sample notification letters that have been used in various Legionnaires' disease outbreaks.

- Letter to Tenants — 2017 pdf [1 page]

  https://www.cdc.gov/legionella/downloads/sample-letter-tenants.pdf

- Letter to Tourist Accommodation — 2017 pdf [2 pages]

  https://www.cdc.gov/legionella/downloads/sample-letter-tourist.pdf

- Guest Notification Letter — 2016 pdf [1 page]

  https://www.cdc.gov/legionella/downloads/sample-letter-guest.pdf

Hotels

- Notification letter template to hotel/travel accommodation guests regarding a Legionnaires' disease outbreak investigation
  Word [1 page] | PDF [1 page]

  https://www.cdc.gov/legionella/downloads/notification-letter-hotel.pdf

- Notification letter template to hotel management regarding a single Legionnaires' disease case possibly associated with the hotel
  Word [1 page] | PDF [1 page]

  https://www.cdc.gov/legionella/downloads/notification-letter-hotel-single-case-508.pdf

Additional resources are provided on the NMCPHC Risk Communication webpage at https://www.med.navy.mil/sites/nmcphc/environmental-programs/Pages/risk-communication.aspx.

## 3.2 Detection of *L. pneumophila* in Building Water Samples

Table 4 provides detailed actions in response to detecting *L. pneumophila* in building water system samples. The response outlined in Table 4 assumes a WMP is in place, that routine monitoring of *L. pneumophila* is part of the WMP, that protocols for building flushing and disinfection

have been established and are documented in the WMP and that communication strategies and tools have been established and are documented in the WMP.

The general approach for setting action levels of *L. pneumophila* and activities for each action level are a modified version of action levels and activities established by the EU. A detailed discussion of regulations and guidelines in various jurisdictions is presented in Section 5 of the National Academy of Sciences, Engineering and Medicine's (2020) report on management of *Legionella* in water system. The action levels were developed for investigations of hotels and public buildings; stricter (lower) action levels should be considered for MTFs, for portions of MTFs associated with higher LD risk and for facilities serving susceptible/immunocompromised populations. It should be noted that the action-levels are not health-based standards (unlike maximum contaminant levels under the National Primary Drinking Water Regulations). The National Academy of Sciences, Engineering and Medicine (2020, page 141) provide a detailed discussion of quantitative microbial risk assessment for Legionella.

*Table 4: Response to Detection of L. pneumophila in Building Water System Samples*

| **Follow-Up Action** | **Details** |
|---|---|
| **Rapid Assessment and Reporting** | Rapidly develop a situational report (sitrep) specifying<br>• Basic information about the building water system<br>  o Is a WMP in place? Since when and in response to what?<br>  o Disinfection concentration at the building entry point<br>  o Range of disinfectant concentrations for flushed POUs<br>  o Have there been prior *L. pneumophila* detections?<br>• The number and percentage of points of use that tested positive for *L. pneumophila*<br>• The locations that tested positive and their characteristics. For positive locations, report<br>  o Location of the positive POU<br>  o Typical use for the POU (e.g., handwashing, showering, janitorial etc.)<br>  o Whether the positive sample was for hot or cold water<br>  o Chlorine concentration<br>  o *L. pneumophila* concentration and action level (see table below)<br>General principles: increasing severity and greater response associated with<br>• Repeat positive locations<br>• Increasing proportion of positive locations<br>• High concentrations of *Legionella*<br><br>The sample round is classified as a "***detection"*** if it is assessed as action level 2i or 2ii. It is classified as an "***incident"*** if it is assessed as action level 2iii or 3. |

<table>
<tr><td></td><td>
<table>
<tr><th>Action level</th><th>Legionella (CFU/L)</th><th>Action Sublevels</th></tr>
<tr><td>0</td><td>Not detected</td><td></td></tr>
<tr><td>1</td><td><100 to 1000</td><td></td></tr>
<tr><td>2</td><td>>1000 to < 10,000</td><td>i. A small proportion (< 20%) of samples is positive and none of the locations is a repeat positive<br>ii. A small proportion (<20%) of samples is positive and one or more locations is a repeat positive<br>iii. The majority of samples are positive.</td></tr>
<tr><td>3</td><td>≥ 10,000</td><td></td></tr>
</table>
</td></tr>
<tr><td>Preparatory and Initial Communication</td><td>Target audiences and key messages differ for detections and incidents.<ul><li>For detections, the audiences are the WMP team and staff to whom they report. Key messages are that the WMP is in place, that routine monitoring has not identified high risk conditions and that WMP activities should continue and be documented.</li><li>For incidents, the audience also includes the BUMED chain of command and building occupants or visitors who might have had contact with Legionella-positive water taps. Key messages are described in section 4.1 and the two most critical messages are to avoid counterproductive responses and that LD risk is elevated, and stress that staff are investigating and managing the risk and that additional information will be provided as data are collected and actions are taken.</li></ul></td></tr>
<tr><td>Additional Data Collection and Reporting</td><td>Collect information on the building water supply (e.g., were there disturbances such as construction activities in the distribution system in the building vicinity?)<br>Determine whether the controls (in the WMP) are within specified limits<ul><li>Disinfectant</li><li>Temperature</li><li>Water age</li></ul>Estimate the extent of contamination<ul><li>Resample all locations (first draw sample)</li><li>Take a first draw and flushed sample for contaminated taps, then do the same for a nearby tap on the same branch. Elevated Legionella concentration in both flushed samples or both first draw samples is evidence of potential wider contamination than a single point of use.</li></ul>Reassess the action level and update the detection or incident report with additional data and planned follow-up actions (described below).</td></tr>
</table>

<table>
<tr><td>Communication</td><td>Target audiences<ul><li>WMP key personnel and staff and management responsible for building water system operation and maintenance</li><li>MTF Health officials</li><li>BUMED chain of command</li><li>Personnel working in an impacted building (on action level 3)</li></ul>General messaging<ul><li>For WMP personnel, health officials and BUMED chain of command, updated detection report and proposed actions.</li><li>For personnel working in the impacted building, updated information on their risk and the planned actions/response.</li></ul>Communication platforms<ul><li>Text messages with links to the detection report and a “contact us” pathway for stakeholders to give feedback</li><li>Emails or other preferred messaging platforms (e.g., and/or WhatsApp, Skype or MS Teams)</li><li>Memoranda (on the order of a drinking water advisory) distributed to impacted building occupants</li><li>Posters in impacted locations; content clear, but proportional to the risk.</li><li>E-newsletters posted on relevant organizations’ websites/intranets or that accompany company or association emails</li></ul></td></tr>
<tr><td>Follow-up</td><td>If the revised action level is 2iii or 3, perform a full building flush per the guidance.<table><tr><th>Action level</th><th>Actions</th></tr><tr><td>0</td><td>Acceptable – no action</td></tr><tr><td>1</td><td>Refer to the responsible person and ensure that routine monitoring parameters (biocide, temperature, etc.) are within target limits throughout the system</td></tr><tr><td>2</td><td>i. If a small proportion of samples is positive (<20%) and none of the locations is a repeat positive, the system should be resampled. If a similar count is found again, then a review of the control measures and risk assessment should be carried out to identify any remedial actions<br>ii. If a small proportion of samples is positive (<20%) and one or more locations is a repeat positive, then<ul><li>Resample the system</li><li>For repeat positive sample locations, adjust the control strategy. For chronically positive sites, clean and disinfect to the origin of the branch</li></ul></td></tr></table></td></tr>
</table>

| | | |
|---|---|---|
| | | • For other sample locations, review control measures and conduct a hazard analysis to determine whether the control strategy must be changed.<br>iii. If the majority of samples are positive, the system may be colonized, albeit at a low level, with *Legionella*. Disinfection of the system should be considered, but an immediate review of the control measures and a risk assessment should be carried out to identify any other remedial action required. |
| | 3 | The system should be re-sampled, and an immediate review of control measures and a risk assessment carried out to identify any remedial actions, including disinfection of the entire system or affected area is necessary |
| **Modify WMP** | The WMP is updated to reflect revised control limits and practices. Examples of modifications are more frequent flushing of one or more points of use, more frequent full-building flushing, revised temperature control limits, and periodic disinfection (e.g., thermal or chemical) for persistently contaminated points of use and connected plumbing. | |
| **Finalize the Report** | Update the sitrep to include<br>• Actions taken<br>• Further actions recommended | |

## 3.3 LD Cases with Suspected Association with Building Water Systems

Case and outbreak responses are initiated and directed by public health authorities and proceed according to BUMED and state public health protocols. Although in charge of the investigation, public health officials might not have a deep general understanding of building water systems and water quality and are unlikely to have specific knowledge about the building water system with the suspected implication in a case or outbreak or water quality in the specific building water system.

The response outlined below recognizes the overall authority of public health authorities during an investigation and proposes specific building water system investigations and communication activities that can be done to support the investigation.

*Table 5: Response to LD Cases with Suspected Association with Building Water Systems*

| Follow-Up Action | Details |
|---|---|
| **Initial Information collection** | Public health officials contact the person responsible for building water system management (specified in the Water Management Plan) and provide information about the case or outbreak and why the building water system is being investigated. At a minimum, the responsible person needs<br>• The date(s) of case(s) with potential association with the building water system<br>• Reason(s) the case(s) are suspected to have an association with the building water system<br>• The most recent date(s) the case(s) were present in the building<br>• A description of the parts of the building used/frequented by the case(s) and the frequency of use (e.g., daily, infrequently, once)<br>• A list of water uses and specific fixtures for each case<br><br>The responsible person reviews the WMP and associated logs and reports to determine<br>• whether the WMP was operational during the period when *Legionella* exposure might have occurred,<br>• *Legionella* concentration in fixtures that might have been used by case(s), if available and<br>• If water quality parameters defined in the WMP, e.g. disinfectant levels, pH, temperature, etc., were within specified limits.<br><br>Public health officials make an initial assessment of the likelihood that exposure to water from the building water system caused the case or outbreak (unlikely, possible or likely). The initial assessment determines how initial communication with stakeholders (chain of command and other building users) proceeds.<br>The responsible person assists the lead public health authority in reporting and appends a brief report to the building WMP. |
| **Preliminary Communication** | Communication follows public health protocols and uses public health strategies and tools when possible. In the absence of direction from public health authorities, preliminary communication can proceed as follows.<br>The audiences, strategy and messages for preliminary communication are determined by the public health officials' initial assessment.<br>**Audiences**<br>If it is unlikely the building water system is associated with the case(s)<br>• The communication audience is members of the water management team (and not chain of command or other building users).<br>• Communication includes<br>o distribution of the sitrep appended to the water management plan and |

| | |
|---|---|
| | ○ a face-to-face meeting of the WMP team for two-way information sharing, including the collection of potentially pertinent information from staff.<br>If possible that the Building Water System (BWS) was associated with the case(s), in addition to the steps listed above,<br>• The BUMED chain of command is notified (if not already notified by public health authorities)<br>• Public health authorities determine whether other building users and occupants are notified that a case could be associated with the building that they use and are informed about their risks, steps the responsible persons are taking for risk assessment and mitigation, and steps they can take for risk mitigation.<br>If it is likely that the building water system was associated with the cases, in addition to audiences outlined above,<br>• Building users and occupants are notified that a case is likely associated with the building they use and are informed about their risks and steps they can take for risk mitigation.<br><br>**Strategy, Key Messages and Tools**<br>At this stage of the investigation, results are preliminary and association of the case(s) with the building water system is not established. Therefore, the key messages to BUMED chain of command and to building occupants and users are<br>• The water supply should not be interrupted, treatment devices should continue to be used and maintained.<br>• The building water is safe to drink; aerosols and in some cases aspiration exposures (not oral ingestion) can cause Legionnaires' disease.<br>• Legionnaires' disease is a relatively rare illness and public health and building water system staff are investigating whether the illness is associated with the building water system and, if so, the best approach for reducing risk.<br><br>The channels used for disseminating these messages are determined by public health authorities. In the absence of direction from public health authorities, the BUMED chain of command is notified via email, and building occupants are notified via fliers and posters.<br>Examples of tools for communicating to the chain of command and to building occupants are provided in Section 3.1.2 and appendicies A and F to this report. |
| **Additional Data Collection and Reporting** | The WMP team reviews the WMP and collects samples and additional data for water system points of use and locations frequented by the cases. |

| | |
|---|---|
| | Sample collection is directed by public health officials and is part of an outbreak/case investigation. In addition to direction from public health authorities, the following activities are required.<br>• Collect information on the building water supply for the period roughly one month prior to the onset of the case(s) (e.g., were there disturbances such as construction activities in the distribution system in the building vicinity?)<br>• Determine whether the controls (in the WMP) were within specified limits at points of use frequented by the case and remain within control limits. Both hot and cold water are assessed. At a minimum, the following can be determined:<br>  • Disinfectant concentration (first draw and fully flushed)<br>  • Temperature when fully flushed<br>  • Water age (e.g., data from meters if the branch is metered or an estimate of the frequency of use for the POU based on observations by the WMP team or based on a flushing log).<br><br>In coordination with public health authorities, collect microbial samples. Sample analysis for *Legionella pneumophila* could involve analysis (gene sequencing) that allows a very specific comparison of bacteria from the LD case(s) to bacteria in the BWS. In addition to coordination from public health authorities, the following activities are required.<br>• Collect a 100 mL building POE sample and analyze for *L. pneumophila* via a culture method. Alternatively, a larger sample volume can be collected and analyzed. A larger sample volume can improve the chances of detecting *L. pneumophila* when there is a low concentration in the water, but does not provide any additional information about the level of contamination or the actions required beyond the information provided by a 100 mL sample.<br>• Collect 100 mL first-draw samples from all locations frequented by the case(s) and analyze samples for *L. pneumophila* via a culture method.<br><br>Water quality and other BWS data collected in additional data collection and reporting is provided to public health authorities and amended to the WMP.<br>Public health authorities reassess the likelihood that the BWS was associated with a case of Legionnaires' disease and provide the revised assessment to the BWS responsible person (point of contact). |
| **Communication** | If the public health assessment changes based on the review of water quality and other data, revised communications are delivered to target audiences. The target audiences and messages are dependent on the public health assessment (BWS was unlikely associated with case(s), possibly associated with case(s) or probably associated with case(s). The target audiences, strategy and messages are the same as in the previous communication step. |

| | | |
|---|---|---|
| **Follow-up** | Condition | Action |
| | Public health authorities determine the BWS was associated with one or more cases | • Disinfect all points of use frequented by cases, along with plumbing extending back to the origin of branches connecting the points of use to the building's main distribution. Disinfection proceeds as specified in the BWS WMP and includes flushing.<br>• Revise the WMP controls to reduce the likelihood of *L. pneumophila* occurrences at the POUs. This would typically involve increase of use/flushing or increase of hot water temperature.<br>• Increase monitoring frequency at POUs to weekly until no POU tests positive for *L. pneumophila* in successive samples, all samples in a sample round have *L. pneumophila* concentration < 1000 CFU/L and < 20% of sampled taps are positive for the sample round.<br>• **DO NOT DISCONTINUE WATER SUPPLY TO THE BUILDING OR IMPACTED POINTS OF USE. WATER STAGNATION CAN CAUSE ADDITIONAL WATER QUALITY PROBLEMS.** |
| | At least one POU had *L. pneumophila* concentration > 10,000 CFU/L | • Disinfect all points of use with concentration > 10,000 CFU/L, along with plumbing extending back to the origin of branches connecting the points of use to the building's main distribution. Disinfection proceeds as specified in the BWS WMP and includes flushing.<br>• Revise the WMP controls to reduce the likelihood of *L. pneumophila* occurrences at the POUs. This would typically involve increase of use/flushing or increase of hot water temperature.<br>• Increase monitoring frequency at POUs to weekly until no POU tests positive for *L. pneumophila* in successive samples, all samples in a sample round have *L. pneumophila* concentration < 1000 CFU/L and < 20% of sampled taps are positive for the sample round.<br>• DO NOT DISCONTINUE WATER SUPPLY TO THE BUILDING OR TO IMPACTED POINTS OF USE. |

<table>
<tr><td></td><td></td><td>WATER STAGNATION CAN CAUSE ADDITIONAL WATER QUALITY PROBLEMS.</td></tr>
<tr><td></td><td>Public health authorities do not find an association between the BWS and the case(s) and at least one POU had L. pneumophila concentration > 1000 CFU/L in supplemental sampling</td><td>• For repeat positive sample locations, adjust the control strategy. For chronically positive sites, clean and disinfect to the origin of the branch.<br>• For other sample locations, review control measures and conduct a risk assessment to determine whether the control strategy must be changed.</td></tr>
<tr><td></td><td>Other conditions</td><td>• No action</td></tr>
<tr><td>Modify WMP</td><td colspan="2">WMP is updated to reflect the revised control strategy and control limits. The most likely revisions are<br>• Increase in use/flushing frequency for impacted POUs<br>• Increase in cleaning frequency for impacted POUs<br>• Change in temperature targets for POUs and associated plumbing<br><br>If these strategies do not reduce the incidence of L. pneumophila positive samples, additional measures such as periodic shock disinfection, periodic superheating or supplemental disinfection followed by flushing may be required.</td></tr>
<tr><td>Follow-up communication</td><td colspan="2">As with other actions, communication is directed by public health authorities in the case and outbreak investigations. In the absence of direction from public health authorities, the following items should be communicated with all stakeholders involved in prior communication steps.<br>• Actions taken and their expected impacts<br>• Further actions recommended</td></tr>
</table>

# SECTION 4 – REFERENCES

Alary, M., and Joly, J.R. 1991. Risk factors for contamination of domestic hot water systems by *legionellae*. Appl. Envir. Microbiol. 57, 2360–2367.

Barrette, I., 2019. Comparison of Legiolert and a conventional culture method for detection of *Legionella pneumophila* from cooling towers in Québec. J. AOAC Int. 102, 1235–1240

CDC National Notifiable Diseases Surveillance System, 2016 Annual Tables of Infectious Disease Data. Atlanta, GA. CDC Division of Health Informatics and Surveillance, 2017. Available at: https://www.cdc.gov/nndss/infectious-tables.html

CDC, 2017. Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings. A Practical Guide to Implementing Industry Standards, v 1.1. https://www.cdc.gov/legionella/downloads/toolkit.pdf

CDC, 2020. Surveillance Reports for Drinking Water-associated Disease & Outbreaks. Internet: https://www.cdc.gov/healthywater/surveillance/drinking-surveillance-reports.html (Accessed: June 2020).

Collins, S, Stevenson, D, Bennett, A, and Walker, J, 2016. Occurrence of *Legionella* in UK household showers. Int J of Hyg and Env Health 220(2 ptB), 401-406.

Cooley LA, Pondo, T, Francois Watkins LK, Shah P, Schrag S; Active Bacterial Core Surveillance Program of the Emerging Infections Program Network. Population-Based Assessment of Clinical Risk Factors for Legionnaires' Disease. Clin Infect Dis. 2020;70(11):2428-2431.

de Vos, L., Boon, N., Verstraete, W., 2005. *Legionella pneumophila* in the environment: the occurrence of a fastidious bacterium in oligotrophic conditions. Rev. Environ. Science Bio/Technol. 4, 61–74.

Dooling KL, Toews KA, Hicks LA, et al. Active Bacterial Core Surveillance for Legionellosis - United States, 2011-2013. MMWR Morb Mortal Wkly Rep. 2015;64(42):1190-1193

ECDC, 2017. European Technical Guidelines for the Prevention, Control and Investigation of Infections Caused by *Legionella* species. 2017. https://www.ecdc.europa.eu/en/publications-data/european-technical-guidelines-prevention-control-and-investigation-infections

ECDC, 2020. Surveillance Atlas of Infectious Diseases. https://atlas.ecdc.europa.eu/public/index.aspx?Dataset=27&HealthTopic=30. Accessed 5/22/20.

Hayes-Phillips, D, Bentham, R, Ross, K, and Whiley, H, 2019. Factors influencing *Legionella* contamination of domestic household showers. Pathogens 8, 27.

Lautenschlager, K., Boon, N., Wang, Y., Egli, T., Hammes, F., 2010. Overnight stagnation of drinking water in household taps induces microbial growth and changes community composition. Water Res. 44, 4868–4877.

LeChevallier, M.W., 2019a. Monitoring distribution systems for *Legionella pneumophila* using Legiolert. AWWA Water Sci. 1, e1122

LeChevallier, M.W., 2019b. Occurrence of culturable *Legionella pneumophila* in drinking water distribution systems. AWWA Water Sci. 1, e1139

Mapili, K., Pieper, K.J., Dai, D., Pruden, A., Edwards, M.A., Tang, M., Rhoads, W.J., 2020. *Legionella pneumophila* occurrence in drinking water supplied by private wells. Lett. Appl. Microbiol.

Mapili, K.I.M., 2019. Characterization of Opportunistic Pathogens in Drinking Water Supplied by Private Wells (PhD Thesis). Virginia Tech.

National Academies of Sciences, Engineering, and Medicine 2020. Management of *Legionella* in Water Systems. Washington, DC: The National Academies Press. https://doi.org/10.17226/25474.

Naval Facilities Engineering Command (2016). Legionnairres Technical Alert

New York City Department of Health and Mental Hygiene (2016). Notice of Adoption of Chapter 8 (Cooling Towers) of Title 24 of the Rules of the City of New York. Internet: https://www1.nyc.gov/assets/doh/downloads/pdf/notice/2016/noa-chapter8-title24.pdf

New York Codes, Rules and Regulations (2016) Title: Subpart 4-1 - Cooling Towers. Internet: https://regs.health.ny.gov/content/subpart-4-1-cooling-towers

Orkis, LT, Harrison, LH, Mertz, KJ, Brooks, MM, Bibby, KJ, and Stout, JE, 2018. Environmental sources of community-acquired legionnaires' disease: A review. Intl J of Hyg and Env Health 221 764–774.

Parr, A., Whitney, E.A., Berkelman, R.L., 2015. Legionellosis on the rise: a review of guidelines for prevention in the United States. J. Public Health Manag. Practice 21, E17–E26.

Pepper, I.L., Rusin, P., Quintara, D.R., Haney, C., Josephson, K.L., Gerba, C.P., 2004. Tracking the concentration of heterotrophic plate count bacteria from the source to the consumer's tap. Int. J. Food Microbiol. 92, 289-295.

Petrisek, R., Hall, J., 2018. Evaluation of a most probable number method for the enumeration of *Legionella pneumophila* from North American potable and non-potable water samples. J. Water Health 16, 25–33

Rech, M.M., Swalla, B.M., Dobranic, J.K., 2018. Evaluation of Legiolert for quantification of *Legionella pneumophila* from non-potable water. Curr. Microbiol. 75, 1282–1289.

Rogers, J., Dowsett, A.B., Dennis, P.J., Lee, J.V., Keevil, C.W., 1994. Influence of temperature and plumbing material selection on biofilm formation and growth of *Legionella pneumophila* in a model potable water system containing complex microbial flora. Appl. Environ. Microbiol. 60, 1585–1592.

Serrano-Suárez, A., Dellundé, J., Salvadó, H., Cervero-Aragó, S., Méndez, J., Canals, O., Blanco, S., Arcas, A., Araujo, R., 2013. Microbial and physicochemical parameters associated with *Legionella*. Environ. Sci. Pollut. Res. 20, 5534–5544.

Spies, K., Pleischl, S., Lange, B., Langer, B., Hübner, I., Jurzik, L., Luden, K., Exner, M., 2018. Comparison of the LegiolertTM/Quanti-Tray® MPN test for the enumeration of *Legionella pneumophila* from potable water samples with the German regulatory requirements methods ISO 11731-2 and ISO 11731. Int. J. Hyg. Environ. Health 221, 1047–1053.

US Department of Health and Human Services (2017). Requirement to Reduce Legionella Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires' Disease (LD). https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/Downloads/QSO17-30-HospitalCAH-NH-REVISED-.pdf

US EPA, 1989. National Primary Drinking Water Regulations: Filtration and Disinfection; Turbidity, Giardia lamblia, Viruses, *Legionella*, and Heterotrophic Bacteria, final rule. Federal Register, 54(124), 27486–27541. https://www.epa.gov/dwreginfo/surface-water-treatment-rules

US EPA, 2009. National Primary Drinking Water Regulations. Office of Drinking and Groundwater, EPA 816-F-09-004, https://www.epa.gov/sites/production/files/2016-06/documents/npwdr_complete_table.pdf.

van Heijnsbergen, E., Schalk, J.A.C., Euser, S.M., Brandsema, P.S., den Boer, J.W., de Roda Husman, A.M., 2015. Confirmed and potential sources of *Legionella* reviewed. Environ. Sci. Technol. 49, 4797–4815.

Whiley, H., Taylor, M., 2016. *Legionella* detection by culture and qPCR: comparing apples and oranges. Crit. Rev. Microbiol. 42, 65–74.

WHO, 2007. *Legionella* and the Prevention of Legionellosis. WHO Press, Geneva, Switzerland. Internet: https://www.who.int/water_sanitation_health/emerging/legionella.pdf?ua=1

# Appendix A

## NMCPHC Exposure Pathways Fact Sheet

# Exposure Pathways

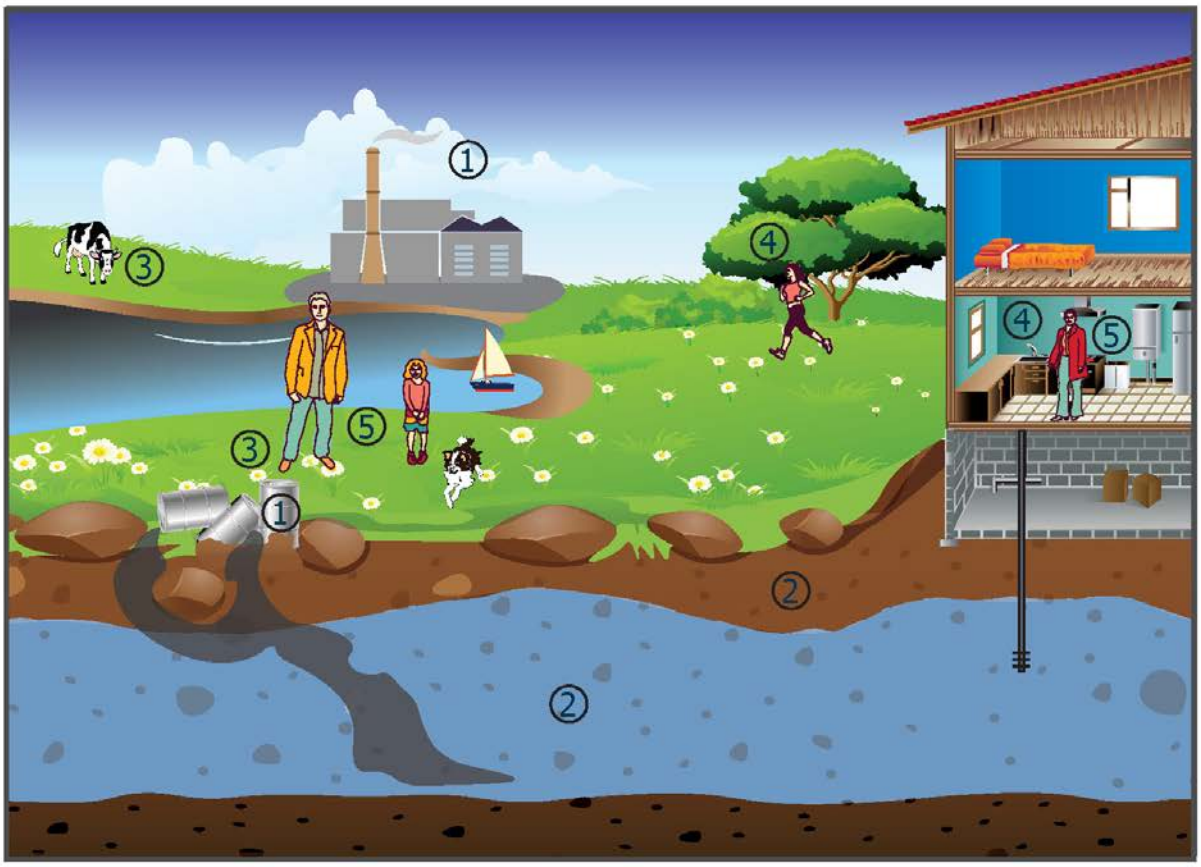
### What is Exposure?

Exposure is when you come in contact with a material and that material enters your body.

### What is an Exposure Pathway?

An exposure pathway is the course along which a material in the environment moves from its source and into your body.

NMCPHC Exposure Pathways Fact Sheet - December 21, 2016



## 5 Elements of a Complete Exposure Pathway

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Source | Media | Exposure Point | Exposure Route | Receptor/ Population |
| How the material gets in the environment<br><br>» Landfill<br>» Tank<br>» Pond<br>» Creek<br>» Incinerator<br>» Drum<br>» Factory | How a material moves from its source to the point of exposure<br><br>» Soil<br>» Sediment<br>» Animals/Plants<br>» Groundwater<br>» Surface Water<br>» Air | Where people contact the media<br><br>» Residence<br>» Business<br>» Residential Yard<br>» Playground<br>» Campground<br>» Waterway | How the material enters the body<br><br>» Breathing air that contains the material<br>» Eating or drinking something with the material in it<br>» Getting it on your skin or touching something that has the material in it or on it | People who are exposed or potentially exposed<br><br>» Residents<br>» Hunters/ Fishermen<br>» Recreational populations<br>» Visitors<br>» Workers |

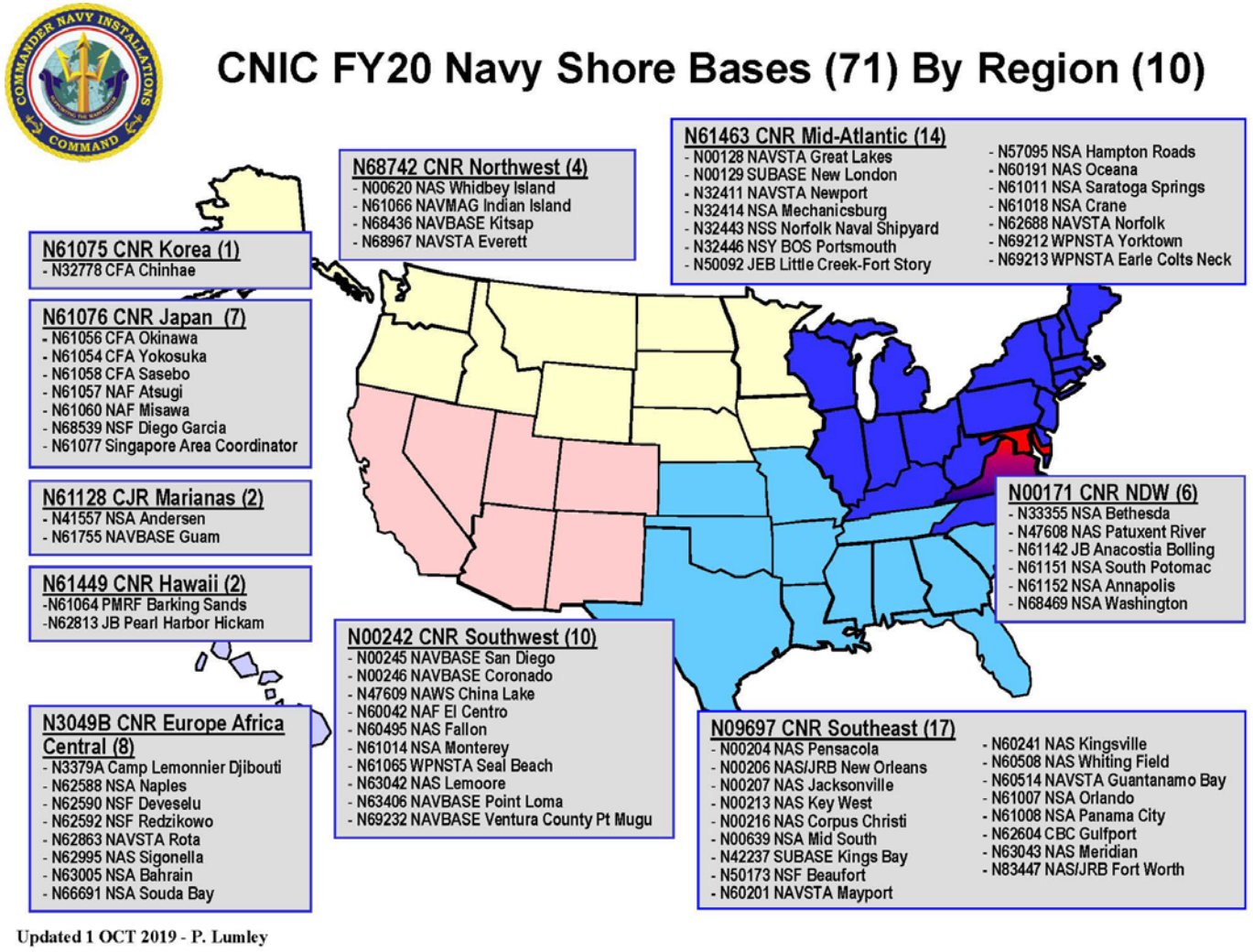
NMCPHC Exposure Pathways Fact Sheet ii

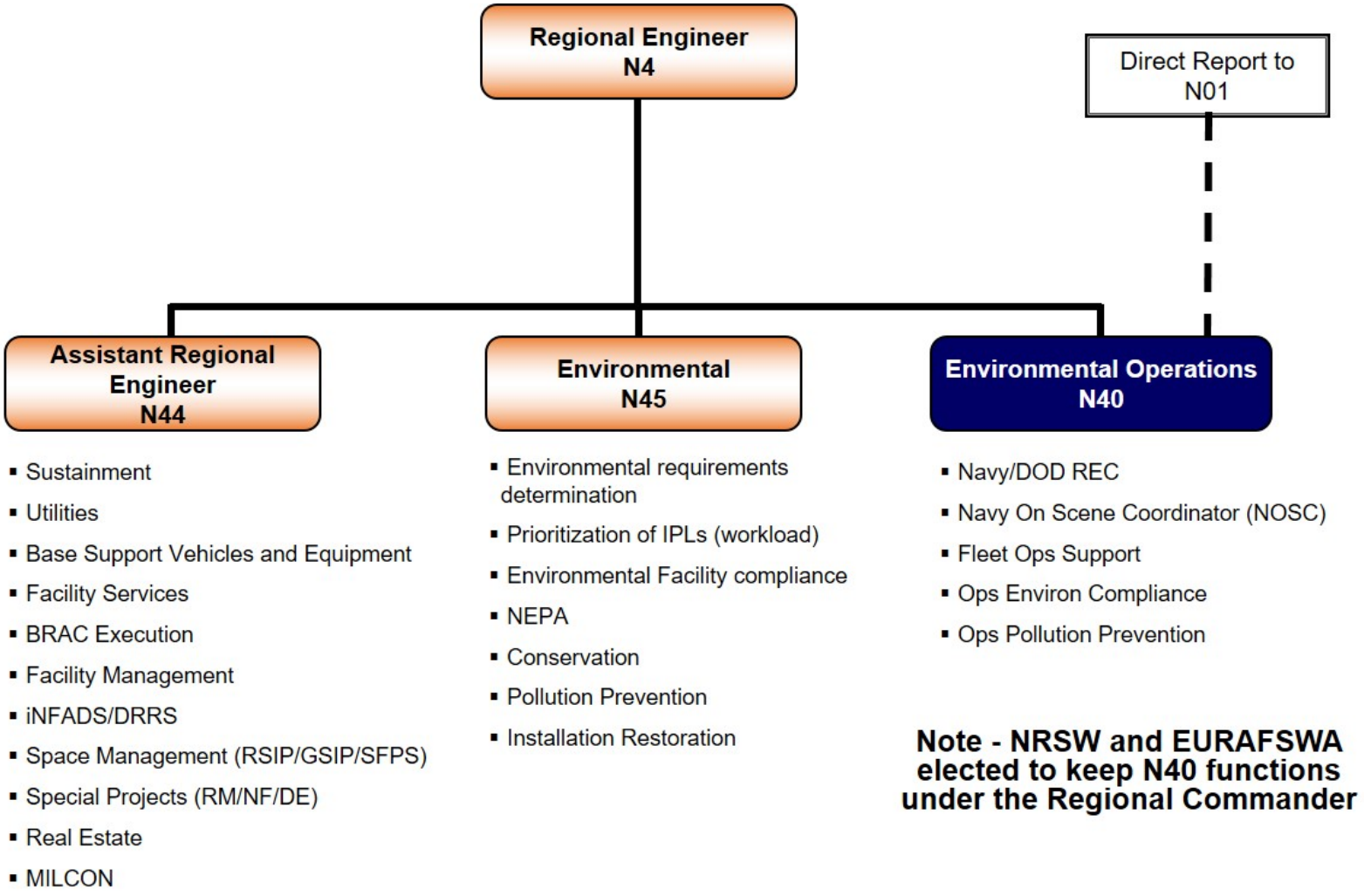
**NAVY AND MARINE CORPS PUBLIC HEALTH CENTER**
PREVENTION AND PROTECTION START HERE

**Navy and Marine Corps Public Health Center**
NMCPHC Exposure Pathways Fact Sheet
620 John Paul Jones Circle, Suite 1100
Portsmouth, VA 23708-2103
www.nmcphc.med.navy.mil

# Appendix B

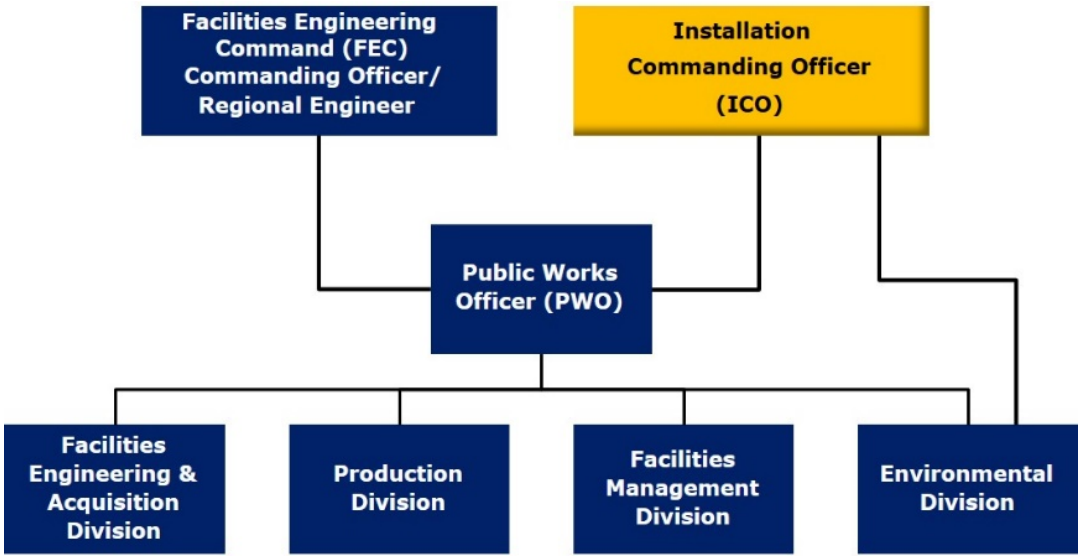
## CNIC FY20 Shore Bases by Region, CNIC Regional Staff Organization for Facilities and Environmental, and Installation NAVFAC PWD Environmental






**CNIC Regional Staff Organization for Facilities and Environmental**

https://www.navfac.navy.mil/map.html


**NAVFAC Installation PWD-Environmental. ICO has direct line to Environmental Director.**

# Appendix C

## Building Water Quality and Coronavirus: Flushing Guidance for Periods of Low or No Use – 3 April 2020 – Espri Institute and AH Environmental

# Building Water Quality and Coronavirus: Flushing Guidance for Periods of Low or No Use

The scientists and engineers at the Environmental Science, Policy & Research Institute (ESPRI) and AH Environmental Consultants, Inc. (AH) developed this brief guidance material to help those who are responsible for maintaining building water systems. We have decades of water quality and treatment experience, including building water quality and operation issues, and wanted to share our insights on this topic.

As buildings have been shut down or used less frequently, building water quality degradation becomes a silent but serious issue. This document is meant as a starting point to bring awareness of the issue of water quality degradation in building plumbing when it is not used, or water use is significantly reduced. We kept this brief and provide it as a general roadmap for how to flush contaminants from the building and get the plumbing system water quality back to pre-stagnation conditions. Each building is different, and flushing will need to be tailored accordingly.

Many thanks to those who reviewed and provided suggestions to this material.

Please feel free to circulate and post this information. And stay well in these challenging times.

ESPRI – Tim Bartrand, Sheldon Masters, Tom Hargy, Randi McCuin & Jen Clancy espri@esprinstitute.org

AH – Rich Theiss, Peter Pommerenk, Sean McNamara & Dave Hiltebrand (solutions@ahenv.com)

## What happened in my building water system while the building was out of use?

- The building water system begins at the meter where water enters the building and includes all plumbing, storage and fixtures to each distal tap.
- When the water was not used, the disinfectant in the water dissipated. Without the disinfectant, microorganisms grew on pipes, fixtures and tanks. Some of these may cause disease if they are consumed or inhaled as droplets (particularly while showering).
- The protective scale on pipes could have destabilized. Without the protective scale, toxic metals like lead can dissolve or shear off as particles and end up in water used for drinking or food preparation.
- Potentially harmful substances such as disinfection byproducts (DBPs) built up.
- Mechanical equipment such as cooling towers, boilers and pumps may not have received any routine maintenance. Backflow preventers may have missed annual test cycles.

## How do I prepare the building for re-occupancy?

- The best immediate action is to flush the entire building, including all water-using appliances like ice machines and dishwashers. Flushing clears out the low quality water that accumulated during low use and replaces it with high quality water from the municipal supply. The fresh water will help mitigate the problems (loss of protective scale and biofilm growth) that emerged while the water was stagnant. If staff are available to flush, start now. Starting flushing now means less deterioration of water quality in the building and a sooner recovery to normal conditions.
- Inspect mechanical equipment such as cooling towers, boilers, pumps, backflow preventers, etc., and determine if there are any issues regarding their function.
- Other actions you could take are:
  - Clean showerheads, faucets and other fixtures that can produce aerosols that people could inhale,
  - Develop a water safety plan, a long-term plan for keeping water quality high and protecting building occupants and visitors, and
  - Collect water samples for analysis at a qualified laboratory (only recommended for buildings with specific at-risk populations like children in childcare and elderly people).
- Disinfecting buildings water systems with concentrated chlorine should be considered when there is a strong reason to believe the building is contaminated with pathogens like *Legionella pneumophila*, the bacterium that causes Legionnaires' disease, and/or the people who use the building are particularly susceptible to infections like Legionnaires' disease. Disinfectants (chlorine) are dangerous to handle and can cause serious damage to plumbing system components if used improperly. In most cases, flushing buildings with water that has normal amounts of chlorine (the chlorine already in the building water supply) is sufficient for cleaning the water system.

## How do I flush a residence or small building?

The American Water Works Association (AWWA) posted recommendations for returning homes to service (as of April, 3, 2020). Those recommendations are found at https://www.awwa.org/Resources-Tools/Resource-Topics/Coronavirus#10681543-shutoffs-and-return-to-service-guidance. This information is reproduced below.

"Note that many homes have maintained service or even increased water use as we stay and work at home and do not need to be flushed.

- When homes are returned to service after an extended period of discontinued service (e.g., weeks or months), an adult should be present in the home to ensure that the meter works, leaks are minimized, wastewater piping is intact, and the building's plumbing is flushed. A thorough flushing process is appropriate in such situations.

Note: Social distancing protocols will need to be considered when engaging residents about customer assistance programs, managing lead, and other steps in returning service to the home.

Flushing instructions provided to occupants will vary depending on the structure. This is an area of active research. However, key elements of existing protocols include:

1. Remove or bypass devices like point-of-entry treatment units prior to flushing.
2. Take steps to prevent backflow or the siphoning of contaminants back into plumbing (e.g., close valves separating irrigation systems from home plumbing, disconnect hoses attached to faucets, etc.).
3. Organize flushing to maximize the flow of water (e.g. opening all outlets simultaneously to flush the service line and then flushing outlets individually starting near where the water enters the structure).
4. Run enough water through all outlets (e.g., hose bibs, faucets, showerheads, toilets, etc.), removing aerators when possible. Typical durations in existing protocols range from 10 to 30 minutes for each outlet (duration varies based on outlet velocity).
5. Flush the cold water lines first, and then the hot water lines. Note: the hot water tank can be drained directly; it can require roughly 45 minutes to fully flush a typical 40-gallon hot water tank.
6. Replace all point-of-use filters, including the filter in refrigerators.
7. Additional precautions may be warranted if there is excessive disruption of pipe scale or if there are concerns about biofilm development. Actions that might be warranted include continued use of bottled water, installation of a point-of-use device, or engaging a contractor to thoroughly clean the plumbing system.

Residents should be reminded that if point-of-use devices are installed, POU devices should be properly installed and adequately maintained."

## How do I flush a larger building?

Based on the experience of AH and ESPRI, a single flush cannot bring the building water system back to normal operation and re-establish good water quality. Flushing requires an initial flush to get out low quality water and contaminants and then follow-up flushes that may bring the building back to pre-COVID water quality. Ongoing flushing draws particles through and out of the system and brings in disinfectant from the municipal system that can help control biological growth. The longer service is interrupted, the more the required level of effort for restoration.

Experience in flushing and maintaining buildings has shown that there are some general principles for an effective flushing strategy. In general,

- Flushing should proceed uni-directionally, that is from the service entrance to the periphery of the plumbing system (distal points).
- Some buildings have water treatment systems like filters and water softeners at the building water supply. Those treatment systems were installed for a reason and should not be bypassed. Those treatment systems need to be cleaned, flushed and maintained as part of bringing the building back into use.
- Building water systems have a variety of places where water is stored. At a minimum, they should all be identified, drained, and flushed with clean cold water, after the building cold water service is properly restored. These include, but are not limited to:
  - Hot water storage (some buildings have more than one type of heating system and hot water storage),
  - Hot water recirculating loop(s),



- Humidifiers,
- Ice machines,
- Dishwashers,
- Cooling towers, and
- Ultrapure water storage (membrane filtration).

Before flushing, sketch out the building water system to the best of your ability and identify:

- the water supply,
- zones or branches with a common water supply (e.g., a branch to a wing of a building or a set of branches served by the same riser),
- the faucet nearest the starting point of the zone and the most distant faucet or use for each zone,
- water heaters and recirculating heated water loops, and
- appliances and water-using features (e.g., hot tubs).

Parts of the water system that are most important to flush because they have the greatest opportunity to make people sick include:

- faucets used for drinking water or food preparation,
- drinking fountains,
- ice machines and refrigerators with ice makers,
- showers,
- kitchen sink sprayers,
- water features that generate aerosols (fountains, spas, etc.),
- parts of the water system that are used by children, and
- components of the water system used by elderly people and susceptible people.

However, it is also important to identify and flush as many other water outlets as possible - utility sinks, hose taps, piping in place to serve any future installations, removed water taps - to remove contamination in the piping.

**Initial flushing and cleaning**. The initial flush clears out contaminants that accumulated during stagnation and draws in fresh, high-quality water to the piping. Cleaning of fixtures removes contaminants from the complex internal structures at the point of discharge. Complete the initial flushing and cleaning steps before resuming normal building operation:

- Clean fixtures.
  - Clean showerheads.
  - Replace/maintain point of use filters.
- Flush zone-by-zone. Zones are branches of the building water system with a common source or parts of the building water system served by a common riser.
- The first zone to flush is the one nearest the building supply. Flush zones progressively outward from the supply.
- In each zone, flush the cold water plumbing first and hot water second.



- Begin flushing at the point of use (POU) nearest to the origin of the zone. Aerators and other flow restrictors are removed at the POU nearest the beginning of the zone and the tap is opened wide.
- Open other taps on the same branch, moving from the faucet nearest the origin to the most distant POU tap. Continue flushing until the final POU tap is flushed for at least 5 minutes AND the cold water temperature at the final POU tap is steady.

Drain hot water tanks on the first flush after resumption of flow. If draining is not possible, hot water flushing time depends upon the size of water heater tank. Maintain the water heater temperature. DO NOT turn the heater off as water temperature is critical to prevent microorganisms from growing in the heater and being disseminated in aerosols.

**Ongoing flushes.** Ongoing flushing can repair destabilized scale and control biofilms. Re-stabilizing scale and controlling biofilms is an ongoing process. In the best case, ongoing flushing is conducted for about 12 weeks – the duration needed for protective scale to re-stabilize and for lead borne on particles to be thoroughly washed from the plumbing system. This is the duration recommended in an industry standard (AWWA) on flushing related to lead. In some cases, longer flushing duration might be required. Monitoring for problematic organisms like *Legionella pneumophila*, the bacterium the causes Legionnaires' disease, for lead and for disinfectant are the best ways to assess whether flushing is working and how long it should continue. Even when the building water system has recovered from a lengthy stagnation, flushing is a best practice, is easy and it has proven water quality benefits. Recommendations for ongoing flushing include:

- *Make sure each POU tap is opened at least once per day.* Some POUs are used frequently during normal building operation. Others might be used less frequently and might need to be opened intentionally.
- Flush the full building once per week during ongoing flushing. Full building ongoing flushes proceed the same as the initial flush except water tanks do not need to be drained and hot water flushing times are the same as cold water flushing times. Still flush the cold and hot water systems separately – cold first and hot second.
- During ongoing flushing, it is a good idea to measure the water quality of water coming into the building and at some taps in the building. Many building operators will not have the equipment or the ability to make measurements. ***Even if operators cannot measure water quality, they should still flush the building.***
    - For those who can measure water quality, the most important measurements to make are the concentration of disinfectant (chlorine) in the building supply and the concentration of disinfectant in the cold water of the most distant tap of each zone after that tap is fully flushed. By comparing the disinfectant in the distant taps to the disinfectant in the building supply, you can tell whether the disinfectant is protecting the whole plumbing system. There is no benefit to measuring the disinfectant in the hot water system. At elevated temperature, disinfectant dissipates.
    - There are many other water quality measurements you can make. We do not recommend making those measurements, other than for chlorine, unless there is a compelling reason and unless you can understand what the results mean and what to do about them.



**Long-Term Risk Management: Implement a Water Management Plan (WMP)**

- To maintain high quality water in a building at all times, building owners and operators should implement a WMP that follows industry recommendations, such as ASHRAE 188 (2018) or similar to continually reduce the risk of infections due to water quality degradation.



# Appendix D

## CNIC Flushing of Water Systems Message – 30 April 2020

-----Original Message-----

From: [redacted]

Sent: Thursday, April 30, 2020 3:50 PM

To: CNIC N4 Region Engineers <CNIC.N4.Region.Engineers@navy.mil>; CNIC N4 Assistant Region Engineers <CNIC.N4.Assistant.Region.Engineers@navy.mil>

Cc: [redacted]

Subject: Flushing of Water Systems

Region Engineers,

It is our understanding that some building activities that may have been dormant for 30+ days during lock downs may be opening soon based on local Installation leadership decisions. NAVFAC will be publishing some "facility reset" guidelines very soon, but I wanted to release the below immediately so that you have it and can consider at the PWD level so that human health and safety of our drinking water systems is maintained in concert with the Navy Medical health professionals.

Drinking water is treated with chemicals to maintain water quality for a certain period of time with expected normal customer usage. Degradation of water quality in our water systems due to low and no usage as a result of the social distancing telework orders and building closures (like gyms or bowling alleys) is a reality. To prepare for the return to work, flushing of the drinking water systems to pre-stagnation conditions is recommended by the drinking water risk management and health specialists at Navy Marine Corps Public Health Center (NMCPHC). Flushing replaces stagnant water with fresh water to mitigate issues like loss of protective scale and biofilm growth that emerge when water is stagnant. Each Navy drinking water system should implement a multi-step flushing program for both the utility lines and each facility water system prior to reoccupation. This is not applicable for part of the installation system or buildings that have been fully utilized during the COVID-19 response (PPV housing, Navy housing including UH, Hangars, Shipyard shops, NGIS, etc).

When your PWDs determine that sections of the drinking water system have been dormant or vastly lower than normal flow, flushing mains should follow existing unidirectional flushing plans. As when performing unidirectional flushing if any part of your installation is occupied you will need to notify customers as flushing will dislodge debris and can produce discolored water. Once you have determined the mains contains fresh water containing disinfectant (chlorine), flushing individual buildings can commence. Flushing the buildings in a systematic way, starting at the building lateral/meter and flush outward to the furthest outlets in the building, including all water using appliances (ice machines, dishwashers, hot water heaters, etc.). Clean and disinfect faucet aerators any shower heads that can collect any debris removed/dislodged by flushing. Flushing should include a minimum of three volumes of the plumbing capacity to ensure debris (scale/biofilm) removal. Flushing activity should precede building occupancy by no more than 72 hours as the disinfectant (chlorine) will naturally dissipate from drinking water after a few days. Obviously building flushing will need to be done with the help of tenant command personnel to be done effectively.

Chlorine residual can be monitored with portable test kits typically used by the drinking water, wastewater, and stormwater staff for process/compliance monitoring. Depending on the kits used by your installations, additional supplies may be required to conduct monitoring on this scale as it is above and beyond the typical monitoring requirement. Example the Hach pocket colorimeter requires reagent pouches to conduct the test. We are not recommending that any sampling sent to a certified laboratory be conducted for the building flushing events unless already required by the approved compliance sampling plans.

NMCPHC has also published guidance for building water quality at https://www.med.navy.mil/sites/nmcphc/Documents/program-and-policy-support/COVID-2019/FINAL_Coronavirus-Building-Flushing-Guidance-20200403-rev-1.pdf

Thanks for your attention to this guidance, and be looking for NAVFAC's message on this and other topics soon.

[redacted]

[redacted]

Director for Facilities and Environmental

Commander Navy Installations Command

[redacted]

W: 202-433-4353

[redacted]

# Appendix E

## NAVFACENGOM Technical Advisory 20-03 for Reactivation of Shore Facilities and Vehicles Message - May 2020

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INFO CNO WASHINGTON DC//N3/N4/N8//
SUBJ/TECHNICAL ADVISORY 20-03 FOR REACTIVATION OF SHORE FACILITIES AND VEHICLES
FOLLOWING COVID-19 CONDITIONS//
REF/A/DOC/NAVFAC/27APR20//
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NARR/REF A IS NAVFAC LETTER SER PW/159 ON COVID-19 PUBLIC WORKS CERTIFICATION
AND LICENSE IMPACTS. REF B IS OSHA STANDARD FOR THE CONTROL OF HAZARDOUS ENERGY
(LOCKOUT/TAGOUT), TITLE 29 CODE OF FEDERAL REGULATIONS PART 1910.147. REF C IS
ALNAV 049/20 ON MODIFICATION TO ALNAV 044/20 REISSUANCE OF DEPARTMENT OF THE NAVY TRAVEL RESTRICTIONS IN RESPONSE TO CORONAVIRUS DISEASE 2019. REF D IS CDC GUIDANCE FOR REOPENING BUILDINGS AFTER PROLONGED SHUTDOWN OR REDUCED OPERATION,
HTTPS://WWW.CDC.GOV/CORONAVIRUS/2019-NCOV/PHP/BUILDING-WATER-SYSTEM.HTML,
HTTPS://WWW.CDC.GOV/CORONAVIRUS/2019-NCOV/PHP/BUILDING-WATER-SYSTEM.HTML. REF E IS NMCPHC GUIDANCE ON BUILDING WATER QUALITY, HTTPS://WWW.MED.NAVY.MIL/SITES/NMCPHC/DOCUMENTS/PROGRAM-AND-POLICY-SUPPORT/COVID-2019/FINAL_CORONAVIRUS-BUILDING-FLUSHING-GUIDANCE-20200403-REV-1.PDF. REF F IS DOD UFC 3-230-02, OPERATION AND MAINTENANCE: WATER SUPPLY SYSTEM. REF G IS NAVMED P-5010: CHAPTER 5 WATER SUPPLY ASHORE. REF H IS ANSI/ASHRAE STD 188-2018, LEGIONELLOSIS: RISK MANAGEMENT FOR BUILDING WATER SYSTEMS. REF I IS DOD UFC 3-810-01N, NAVY AND MARINE CORPS ENVIRONMENTAL ENGINEERING FOR FACILITY CONSTRUCTION. REF J IS NAVFAC PWBL LETTER SER PW/157 ON GUIDELINES FOR HVAC OPERATIONS AND MAINTENANCE FOR COVID-19. REF K IS DOD UFC 3-430-07, OPERATIONS AND MAINTENANCE: INSPECTIONS AND CERTIFICATION OF BOILERS AND UNFIRED PRESSURE VESSELS. REF L IS CDC ENVIRONMENTAL CLEANING AND DISINFECTION RECOMMENDATIONS, INTERIM RECOMMENDATIONS FOR US COMMUNITY FACILITIES WITH SUSPECTED/CONFIRMED CORONAVIRUS DISEASE 2019,
HTTPS://WWW.CDC.GOV/CORONAVIRUS/2019-NCOV/COMMUNITY

/ORGANIZATIONS/CLEANING-DISINFECTION.HTML. REF M IS NAVMED/COVID-19: GENERAL GUIDANCE FOR CLEANING AND DISINFECTING FOR NON-HEALTHCARE SETTINGS. REF N IS NAVFAC LETTER ON COVID-19 AND FSC CONTRACTS. REF O IS NAVFAC LETTER SER PW/158 OF GUIDELINES FOR TRANSPORTATION OPERATIONS FOR COVID-19.//
POC/D. CURFMAN/CIV/UNIT: NAVFAC CHENG/WNYD BLDG 33/TEL: (202) 685-9230/EMAIL: DAVID.CURFMAN@NAVY.MIL//
GENTEXT/REMARKS/AS IMPACTS FROM THE COVID-19 PANDEMIC RECEDE AND STAY-AT HOME RESTRICTIONS ARE LIFTED, NAVAL INSTALLATIONS WILL BEGIN TO BRING WORKERS BACK AND RESUME OPERATIONS IN THEIR FACILITIES. CONCURRENTLY, THE PHYSICAL CONDITION AND OPERATIONS OF BUILDING SYSTEMS MAY REQUIRE INSPECTION AND SYSTEM ADJUSTMENTS DUE TO ISSUES CAUSED BY EXTENDED VACANCY. REQUEST DISSEMINATION OF THIS ADVISORY TO ALL SUBORDINATE COMMANDS, TENANTS, AND THEIR BUILDING MANAGERS TO ENSURE AWARENESS OF REQUIRED ACTIONS.
1. PURPOSE. THIS TECHNICAL ADVISORY PROVIDES GUIDANCE FOR REACTIVATION OF DORMANT OR LOW-USE FACILITIES AND TRANSPORTATION ASSETS IN ORDER TO MITIGATE THE SPREAD OF INFECTION AND ENSURE PROPER AND SAFE RETURN TO SERVICE.
THESE GUIDELINES ARE NOT INTENDED TO REPLACE SPECIFIC GUIDANCE THAT EXISTS FROM OTHER GOVERNING FEDERAL, STATE, OR LOCAL AGENCIES. BUILDING TENANTS ARE RESPONSIBLE FOR ASSESSING THEIR FACILITIES, PERFORMING BASIC USER MAINTENANCE AND CLEANING, AND REPORTING OUT-OF-NORM CONDITIONS. IF A BUILDING WAS LIGHTLY USED (10% OR GREATER OF THE NORMAL POPULATION WAS PRESENT) THEN LITTLE WORK IS NEEDED FOR REACTIVATION. IF THE BUILDING WAS COMPLETELY ABANDONED, E.G. HVAC WAS OFF, ELEVATORS WERE NOT OPERATED, NO TOILETS FLUSHED, OR AVERAGE WATER USAGE WAS LESS THAN 50%, A MORE CAREFUL STARTUP IS NEEDED.
2. INSPECTIONS, CERTIFICATIONS, AND LICENSES.
2.A. EACH SITE THAT EXTENDED INSPECTIONS, CERTIFICATIONS AND LICENSES BASED ON REF (A) SHALL PERFORM AN ASSESSMENT OF ACTIONS REQUIRED TO ELIMINATE BACKLOGGED OR LAPSED INSPECTIONS, CERTIFICATIONS AND LICENSES. FORWARD A PRIORITIZED PLAN TO RETURN ALL ITEMS TO CURRENT CERTIFICATIONS TO NAVFAC ATLANTIC OR PACIFIC BASED ON AOR FOR VISIBILITY AND TRACKING. EXCEPTIONS SHALL BE MAINTAINED IN THE APPROPRIATE EQUIPMENT OR PERSONNEL HISTORY FILE UNTIL SUCH TIME THAT NORMAL PERIODICITY IS REGAINED, BUT NO LESS THAN 2 YEARS.
2.B. ANY EQUIPMENT NOT CERTIFIED FOLLOWING THE EXTENSIONS GRANTED BY REF (A) MUST BE LOCKED-OUT (LO) AND TAGGED OUT (TO) UNTIL CERTIFICATION OCCURS PER REF (B).
2.C. INSPECTIONS AND CERTIFICATIONS REQUIRING TRAVEL ARE GOVERNED BY REF (C) AND CONSIDERED MISSION ESSENTIAL. APPROVAL BY A FLAG OR SES OFFICIAL IN THE TRAVELERS CHAIN OF COMMAND IS REQUIRED.
3. DRINKING WATER SYSTEM FLUSHING GUIDANCE.
3.A. AS OF DATE OF THIS TECHNICAL ADVISORY, THE MAJORITY OF WATER SYSTEMS HAVE REMAINED IN USE, WITH SOME POPULATION PRESENT, TESTING CONTINUED, OR AUTOFLUSHERS OPERATIONAL. FOR FACILITIES THAT WERE LAID UP (TEMPORARILY SECURED) OR THOSE SITUATED AT THE END OF A LONG WATER LINE RUN, ADDITIONAL ATTENTION IS MERITED. IT IS IMPERATIVE THAT NAVY WATER SYSTEMS MAINTAIN COMPLIANCE WITH DRINKING WATER QUALITY STANDARDS. DEGRADATION OF WATER QUALITY IS POSSIBLE DUE TO LOW OR NO USAGE AS A RESULT OF REMOTE WORK. FLUSHING OF THE DRINKING WATER SYSTEMS TO PRE-STAGNATION CONDITIONS IS RECOMMENDED FOR SYSTEMS WHICH HAVE SEEN SIGNIFICANT REDUCTION IN USAGE OR LOW RESIDUAL CHLORINE

SAMPLING RESULTS (WHERE SAMPLING IS ROUTINELY BEING PERFORMED). FLUSHING REPLACES STAGNANT WATER WITH FRESH WATER TO MITIGATE ISSUES LIKE BIOFILM GROWTH, LOSS OF CHLORINE RESIDUAL, POTENTIAL ELEVATION OF LEAD AND COPPER LEVELS, AND FORMATION OF DISINFECTION BYPRODUCTS THAT EMERGE WHEN WATER IS STAGNANT. AS INDICATED IN REF (D) THROUGH REF (G), FLUSH WATER SYSTEMS, VERIFY WATER HEATER MAINTENANCE IS UP TO DATE CHECK WATER HEATER SETPOINTS AT 140F, AND CLEAN AND REMOVE SLIME FROM DRINKING FOUNTAINS, COOLING TOWERS AND BASINS, ICE MACHINES, AND DISHWASHERS TO MINIMIZE LEGIONELLOIS RISK. IN ANY FACILITY THAT HAS BEEN SHUT DOWN WITH THE HVAC SYSTEM TURNED OFF, THE POTABLE WATER SYSTEM MUST BE TURNED OFF AT THE SERVICE ENTRANCE AND DRAINED.

3.B. EACH AFFECTED NAVY DRINKING WATER SYSTEM SHOULD IMPLEMENT A MULTI-STEP FLUSHING PROGRAM FOR THE UTILITY LINES AND EACH DORMANT FACILITY DURING THE COVID-19 OUTBREAK. TO REDUCE THE AMOUNT OF UNNECESSARY FLUSHING, IMPLEMENT TARGETED FLUSHING FOR LARGER WATER SYSTEMS WHICH MAY HAVE HAD CONTINUING OPERATIONS FOR LARGE PORTIONS OF THE INSTALLATION. IN THIS SITUATION, IT MAY BE MORE EFFECTIVE TO FLUSH PORTIONS OF THE UTILITY MAIN SERVING VACATED FACILITIES, OR AS NECESSARY (BASED ON CHLORINE RESIDUAL SAMPLING RESULTS) RATHER THAN FLUSHING THE ENTIRE UTILITY SYSTEM.

3.C. CLOSED OR LIMITED ACCESS BUILDINGS CAN LEAD TO REDUCED WATER FLOWS THAT MAY RESULT IN THE RISK OF BACTERIAL GROWTH IN PLUMBING SYSTEMS AND ASSOCIATED EQUIPMENT. IMPLEMENT THE MULTI-STEP FLUSHING MANAGEMENT PLAN WITH CHLORINE SAMPLING, VERIFY HOT WATER HEATERS SET POINTS ARE AT 140F, CLEAN AND REMOVE ANY SLIME FROM DRINKING FOUNTAINS, COOLING TOWERS AND BASINS, ICE MACHINES, AND DISHWASHERS TO MINIMIZE LEGIONELLOSIS PER REF (D) AND REF (H).

3.D. FOR SMALLER SYSTEMS , CONSIDER THE FOLLOWING METHODOLOGY FOR FULL-SYSTEM FLUSHING:

3.D.1. FIRST FLUSH THE WATER MAINS THROUGHOUT THE INSTALLATION. UTILITY DEPARTMENTS SHOULD HAVE A UNIDIRECTIONAL FLUSHING PLAN THEY IMPLEMENT TWICE A YEAR TO SCOUR DEBRIS FROM THE WATER SYSTEM.

3.D.2. FLUSHING MUST BEGIN AT THE POINT OF ENTRY OF THE WATER SYSTEM, EITHER AT THE PLANT THAT PRODUCES THE INSTALLATIONS WATER OR THE CONNECTION TO THE LOCAL UTILITY.

3.D.3. FOLLOWING THE UNIDIRECTIONAL FLUSHING PLAN, THE FLUSHING SHOULD RADIATE OUT FROM THE POINT OF ENTRY TO THE FURTHEST POINT OF THE DISTRIBUTION SYSTEM.

3.D.4. THE UTILITY FLUSHING EVENT MUST BE SCHEDULED SO THAT INDIVIDUAL BUILDINGS MAY BEGIN THEIR FLUSHING EXERCISE WITH FRESH WATER AFTER THE WATER MAINS HAVE BEEN FLUSHED.

3.D.5. IF THERE IS OCCUPIED HOUSING ON THE INSTALLATION, NOTIFICATION OF THE FLUSHING ACTIVITIES NEED TO BE PROVIDED AS THE FLUSHING EXERCISE WILL DISLODGE DEBRIS WHICH CAN APPEAR IN THEIR DAILY USAGE.

3.D.6. THERE IS NO REQUIREMENT TO CONDUCT ADDITIONAL WATER QUALITY SAMPLING FOR COMPLIANCE WHILE CONDUCTING THE FLUSHING EXERCISE, HOWEVER ALL LINES SHOULD BE FLUSHED UNTIL A DETECTABLE CHLORINE RESIDUAL IS OBSERVED. NORMAL DRINKING WATER COMPLIANCE MONITORING IS CONTINUING. WHILE SOME STATES ARE ALSO DEVELOPING COVID-19 GUIDANCE THAT INCLUDES TESTING FOR LEGIONELLA, NAVY INSTALLATIONS NEED NOT PERFORM ADDITIONAL SAMPLING.

3.D.7. FACILITY AND BUILDING FLUSHING MUST NOT OCCUR UNTIL THE MAIN WATER

DISTRIBUTION LINES HAVE BEEN FLUSHED. COORDINATE BUILDING FLUSHING ACTIONS WITH UTILITY FLUSHING ACTIONS.
3.D.8. UPON COMPLETION OF ANY NECESSARY UTILITY FLUSHING, FLUSH THE BUILDING SYSTEMATICALLY, STARTING AT THE BUILDING LATERAL/METER WHERE CONNECTED TO THE WATER MAINS AND FLUSH OUTWARD TO THE FURTHEST OUTLETS IN THE BUILDING, INCLUDING FLUSHING, CLEANING, AND REMOVAL OF ANY SLIME FROM ALL WATER USING APPLIANCES (ICE MACHINES, DISHWASHERS, HOT WATER HEATERS, ETC).
3.D.9. INSPECT MECHANICAL EQUIPMENT CONNECTED TO THE WATER SUPPLY SUCH AS COOLING TOWERS, BOILERS, BACKFLOW PREVENTERS, ETC. TO DETERMINE IF THERE ARE ANY ISSUES REGARDING FUNCTION FROM PROLONGED IDLENESS.
3.D.10. CLEAN, FLUSH, AND REMOVE ANY SLIME FROM EYEWASH STATIONS, SAFETY SHOWERS, FAUCET AERATORS AND SHOWER HEADS THAT COLLECT ANY DEBRIS DISLODGED BY FLUSHING.
3.D.11. REPEAT FACILITY FLUSHING TO REDUCE STAGNATION. USE KNOWLEDGE OF THE SYSTEM TO REPEAT FLUSHING AS APPROPRIATE. IF POSSIBLE, FLUSH SYSTEM MONTHLY UNTIL FACILITY OPERATIONS RETURN TO PRE-COVID OPERATIONAL CONDITIONS.
3.D.12. ONLY DESIGNATED PERSONNEL WITH THE KNOWLEDGE OF THE INSTALLATIONS WATER SYSTEM SHOULD PERFORM A FLUSHING PLAN TO AVOID WATER HAMMER CONDITIONS, AND ENSURE SYSTEM PRESSURE DOES NOT DROP BELOW 20 PSI. BACKFLOW CONDITIONS CAN OCCUR IF THE SYSTEM EXPERIENCES LOW PRESSURE.
3.E. PRIOR TO BUILDING START UP AND BRINGING A BUILDING TO FULL OPERATION, UTLIZE THE 5 STEPS OF REF (D) TO MINIMZE MOLD RISK AND TO PERFORM AN INSPECTION FOR MOLD. SHOULD MOLD BE FOUND, PROVIDE A MOLD RESPONSE PER REF (I), AND COORDINATE WITH THE COGNIZANT INDUSTRIAL HYGIENIST.
4. BUILDING ELECTRICAL AND MECHANICAL SYSTEMS.
4.A. WHEN A SYSTEM HAS BEEN INACTIVE FOR AN EXTENDED PERIOD OF TIME (E.G. GREATER THAN 30 DAYS), PRIOR TO BUILDING START-UP, PERFORM HVAC MAINTENANCE AND FILTER CHANGE. RUN HVAC EQUIPMENT FOR A MINIMUM OF 24 HOURS PRIOR TO RE -OCCUPANCY. THIS WOULD INCLUDE PERFORMING CHECKS ON BOILERS, PRESSURE VESSELS, AND HOT WATER GENERATORS BY THE BOILER INSPECTOR. PROVIDE FLUSHING OF FACILITIES BEFORE AND POST OCCUPANCIES. REF (J).
4.B. DEPENDING ON THE NUMBER OF INACTIVE SYSTEMS, A METHODICAL ELECTRICAL POWER AND MECHANICAL SYSTEM START-UP SHOULD BE PERFORMED TO PREVENT LOAD SHED FROM SIMULTANEOUSLY STARTING MULTIPLE SYSTEMS.
4.C. IF BOILERS & UNFIRED PRESSURE VESSELS WERE DEENERGIZED, START UP MUST BE COORDINATED WITH THE PWD POC BEFORE REENERGIZING THE EQUIPMENT AND START OPERATIONS.
4.C.1. NOTIFY THE BOILER INSPECTOR OF ANY BOILER, PRESSURE VESSEL, HOT WATER GENERATOR, AND HEAT EXCHANGER SHUT-DOWN WITH LOCK OUT AND TAG OUT. THE PURPOSE OF THE NOTIFICATION IS TO HELP THE BOILER INSPECTOR PLAN FOR START-UP SERVICES. PRIOR TO THE RESUMPTION OF ACTIVE SERVICE OF BOILERS, HOT WATER GENERATORS, PRESSURE VESSELS, AND HEAT EXCHANGERS, NOTIFY THE BOILER INSPECTOR OF UPCOMING START-UP SO THEY CAN PROVIDE ANY REQUIRED INTERNAL AND EXTERNAL INSPECTION, START-UP, TESTING, AND CERTIFICATION SERVICES REF (K).
4.C.2. BOILER INITIAL START UP (IF DEENERGIZED) BEFORE PUTTING IN SERVICE SHALL INCLUDE THE FOLLOWING:
4.C.2.(1) PERFORM BOILER AND COMBUSTION CONTROL SAFETY DEVICE TESTING.
4.C.2.(2) ENSURE BOILER IS CERTIFIED FOR OPERATION IN ACCORDANCE WITH REF (K).

DISTRIBUTION LINES HAVE BEEN FLUSHED. COORDINATE BUILDING FLUSHING ACTIONS WITH UTILITY FLUSHING ACTIONS.
3.D.8. UPON COMPLETION OF ANY NECESSARY UTILITY FLUSHING, FLUSH THE BUILDING SYSTEMATICALLY, STARTING AT THE BUILDING LATERAL/METER WHERE CONNECTED TO THE WATER MAINS AND FLUSH OUTWARD TO THE FURTHEST OUTLETS IN THE BUILDING, INCLUDING FLUSHING, CLEANING, AND REMOVAL OF ANY SLIME FROM ALL WATER USING APPLIANCES (ICE MACHINES, DISHWASHERS, HOT WATER HEATERS, ETC).
3.D.9. INSPECT MECHANICAL EQUIPMENT CONNECTED TO THE WATER SUPPLY SUCH AS COOLING TOWERS, BOILERS, BACKFLOW PREVENTERS, ETC. TO DETERMINE IF THERE ARE ANY ISSUES REGARDING FUNCTION FROM PROLONGED IDLENESS.
3.D.10. CLEAN, FLUSH, AND REMOVE ANY SLIME FROM EYEWASH STATIONS, SAFETY SHOWERS, FAUCET AERATORS AND SHOWER HEADS THAT COLLECT ANY DEBRIS DISLODGED BY FLUSHING.
3.D.11. REPEAT FACILITY FLUSHING TO REDUCE STAGNATION. USE KNOWLEDGE OF THE SYSTEM TO REPEAT FLUSHING AS APPROPRIATE. IF POSSIBLE, FLUSH SYSTEM MONTHLY UNTIL FACILITY OPERATIONS RETURN TO PRE-COVID OPERATIONAL CONDITIONS.
3.D.12. ONLY DESIGNATED PERSONNEL WITH THE KNOWLEDGE OF THE INSTALLATIONS WATER SYSTEM SHOULD PERFORM A FLUSHING PLAN TO AVOID WATER HAMMER CONDITIONS, AND ENSURE SYSTEM PRESSURE DOES NOT DROP BELOW 20 PSI. BACKFLOW CONDITIONS CAN OCCUR IF THE SYSTEM EXPERIENCES LOW PRESSURE.
3.E. PRIOR TO BUILDING START UP AND BRINGING A BUILDING TO FULL OPERATION, UTLIZE THE 5 STEPS OF REF (D) TO MINIMZE MOLD RISK AND TO PERFORM AN INSPECTION FOR MOLD. SHOULD MOLD BE FOUND, PROVIDE A MOLD RESPONSE PER REF (I), AND COORDINATE WITH THE COGNIZANT INDUSTRIAL HYGIENIST.
4. BUILDING ELECTRICAL AND MECHANICAL SYSTEMS.
4.A. WHEN A SYSTEM HAS BEEN INACTIVE FOR AN EXTENDED PERIOD OF TIME (E.G. GREATER THAN 30 DAYS), PRIOR TO BUILDING START-UP, PERFORM HVAC MAINTENANCE AND FILTER CHANGE. RUN HVAC EQUIPMENT FOR A MINIMUM OF 24 HOURS PRIOR TO RE -OCCUPANCY. THIS WOULD INCLUDE PERFORMING CHECKS ON BOILERS, PRESSURE VESSELS, AND HOT WATER GENERATORS BY THE BOILER INSPECTOR. PROVIDE FLUSHING OF FACILITIES BEFORE AND POST OCCUPANCIES. REF (J).
4.B. DEPENDING ON THE NUMBER OF INACTIVE SYSTEMS, A METHODICAL ELECTRICAL POWER AND MECHANICAL SYSTEM START-UP SHOULD BE PERFORMED TO PREVENT LOAD SHED FROM SIMULTANEOUSLY STARTING MULTIPLE SYSTEMS.
4.C. IF BOILERS & UNFIRED PRESSURE VESSELS WERE DEENERGIZED, START UP MUST BE COORDINATED WITH THE PWD POC BEFORE REENERGIZING THE EQUIPMENT AND START OPERATIONS.
4.C.1. NOTIFY THE BOILER INSPECTOR OF ANY BOILER, PRESSURE VESSEL, HOT WATER GENERATOR, AND HEAT EXCHANGER SHUT-DOWN WITH LOCK OUT AND TAG OUT. THE PURPOSE OF THE NOTIFICATION IS TO HELP THE BOILER INSPECTOR PLAN FOR START-UP SERVICES. PRIOR TO THE RESUMPTION OF ACTIVE SERVICE OF BOILERS, HOT WATER GENERATORS, PRESSURE VESSELS, AND HEAT EXCHANGERS, NOTIFY THE BOILER INSPECTOR OF UPCOMING START-UP SO THEY CAN PROVIDE ANY REQUIRED INTERNAL AND EXTERNAL INSPECTION, START-UP, TESTING, AND CERTIFICATION SERVICES REF (K).
4.C.2. BOILER INITIAL START UP (IF DEENERGIZED) BEFORE PUTTING IN SERVICE SHALL INCLUDE THE FOLLOWING:
4.C.2.(1) PERFORM BOILER AND COMBUSTION CONTROL SAFETY DEVICE TESTING.
4.C.2.(2) ENSURE BOILER IS CERTIFIED FOR OPERATION IN ACCORDANCE WITH REF (K).

SPECIFICATION IN REF (N). 6.E. PWDS SHOULD RESCHEDULE DEFERRED INSPECTIONS, TESTS, CERTIFICATIONS, AND RECURRING MAINTENANCE AS SOON AS POSSIBLE, USING A RISK BASED APPROACH TO WHAT SHOULD BE ACCOMPLISHED FIRST.
6.F. INCREASED BUILDING JANITORIAL SERVICES AND EXPIRED MATERIAL DISCARD IS EXPECTED TO TEMPORARILY INCREASE WASTE GENERATION ABOVE NORMAL VOLUMES AS BUILDINGS ARE REOCCUPIED. BUILDING OCCUPANTS MUST CHARACTERIZE THE CLEANING WASTE AND EXPIRED MATERIALS AS A SOLID OR A HAZARDOUS WASTE UPON REOCCUPANCY AND PROPERLY DISPOSE OF THE WASTE IN ACCORDANCE WITH EXISTING DISPOSAL PRACTICES. THE LOCAL PWD OR FEC ENVIRONMENTAL BUSINESS LINE CAN PROVIDE GUIDANCE ON CHARACTERIZATION AND MANAGEMENT OF A PARTICULAR WASTE STREAM.
7. TRANSPORTATION.
7.A. EACH SITE NEEDS TO COMPLETE AN ASSESSMENT OF BACKLOGGED VEHICLES/EQUIPMENT TO INCLUDE WEIGHT HANDLING AND AERIAL WORK PLATFORM MAINTENANCE AND CERTIFICATION STATUS. IDENTIFY PERSONNEL LICENSES STATUS, AND ASSETS WHICH WILL NEED TO BE EXTENDED BASED ON CURRENT MANNING LEVELS. SITE MANAGERS WILL REPORT TO THE FLEET MANAGERS THE AMOUNT OF TIME NEEDED TO ELIMINATE THE BACKLOG IN THEIR ASSESSMENT. FLEET MANAGERS WILL FORWARD THEIR ASSESSMENT TO NAVFAC ATLANTIC AND NAVFAC PACIFIC, DEPENDING ON AOR, FOR VISIBILITY AND CONCURRENCE. FLEET MANAGERS WILL VALIDATE OR MAKE RECOMMENDATIONS TO ELIMINATE BACKLOGS USING AVAILABLE RESOURCES. REF (O).
7.B. PERFORM PRE-OPERATIONAL CHECKS ON ALL DORMANT VEHICLES AND EQUIPMENT, INCLUDING RAIL, BEFORE STARTING ANY VEHICLE/ASSET. CHECK ALL FLUID LEVELS PRIOR TO STARTING AND INSPECT UNDER THE HOOD FOR NESTING ANIMALS. PERFORM A WALK AROUND INSPECTION CHECKING THE CONDITION OF TIRES AND LOOKING FOR LEAKS. REPORT ANY MAINTENANCE OR OPERATIONAL ISSUES TO A MAINTENANCE SUPERVISOR FOR CORRECTION.
8. BUILDING MANAGERS.
8.A. ALL TENANT COMMANDS SHALL ENSURE THEIR BUILDING MANAGERS ARE PROVIDED WITH THE PROCEDURES AND CONTACT INFORMATION FOR SECURING A SPACE IDENTIFIED AS POTENTIALLY OCCUPIED BY AN EMPLOYEE OR CONTRACTOR WHO TESTED POSITIVE FOR COVID-19.
8.B. FLUSH ALL TOILETS AND RUN WATER IN SINKS AND SHOWERS FOR 30 SECONDS EACH. POUR ONE GALLON OF WATER INTO EACH FLOOR DRAIN.
8.C. CONDUCT A CHECK OF REFRIGERATORS AND COORDINATE WITH VENDORS TO PERFORM A CHECK OF FOOD, BEVERAGE, AND OTHER ITEMS IN VENDING MACHINES. REMOVE AND DISPOSE OF ANY SPOILED AND EXPIRED SHELF-LIFE PRODUCTS.
8.D. PLACE SIGNAGE IN WORKSPACE AND COMMON AREAS PROMOTING SAFETY THROUGH BASIC INFECTION PREVENTION MEASURES, INCLUDING HAND-WASHING.
8.E. CONTACT THE RELEVANT INSTALLATION PUBLIC WORKS DEPARTMENT WITH ANY QUESTIONS.
9. TECHNICAL CONCURRENCE: THE NAVFAC CHIEF ENGINEER AND THE TECHNICAL WARRANT HOLDERS FOR SHORE FACILITIES ENGINEERING, MECHANICAL ENGINEERING, ELECTRICAL ENGINEERING, FIRE PROTECTION ENGINEERING, ENVIRONMENTAL ENGINEERING, WEIGHT HANDLING, VERTICAL TRANSPORTATION EQUIPMENT, BOILERS, VEHICLES, AND UTILITIES SYSTEMS CONCUR WITH THIS ADVISORY. NAVFAC-WIDE TECHNICAL POINTS OF CONTACT FOLLOW.
9.A. POC FOR WATER SYSTEMS: [redacted],
[redacted]

9.B. POC FOR ELEVATORS/VTE: [redacted]
[redacted]
9.C. POC FOR BOILERS AND UNFIRED PRESSURE VESSELS: [redacted]
[redacted]
9.D. POC FOR FACILITY SUPPORT CONTRACTS: [redacted]
[redacted]
9.E. POC FOR TRANSPORTATION: [redacted]
[redacted]
9.F. POC FOR FACILITIES MAINTENANCE: [redacted]
@NAVY.MIL
9.G. POC FOR HVAC: [redacted]
[redacted]
AND
[redacted]
9.H. POC FOR UTILITIES: [redacted]
PATRICK.T.CONNOR@NAVY.MIL
9.I. POC FOR WASTE MANAGEMENT: [redacted]
[redacted]
10. NAVFAC WILL PROMULGATE ADDITIONAL COVID-19 GUIDANCE IN FUTURE TECHNICAL ADVISORIES.
11. MESSAGE RELEASED BY RADM [redacted], COMMANDER, NAVFAC.
BT
#0001
NNNN
<DmdsSecurity>UNCLASSIFIED//</DmdsSecurity>
<DmdsReleaser>[redacted]</DmdsReleaser>

CLASSIFICATION: UNCLASSIFIED//

# Appendix F

# Navy Briefing Card Template for Legionella

Naval Station [Insert Name] Public Affairs
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**Navy Briefing Card**
***Legionella***
***[Insert Installation and Command Name]***
**[Insert Day/Month/Year]**

## Background: (initial statement)

On [date] [Command] received notification that an employee was confirmed with Legionnaires' disease (LD). The employee, who works in [location, Bldg. number] believes they contracted the disease while at work. There are approximately [number] employees located in the same work space and there are {number} of employees located in the Bldg. currently no one else is known to have contracted the disease. At this point, this is an isolated incident and [location, Bldg. number] cannot be confirmed as the source the LD.

Legionnaires' disease (LD) is a common name for the pneumonia caused by *Legionella* bacteria. A person can develop LD by inhaling water mist with *Legionella* bacteria. *Legionella* bacteria are naturally found at low levels in the soil, lakes, ponds, and streams. With low *Legionella* concentrations in a water source, development of Legionnaires' disease is unlikely. The risk of infection increases as *Legionella* concentrations increase in water sources. Water heaters, cooling towers, and warm, stagnant water can provide conditions that promote *Legionella* bacteria growth.

In the U.S., *Legionella* has been regulated as a primary drinking water contaminant by *treatment technique* under the Safe Drinking Water Act's (SDWA) Surface Water Treatment Rule (SWTR, US EPA, 1989). This means *Legionella* is not specifically tested for during routine SDWA compliance testing. The US EPA believed that if *Giardia* cysts and viruses were removed/inactivated, according to the *treatment techniques* in the SWTR, *Legionella* would also be controlled (US EPA, 2009).

[Installation/Command] leadership/NAVFAC/Facilities has been in contact with the Naval Hospital [name] and the Navy and Marine Corps Public Health Center to determine the best way forward in regards to employee notification and addressing any health concerns.

**Navy Briefing Card - UPDATE 1**
***Legionella***
***[Insert Installation and Command Name]***
**[Insert Day/Month/Year]**

On [Insert Day/Month/Year] [Insert Command] received notification that an employee was confirmed with Legionnaires' disease (LD). Although Legionella bacteria are naturally occurring, a person can develop LD by inhaling water mist from a water source when *the* bacteria is found growing in the water source in high concentrations.

On [date] [Installation/Command] Public Works Department began collecting water quality parameters (Chlorine residual, pH, temperatures) throughout the building drinking system to determine if conditions are conducive to the growth of *Legionella*. Because the employee was

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diagnosed at [hospital name] – and LD is a reportable disease, the City of [City] and [Sate] Departments of Health were notified and will be investigating the case. The Epidemiologist in charge said isolated cases are not uncommon.

After consulting with [consulting parties – *NAVFAC, Command Leadership, Naval Hospital/Clinic Staff, Navy and the Marine Corps Public Health Center,* etc.] it was determined the drinking water did not need to be secured. This is because the route of exposure for contracting LD is not through ingestion of drinking water, rather caused by caused when water becomes aerosolized and then breathed into the lungs.

On [date], [commanding officer] notified employees of a possible case of LD, via e-mail and provided a CDC Legionnaires' Disease fact sheet and frequently asked questions (FAQs) information sheet. The e-mail encouraged anyone who develops pneumonia-like symptoms to see their primary care provider and report the condition to their chain of command. Additionally, it provided information on the commands way forward and a POC for those who may have additional concerns.

**Navy Briefing Card - UPDATE 2**
***Legionella***
***[Insert Installation and Command Name]***
**[Insert Day/Month/Year]**

On [Insert Day/Month/Year] [Insert Command] received notification that an employee was confirmed with Legionnaires' disease (LD). Although Legionella bacteria are naturally occurring, a person can develop LD by inhaling water mist from a water source when *the* bacteria is found growing in the water source in high concentrations.

On [date], NAVFAC plumbers and HVAC techs inspected [location] for stagnant or pooling water. No evidence of pooling water was found, or areas where water was or had the potential to aerosolize.

Out of an abundance of caution, on [date] PWD did conduct additional testing of the drinking water system to ensure compliance with the EPA Safe Drinking Water Act standards.

As shared on UPDATE 1on [date], water quality parameter testing was conducted and results did show a conditions that had the potential for bacteria growth. Out of an abundance of caution, on [date] the building water distribution system was tested for *Legionella* bacteria. In addition, to ensure to ensure ongoing mitigation of *Legionella,* a building water management plan is being developed.

According to MTF Public Health, and Navy and Marine Corps Public Health Center, the specific strain of *Legionella* from the employee would be need to be identified for the risk assessors to confirm a potential correlation between any *Legionella* found in the building water distribution system and the *Legionella* from the test (if done) on the employee. Specifically Public Health will need to see the results of a sputum sample (a test for infection in the lungs) if it was taken. This requires the cooperation and permission (sign a HIPAA release) of the employee which will

allow [insert who] to get a copy of the laboratory analysis from the employee or [hospital name] where the employee was diagnosed.

(*Insert who requested release and if employee agreed/disagreed and any other actions taken. If employee agreed insert the following information* :) Once the employee signed the medical release, [insert who] obtained the tests run by the hospital, (*include what their tests concluded – for this template an example is provided see the following sentence*) it was determined that a chest x-ray and urinary antigen test was conducted, but no sputum test was conducted.

Initially, out of an abundance of caution, the drinking water fountain outside the employees' office was secured [date]. After consultation with the Navy public health experts and NAVFAC Region [date], it was determined that was not necessary and the fountain was flushed and turned back on [on date].

(*If employees express health concerns after initial update it is recommended to hold an All Hands to share information to include when it was held and results should be provided see the following example:)* Due to employee concern, on [Insert date] an "All Hands" was held [location]. The Command's CO, [name] briefed more than [insert number] civilians and military members. In addition, the [installation] CO [name], along with [insert any other SME's present, i.e. medical, public works and facilities etc ….] (*Provide additional updates on the investigation and the current actions taken. Employees provided a positive/negative response see after action report attachment* ).

**Navy Briefing Card - UPDATE 3**
***Legionella***
***[Insert Installation and Command Name]***
**[Insert Day/Month/Year]**

On [Insert Day/Month/Year] [Insert Command] received notification that an employee was confirmed with Legionnaires' disease (LD). Although Legionella bacteria are naturally occurring, a person can develop LD by inhaling water mist from a water source when *the* bacteria is found growing in the water source in high concentrations. Out of an abundance of caution, initially, drinking water at [location] was secured. Because LD is caused by aerosolized water, after consultation with experts, it was determined, drinking water did not need to be secured and was turned back on [date].

The additional testing of the drinking water system by PWD on [date] to ensure compliance with the EPA safe drinking water act standards showed that water did meet EPA standards.

However, the water quality parameter testing (Chlorine residual, pH, temperatures), conducted determined there is a potential for bacterial and other opportunistic pathogen growth.

Therefore, on [insert date], out of an abundance of caution, the water distribution system at [location] was tested by PWD for *Legionella* bacteria. The results take approximately 14 days based on the incubation period and analysis. To ensure ongoing risk reduction of exposure to *Legionella*, Installation PWD, in conjunction with the [local MTF/clinic], Navy and Marine

Corps Public Health Center, and NAVFAC [Region], will continue developing a building water management plan (WMP) for [insert location]. The complexity of the plan will depend on the results of the *Legionella* testing.

**Navy Briefing Card - UPDATE 4**
***Legionella***
***[Insert Installation and Command Name]***
**[Insert Day/Month/Year]**

On [Insert Day/Month/Year] [Insert Command] received notification that an employee was confirmed with Legionnaires' disease (LD). Although Legionella bacteria are naturally occurring, a person can develop LD by inhaling water mist from a water source when *the* bacteria is found growing in the water source in high concentrations. Out of an abundance of caution, initially, drinking water at [location] was secured. Because LD is caused by aerosolized water, after consultation with experts, it was determined, drinking water did not need to be secured and was turned back on [date].

On [insert date] [insert who] was notified there is no presence of *Legionella* in the samples that were taken from [location]. Lab analysis reports will be delivered to the Regional NAVFAC Environmental, PWD Utilities and Environmental staff, and the [local MTF/clinic], and Navy and Marine Corps Public Health Center.

Installation PWD plans to incorporate the following building water management practices, within their WMP to ensure key elements (chlorine residual, pH, water temperature, and water flow) of the system are not conducive to *Legionella* or any other pathogen growth. This will be done with regularly scheduled monitoring, testing, and flushing of the system. [Insert items specific to the command/location]

- Implement routine building flushing protocol in areas of low usage to alleviate water stagnation.
- Replace low flow aerators to promote increased water flow in the building plumbing system.
- Monitor chlorine residual to ensure levels achieved at the tap are 0.5mg/L or greater.
- Monitor water temperature and adjust appropriately. Water temperatures between 77 and 122 degrees promote *Legionella* growth. PWD will gradually increase the hot water temperature to above 122 degrees and will notify the tenants to be aware of the potential for scalding.

On [date] staff was notified of the results and mitigation efforts with no additional inquiries [insert if there are ongoing staff concerns].

**End State:** As a result of our communication efforts, [command] employees will be fully informed of the actions being taken by [insert location] to test for and mitigate (if necessary) *Legionella* bacteria. Employees will feel secure that actions taken are prompt and appropriate and ensure their health and safety are a priority.

Naval Station [Insert Name] Public Affairs
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**Public Statement:**

"On [Insert Day/Month/Year] [Insert Command] received notification an employee was diagnosed with Legionnaires' disease (LD), also known as Legionnaires Pneumonia. We can confirm that a NS employee was diagnosed with Legionnaires' disease however it appears to be an isolated case. Because the health and safety of employees is a top priority, [command] is working closely with the Naval Hospital [name] and the Navy & Marine Corps Public Health Center (NMCPHC) to ensure all necessary actions or precautions are being taken. The NMCPHC, the Naval Hospital Preventive Medicine, and the City and State Departments of Health are investigating the incident. Until more is known and as a precaution, the workforce has been notified and encouraged to see their primary care provider, who develops pneumonia-like symptoms and report their condition to their chain of command, if they develop pneumonia-like symptoms."

**Theme:** Health

**Messages and Talking Points:**

- Memorable, short (12 words or less) relevant, and positive; they are the command's position on an issue and contain no facts. In essence, they answer the "why" a command is taking action.
- Substantiated, releasable **fact**, within the limits of the command's authority that prove or support the above message. Two sentences or less.
- Updated with each briefing card if/when needed.

M1: The safety and well-being of employees is our top priority.
TP1: The Navy and Marine Corps Public Health Center, the Naval Hospital, and the City and State Department of Health are investigating the incident.
TP2: Currently, as far as we are aware, this is an isolated diagnosis.

M1: Immediate action was taken upon notification of the employee's diagnoses.
TP1 The employee's worksite and the building drinking water systems was inspected.
TP2: At this point, because this is an isolated incident we cannot confirm [location] as the source of the Legionnaires' disease.

M3: We will keep our employees fully informed of the situation.
TP1: Until more is known, as a precaution, [command] leadership [will notify] notified employees of the Legionnaires' disease occurrence, [date] and the preliminary risk reduction actions being taken.
TP2: Public Works Department in coordination with public health began testing water quality parameters of the drinking water system.
TP3: Employees were [are] encouraged to seek care from their primary care provider and report their condition to their chain of command if they develop pneumonia-like symptoms.

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Naval Station [Insert Name] Public Affairs
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M4: All actions and precautions are being [will be] taken to promote the health, safety and well-being of [command] employees.
TP1: Water quality tests (bacteria) were [will be] conducted [date],(results found [command] drinking water meets the EPA Safe Drinking Water Act standards but showed a potential for bacteria growth.
TP2: On [date], water samples were [will be] taken to test for *Legionella* from [location]; (results were returned [date] as negative for the presence of *Legionella).*
TP3: A building water management plan is being [will be] developed and implemented to ensure key elements of the water system are not conducive to *Legionella* or any other pathogen growth.

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Naval Station [Insert Name] Public Affairs
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## CO's INITIAL EMPLOYEE NOTIFICATION EMAIL

On [date] I was notified one of our employees has been diagnosed with Legionnaires' disease, (also known as Legionnaires Pneumonia) caused by the bacteria called *Legionella.*

You are receiving this notification because the source of the *Legionella* is not yet known. Legionnaire's disease is contracted by breathing in aerosolized water containing *Legionella* which can sometimes come from shower heads, cooling towers, hot water tanks and heaters and large plumbing systems; it cannot be spread from person-to-person contact or ingestion of drinking water.

Currently, this is an isolated diagnosis. However, as a precaution, if you experience any pneumonia-like symptoms, such as cough, shortness of breath, fever, muscles aches, or headaches please contact your primary care provider. Be sure to notify them of the recent diagnosis of a coworker so they can test you for the bacteria and notify the local and State Public Health Department if results are positive.

Additionally, to ensure we can continue to protect the safety of all employees, please report your condition to your chain of command.

In order to rule out [location] as a possible source I am working closely with our Naval Facilities Command (NAVFAC), Public Works Department, as well as the [installation] Naval Hospital [name] Preventive Medicine Department, and the Navy and Marine Corps Public Health Center (NMCPHC) to ensure every possible action and precaution is in place. Please be assured I am committed to your health, safety, and well-being and I will continue to keep you informed as I receive updated information.

Right now an investigation is taking place to include drinking water and HVAC system inspections as well as …..[include Whatever other actions].
I have attached two *Legionella* fact sheets which can provide you further information. If you have any questions or concerns please contact [POC].

---

**Tenant Command's [Insert name] ALL HANDS, [Insert date] (After Action Report):** *(All hands is needed, generally if there appears to be a heightened health risk concern)*

An "All Hands" was held at [locations], [time], [date]. The [Commanding Officer], briefed [number] civilians and [number] military members about their concerns regarding a recent employee being diagnosed with Legionnaires disease.

The [Installation Commanding Officer] provided additional updates on actions being taken to include the investigation into the disease's source and announced the development of a building water management plan.

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More than eight medical, public works and facilities personnel attended and each answered numerous questions from the audience.

Employee response was [explain if the response seemed positive or negative, worried or at ease etc. the questions asked should provide a good gauge].

The meeting ended at [time] and visiting experts adjourned to the CO's conference room for further discussion. Guests included:

[Insert name] [Insert phone number]
[Insert email]
Occupational & Environmental Medicine
Naval Hospital [Insert name]

[Insert name] [Insert phone number]
[Insert email]
NAVFAC [Insert Region] Environmental

[Insert name] [Insert phone number]
[Insert email]
Public Works Officer
PWD [Command]

[Insert name] [Insert phone number]
[Insert email]
NS PWD Utilities

[Insert name] [Insert phone number]
[Insert email]
PWD Environmental

[Insert name] [Insert phone number]
[Insert email]
Navy & Marine Corps Public Health Center

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## CO's EMAIL UPDATE 1

This email is in regards to a previous notification that was sent out on [date] about one of our employees who was diagnosed with Legionnaires disease, (also known as Legionnaires Pneumonia) caused by bacteria called *Legionella.*

As part of our investigation actions, mentioned previously, on [date], the Public Works Department conducted a thorough inspection of the drinking water distribution system and HVAC system and did not find any stagnant water or other conditions conducive to aerosolizing contaminated water which could serve as a source to contract Legionnaires' disease.

Naval Station [Insert Name] Public Affairs
UNCLASSIFIED

Additionally, on [date] additional water quality testing (not for the *Legionella* bacteria) was conducted, and found our water meets the EPA Safe Drinking Water Act standards. However, the tests also showed there is a potential for bacteria growth based on the combination of water quality parameters such as residual Chlorine concentration, pH, and water temperature. Because of this finding, out of an abundance of caution, I asked that our water supply be specifically tested for the *Legionella* bacteria [date]. The results will take approximately 14 days based on the incubation period required and the analysis. As a reminder, Legionnaires' disease cannot be contracted through ingestion of drinking water.

Additionally, our NAVFAC [Insert region] and PWD are working with the Naval Hospital [name] Preventive Medicine Department and the Navy and Marine Corps Public Health Center to develop a water management plan for [location]. The complexity of the plan will depend on the results of the *Legionella* testing. Once I have the plan I will provide you another update as well as provide you information on what we plan to do to ensure we take all necessary actions that will inhibit bacteria growth.

I will continue to keep you updated as I receive more information. Please direct any questions or concerns to [POC].

---

**CO EMAIL UPDATE 2 (should be 14 days following Legionella tests)**

This is a second (final) update regarding our employee who was diagnosed with Legionnaires' Disease. Since I first notified you, no additional cases of Legionnaires' disease have been reported.

Additionally, in regards to the Legionella testing I mentioned in my last email, those tests were taken on [date] and I am happy to also announce I was notified on [insert date] there is no presence of Legionella [in our water system/location]. Samples were taken from [location(s)]. Those test results are available at [intranet, shared drive, facilities office, etc.,]

A Building Water Management Plan is also being developed by NAVFAC [Insert region] and PWD along with the Naval Hospital [name] Preventive Medicine Department and Navy and Marine Corps Public Health Center. Until it is finalized, the following actions will be taken by Installation Public Works as well as will be incorporated into their final plan which will ensure key elements (chlorine residual, water temperature, pH, and water flow) of the water system are not conducive to *Legionella* or any other pathogen growth. This will be done with regularly scheduled monitoring, testing, and flushing of the system.

- [Insert items specific to the command/location]
- Implement routine building flushing protocol in areas of low usage to alleviate water stagnation.
- Replace low flow aerators to promote increased water flow in the building plumbing system.
- Monitor chlorine residual to ensure levels achieved at the tap are 0.5 mg/L (milligrams per Liter) or greater.

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- Monitor water temperature and adjust appropriately. Water temperatures between 77 and 122 degrees Fahrenheit promote *Legionella* growth. PWD will gradually increase the hot water temperature to above 122 degrees and will notify the tenants to be aware of the potential for scalding.

I am proud of the hard work and dedication of our teams. Please direct any additional questions or concerns to [POC].

---

**Points of contact:**

1. Ms [Insert name], NS Public Affairs. [Insert phone and Email]
2. Mrs. [Insert name], Navy Region [Insert name] Public Affairs. [Insert phone and Email]
3. Mr. [Insert name], Tenant Command [Insert name] Public Affairs. [Insert phone and Email]
4. Mr. [Insert name], NAVFAC Region [Insert name] Public Affairs. [Insert phone and Email]
5. [redacted], Navy and Marine Corps Public Health Center, Risk Communication. Tel: (757) 953-0664. Email. [redacted]
6. [redacted] Navy and Marine Corps Public Health Center, Preventive Medicine. Tel: (757) 953-0712. Email. [redacted]

# Appendix G

# Navy Frequently Asked Questions for Legionella

Naval Station [Insert Name] Public Affairs
UNCLASSIFIED

**Frequently Asked Questions (FAQs)**
***Legionella***
***[Insert Installation and Command Name]***
**[Insert Day/Month/Year]**

**Q. If there is no danger, why was the drinking water secured then reopened?**
**A.** This action was taken initially out of an abundance of caution, until [installation/command] could consult with installation Public Works Department and the public health experts. Once the experts were consulted …..

**Q. We have heard there is *Legionella* bacteria at the [tenant command] on [installation]. Can you confirm that?**
A: No. We can confirm that a [tenant command] employee does have Legionnaires' disease. The installation NAVFAC/Public Works Office plans to conduct testing of the water system on [date] and we will provide results when they become available.

(*When results come back*) On [date] installation Public Works Department tested for the presence of *Legionella* bacteria in the water system of [location]; on [date] results came back indicating there is no presence of *Legionella* in the water system.

**Q: Have employees been notified?**
A: Yes. On [Insert date] [commanding officer] notified employees of the Legionaries' disease diagnosis. He/she provided information on actions employees should take if they became symptomatic as well as fact sheets and a POC for those who may have questions or concerns. Additionally, the CO shared actions are being taken to ensure the health and safety of employees.

(*If an All Hands is held)* [Command] held an "All Hands" where [Commanding Officer] briefed approximately [number] of employees. Employees were provided updates on the investigation into the disease's source and preventive risk management actions being taken. Subject matter experts to include: medical, public works and facilities personnel were also in attendance and answered numerous questions from the audience.

**Q: Has the base population or local public been notified?**
A: The employees who work in the same building were notified, along with pertinent installation leadership and local and state public health officials..

**Q: Has it been reported:**
A: Yes. The City and State Departments of Health, Navy Hospital [Insert name] and the Navy and Marine Corps Public Health Center have been notified and are assisting.

**Q: What were the test results?**
A: Water quality testing was conducted by NAVFAC Region and Public Works on [date] and [date]. Testing determined the water meets EPA Safe Drinking Water Act standards. Additional water samples were then taken on [date] which to test specifically for the *Legionella* bacteria.

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The results for those test (because of the associated incubation period) take approximately 14 days. On [date], test results showed there is no presence of *Legionella* in the water system.

**Q: Is anyone's health at risk?**
A: Although one employee did become ill, this is considered an isolated case not an outbreak by CDC or the State Health Department. Most healthy people exposed to *Legionella* do not get sick. People at increased risk of getting sick are:

- People 50 years or older
- Current or former smokers
- People with a chronic lung disease (like chronic obstructive pulmonary disease or emphysema)
- People with weak immune systems or who take drugs that weaken the immune system (like after a transplant operation or chemotherapy)
- People with cancer
- People with underlying illnesses such as diabetes, kidney failure, or liver failure

Learn more at: https://www.cdc.gov/legionella/about/causes-transmission.html

**Q: Has anyone else contracted the disease?**
A: No additional cases of Legionnaires' disease have been reported.

**Q. How does a person get Legionnaires' disease?**
A person can develop Legionnaires' disease by inhaling water mist contaminated with *Legionella* bacteria. *Legionella* is a type of bacterium found naturally in soil and freshwater environments, like lakes, ponds and streams. It can become a health concern when it grows and spreads in human-made building water systems like: water heaters, cooling towers, shower heads, sinks, faucets, hot tubs, decorative fountains, and large plumbing systems.

**Q. Is Legionnaires' disease transmitted among people?**
A. No. Legionnaires' disease is not contagious and is not transmitted from one person to another.

**Q: What is being done or has been done?**
A: Although Legionnaires is naturally occurring in the environment it can also grow in large complex water systems. Initial response included an inspection of the suspected work area [location]. As a precaution, employees were notified and encouraged to see their primary care providers and report it to their chain of command if they developed pneumonia-like symptoms.

Preceding actions included an inspection by Naval Facilities Command and the Public Works Department plumbers and HVAC technicians for stagnant or pooling water in the building.

PWD then took water quality parameters (e.g., chlorine residual, pH, water temperatures, etc.,) to determine if the conditions in the water distribution system were conducive to promoting the growth of *Legionella*.

Naval Station [Insert Name] Public Affairs
UNCLASSIFIED

As a precautionary measure, the water in the building at [location] was tested on [date] for *Legionella* bacteria. The results took approximately 14 days based on the incubation period and analysis. On [date], [insert who] was notified that there is no presence of *Legionella* in the sample that were taken from [location].

Preventing the conditions that promote the growth *Legionella* bacteria in building water systems is key to preventing infection, however, *Legionella* are relatively resistant to standard water disinfection procedures and, can occur in potable water (water fit for human consumption). Because of this PWD will incorporate the following building water management practices to ensure key elements (chlorine residual, pH, water temperature, and water flow) of the system are not conducive to *Legionella* or any other pathogen growth. This will be done with regularly scheduled monitoring, testing, and flushing of the system.

- Implement routine building flushing protocol in areas of low usage to alleviate water stagnation.
- Replace low flow aerators to promote increased water flow in the building plumbing system.
- Monitor chlorine residual to ensure levels achieved at the tap are 0.5mg/L or greater.
- Monitor water temperature and adjust appropriately. Water temperatures between 77 and 122 degrees promote *Legionella* growth. PWD will gradually increase the hot water temperature to above 122 degrees and will notify the tenants to be aware of the potential for scalding.

**Q: How is NS PWD responding?**
A: NS PWD will be incorporating the following building water management practices to ensure key elements (chlorine residual, water temperature, and water flow) of the system are not conducive to *Legionella* or any other pathogen growth. This will be done with regularly scheduled monitoring, testing, and flushing of the system.

- Implement routine building flushing protocol in areas of low usage to alleviate water stagnation.
- Replace low flow aerators to promote increased water flow in the building plumbing system.
- Monitor chlorine residual to ensure levels achieved at the tap are 0.5mg/L or greater.
- Monitor water temperature and adjust appropriately. Water temperatures between 77 and 122 degrees promote *Legionella growth.* PWD will gradually increase the hot water temperature to above 122 deg and will notify the tenants to be aware of the potential for scalding.

**Q: How often is the water system maintained?** *(verify actions with your command – the following is an example)*
A: Maintenance to include monitoring/sampling/flushing etc. happens on a monthly basis at multiple/different facilities around all of the NS sites by our water monitor. The city also tests/samples the water at the distribution site (source). All of our water comes from the city so we have checks taking place at several points of the distribution system. The city is responsible for the chlorine residual levels and is constantly monitoring.

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- Incorporate additional flushing protocol in areas/facilities of low usage to alleviate water stagnation.
- Work with PWD to replace aerators in low flow areas to promote increased water flow in building system.
- Continue to monitor chlorine residual to ensure levels achieved at the tap are 0.5mg/L or greater.
- Monitor water temperature and adjust temperatures when necessary.

**Q: What is Legionnaires' Disease?**
A: Legionnaires' Disease is a serious type of pneumonia (lung infection) caused by *Legionella* bacteria. People can get sick when they breathe in mist or accidently aspirate or breathe water into the lungs containing *Legionella*. Scientists have identified at least 60 different *Legionella* species, and one, *Legionella pneumophila* (L. *pneumophila*) is responsible for approximately 90% of Legionnaires' Disease cases.

**Q: Is it treatable?**
A: Yes. Legionnaires' disease is treated with antibiotics (drugs that kill bacteria in the body).

**Q. Does everyone who inhales *Legionella* bacteria into the lungs develop Legionnaires' disease?**
A. No. Most people have resistance to the disease. Scientists believe that fewer than 5% of persons exposed to water contaminated with *Legionella* bacteria will develop Legionnaires' disease.

**Q. What are the symptoms?**
A. Legionnaires' disease is very similar to other types of pneumonia (lung infection), with symptoms that include:

• Cough
• Shortness of breath
• Fever
• Muscle aches
• Headaches

Legionnaires' disease can also be associated with other symptoms such as diarrhea, nausea, and confusion. Symptoms usually begin 2 to 10 days after being exposed to the bacteria, but it can take longer so people should watch for symptoms for about 2 weeks after exposure.

**Q. How soon after exposure can a person develop Legionnaires' disease symptoms?**
A. According to the Center for Disease Control Symptoms usually begin two to 10 days after being exposed to the bacteria, but it can take longer, about 2 weeks after exposure.

**Q. Who is at most risk to contract Legionnaires?**
A. Most healthy people exposed to *Legionella* do not get sick. People at increased risk of getting sick are:

- People 50 years or older
- Current or former smokers
- People with a chronic lung disease (like chronic obstructive pulmonary disease or emphysema)
- People with weak immune systems or who take drugs that weaken the immune system (like after a transplant operation or chemotherapy)
- People with cancer
- People with underlying illnesses such as diabetes, kidney failure, or liver failure

**Q. What are the common sources of infection?**
A. Other than found naturally in freshwater environments (lakes and streams), the common sources of infection in human-made building water systems include:

- Showerheads and sink faucets
- Cooling towers (structures that contain water and a fan as part of centralized air cooling systems for building or industrial processes)
- Hot tubs that aren't drained after each use
- Decorative fountains and water features
- Hot water tanks and heaters
- Large plumbing systems

Home and car air-conditioning units do not use water to cool the air, so they are not a risk for *Legionella* growth.

**Q. Are there any precautions being taken to prevent any future health risks?**
A. NS Public Works will be incorporating the following building management practices to ensure key elements (chlorine residual, water temperature, and water flow) of the system are not conducive to *Legionella* or any other pathogen growth. This will be done with regularly scheduled monitoring, testing, and flushing of the system.

- Implement routine building flushing protocol in areas of low usage to alleviate water stagnation.
- Replace low flow aerators to promote increased water flow in the building plumbing system.
- Monitor chlorine residual to ensure levels achieved at the tap are 0.5mg/L or greater.
- Monitor water temperature and adjust appropriately. Water temperatures between 77 and 122 degrees promote *Legionella* growth. PWD will gradually increase the hot water temperature to above 122 degrees and will notify the tenants to be aware of the potential for scalding.

**Q. Where can I go to learn more about Legionnaires' Disease?**
A. We recommend the following information sources:

- CDC Legionella Website: https://www.cdc.gov/legionella/index.html

- OSHA Legionellosis Website: https://www.osha.gov/SLTC/legionnairesdisease/index.html
- National Academies of Science: Management of *Legionella* in Water Systems (2020)
- National Institute for Occupational Safety and Health: Preventing Occupational Exposure to *Legionella* (September 2019)
- Naval Facilities Engineering Command: Legionnaires Technical Alert of 12 January 2026

# Appendix H

## Methods for *Legionella* Analysis in Environmental Samples and Interpretation of Laboratory Results

### METHODS FOR *LEGIONELLA* ANALYSIS

#### A.1 BCYE-Based Culture Methods

The CDC, the International Standards Organization (ISO) and Standard Methods for the Examination of Water and Wastewater (APHA) have published culture methods for detection of *Legionella* in water. These methods are based on plating the sample to multiple buffered charcoal yeast extract (BCYE) agar formulations that inhibit interfering bacteria to varying degrees and/or promote growth of *Legionella*. The incubation period is from 7 to 10 days followed by confirmation steps that can take another 2 to 3 days to complete. Standard Methods 9260J (https://www.standardmethods.org/doi/abs/10.2105/SMWW.2882.201) provides an overview of options for concentration, sample pretreatments, and media additives but is not prescriptive. The CDC method (https://www.cdc.gov/legionella/labs/procedures-manual.html) is prescriptive, but it does not report validation data. ISO11731:2017 € (https://www.iso.org/standard/61782.html) is the only method that has been validated through interlaboratory studies with reproducibility and repeatability results reported. The ISO method also reports performance results of an intra-laboratory validation.

Traditional culture methods for the recovery and detection of *Legionella* species in drinking water have relied on a variety of strategies to improve recovery and detection. The best recoveries are realized when sample volumes are plated directly to agar. However, the volumes analyzed will be limited to no more than 500 µL per plate. Centrifugation and filtration are two techniques frequently used to concentrate water for detection of *Legionella*. Brindle et al. (1987) reported the highest *L. pneumophila* recoveries by centrifugation at 6100 *g* for 10 minutes using a high-speed centrifuge and a fixed angle rotor. Boulanger and Edelstein (1995) reported recovery efficiencies of *L. pneumophila* in seeded 50 mL samples ranging from 1.1 to 44.5 percent ($n$=9) and 19.7 to 52.9% ($n$=19), using centrifugation speeds of 3800 *g*; 30 min and 8150 *g*; 15 min, respectively. Although the highest recoveries reported in this study were achieved concentrating seeded water onto 0.2 µm pore-sized, 47-mm PCTE flat plate membranes. A mean recovery of 52.6% was reported with recoveries ranging from 15.7 to 91.3 percent ($n$=45). Seeding levels used for these recovery trials ranged from $10^3$ to $6 \times 10^6$ cfu/mL. The CDC mentions centrifugation as a method for sample concentration but provides no recommendations for centrifugation conditions. Standard Methods 9260J recommends centrifuging samples at 1000 *g* for 10 minutes and removing all but 10 mL of the supernatant. The ISO method recommends centrifugation if samples contain too many solids making filtration impossible. Centrifugation speeds of 6000 *g* for 10 minutes or 3000 *g* for 30 minutes and removing the supernatant to yield a final volume of 2 to 10 mL is prescribed in the ISO method. For laboratories that prefer to concentrate the samples using filtration, all methods recommend using a 0.2 µm pore-sized polycarbonate track-etched (PCTE) membranes for concentrating water. The ISO method further prescribes using 0.2 µm or 0.45 µm pore-sized cellulose nitrate or mixed cellulose esters membranes when applied directly to the agar.

Issues with detection and recovery can arise when environmental water samples are concentrated. Heterotrophic bacteria, other biological and inorganic particles are also concentrated. When the sample is plated on BCYE agar for culture, the heterotrophic bacteria can out compete the *Legionella* species. Interfering debris may occlude *Legionella* colonies from view. One strategy to inhibit the growth of the heterotrophs is to use agents, such as antibiotics, fungicides, amino acids, and/or dyes. Common additives include glycine, vancomycin, Polymyxin B, cycloheximide, colistin, bromocresol purple and bromothymol blue. BCYE Agar Base contains yeast extract to support growth and L-cysteine, ferric pyrophosphate and α-ketoglutarate are necessary for *Legionella* species growth. The CDC method recommends plating samples on BCYE with cysteine, BCYE supplemented with Polymyxin B, vancomycin and cycloheximide (PVC) with and without cysteine, and BCYE supplemented with GCPC and glycine (GVPC). The ISO method recommends plating samples BCYE, GPVC or Modified Wadowsky Yee (MWY) agar.

Another strategy to reduce bacterial interferences is to include a pre-treatment step. Commonly practiced pre-treatments include heating the sample at 50°C for 30 minutes or lowering the pH of the sample to 2.2 with acid and allowing the sample to stand for 5 to 30 minutes. These steps reduce the numbers of viable bacteria and fungi in the sample prior to plating for culture. Pretreatment of sample concentrates should not be employed unless the total bacterial concentration is known. As a result, samples with unknown histories should be plated with and without pretreatment. Inclusion of these pretreatments does not come without a downside. Boulanger and Edelstein (1995) reported losses of up to 30 percent of seeded bacteria when the acid treatment was employed.

Replicate volumes of sample or sample concentrate are applied to multiple agar plates and then incubated for 7 to 10 days. The CDC method directs laboratories to incubate plates in a humid 2.5% $CO_2$ atmosphere at 35°C while the ISO method does not use $CO_2$ and prescribes an incubation temperature of 34 to 38°C. Plates are examined at regular intervals during the incubation for overgrowth. Colonies observed on agar plates the first three days of incubation are most likely not *Legionella*. Examination of colonies that grow on agar without cysteine are compared to those that grow on agar with cysteine. BCYE agar supplemented with antibiotics and other additives should yield fewer colonies of interfering bacteria.

### A.2 Confirmation of Suspected Legionella Colonies

*Legionella* colonies on BCYE agar appear at approximately 4 days of incubation but may take up to 7 to 10 days to appear. Colonies are 2 to 4 mm in diameter, convex, and round with an entire edge. Colonies are bright white in the center and the edges appear textured and can appear to shimmer with blue, red or green colors. Some species exhibit autofluorescence which can be detected when examined with long-wave ultraviolet light. Suspect colonies are confirmed using a variety of tests. The first confirmation step usually involves streaking a suspect colony on BCYE agar without cysteine ("BCYE–") or blood agar and BCYE. The isolate that grows BCYE and not on blood agar or BCYE– are presumed to be legionellae. Further confirmation tests include direct

fluorescent antibody (DFA) testing or latex agglutination. DFA kits are available from Prolab Diagnostics, Inc. (https://pro-lab.com/products/clinical-microbiology/bacteriology/legionella-direct-fluorescent-antibody-test-kits/) or Bio-Rad (https://www.bio-rad.com/en-us/sku/32514-monofluo-legionella-pneumophila-ifa-test-kit?ID=32514). Antibody reagents can be purchased for *Legionella pneumophila* serogroup 1 (Lp sg1), collectively or each individually for *Legionella pneumophila* serogroups 2 -14 (Lp sg 2-14) and for *L. micdadei* with the Prolabs kit while the Bio-Rad DFA kit only detect *L. pneumophila.* Latex agglutination kits for confirmation of *Legionella* are available from Oxoid (part of Thermo Scientific), Prolab Diagnostics, Inc. bioMérieux, and Microgen Bioproducts (Camberley, Surrey, UK). The Microgen and Oxoid latex kit have reagents for confirmation of *L. pneumophila* serogroup 1 (sg1), *L. pneumophila* sg 2-15 and *Legionella* species. The Prolab kit has individual reagents for *L. pneumophila* serogroups 1 – 14, and *L. micdadei.* The bioMérieux kit specifies detection of *L. pneumophila* and *L. anisa.* Molecular methods can be used to confirm suspect colonies using PCR followed by gel electrophoresis, qPCR, DNA hybridization or DNA sequencing.

### A.3 Other Culture Methods

Other culture technologies commercially available include the Phigenics Validation Test® (PVT) by Phigenics Analytical Services Laboratory (Warrenville, IL) and the Legiolert* test by IDEXX. The PVT test is marketed as a time-zero test in the sense the sample is acidified and inoculated at the time of collection. The manufacturers claim this technique provides more accurate results since changes to the sample during transport to the lab are eliminated. Heat packs are provided during colder times of the year to initiate incubation of test samples during transport to the laboratory. Viable *Legionella* species results are reported in 2 to 4 days after arrival at the laboratory. Various PVT test options are available with additional parameters including total heterotrophic aerobic bacteria (THAB), *Legionella* ISO 11731 spread plate method and a PCR marker test as a negative screen. The limit of detection is reported at 10 cfu/mL for the standard PVT test and 1 cfu/mL for the PVT with ISO and PVT premium options. Testing can be done at the Phigenics' laboratory or users may opt to do the analytical testing themselves following the vendor's instructions. It is important to note that this method has not been independently validated.

The Legiolert* test by IDEXX Laboratories (Westbrook, ME) eliminates the issues encountered with concentration and interference from non-target microorganisms in the traditional culture methods. The Legiolert test is an enzyme substrate assay for detection of viable *L. pneumophila* in potable water. The manufacturer indicates that this product detects actively growing strains of *L. pneumophila* in 7 days with a detection limit of 1 organism/100 mL. The procedure uses a Most Probable Number (MPN) format with use of Quanti-Trays to yield an enumerative result. After the incubation period, a turbid or brown color indicates the presence of viable *L. pneumophila.* All serogroups of *L. pneumophila* are detected with this product. The brown color that develops can vary so confirmation tests as described above should be performed after aseptically removing a 5 µL aliquot of the well contents and streaking for isolation to get isolated colonies

to test. Legiolert has been validated in June 2019 through the Association Française de Normalisation (AFNOR)[1].

## A.4 Molecular Methods

Molecular methods for detection of pathogens have gained popularity over the past two decades. These assays specifically target the organisms' DNA or RNA to determine their presence. These assays are designed to detect at the genus level or at the species level using primers and probes that target gene sequences unique to the target genus or species. Common gene targets are the 16S rRNA gene for detection of *Legionella* spp., the macrophage infectivity potentiator (*mip*) gene for *L. pneumophila* and the *wzm* gene specific to *L. pneumophila* sg 1. While PCR assays are considered to be relatively low-cost and rapid, the specialized equipment required to perform this testing is expensive. In addition, the technical expertise required to perform these assays is quite high. Strict adherence to sample flow through the laboratory, separation of work areas and equipment, storage of reagents, quality control measures and meticulous attention to detail are essential. Areas for reagent preparation, DNA extraction and DNA amplification must be separate.

A plethora of PCR and qPCR assays have been published in peer-reviewed journals since the 1980s targeting a variety of genes in a variety of matrices. DNA concentrations of *Legionella* spp. and *L. pneumophila* in potable waters are generally overestimated compared to culture since molecular methods detect viable cells, dead cells, and VBNC cells. In addition, correlation between cfu/mL and genomic units (GU) has not been established (Whiley and Taylor, 2016). Some researchers have used ethidium monoazide (EMA) or propidium monoazide (PMA) prior to DNA extraction in attempts to amplify only viable cells. These fluorescent nucleic acid stains bind to DNA that is not protected by a cell membrane and are therefore not enumerated by qPCR. Optimization of these stains must be determined with each matrix and may not be effective in complex matrices such as biofilms where the extracellular materials present may inhibit the effectiveness of the stain in binding to DNA. In addition, if not enough of these stains are added free DNA is available for amplification in the PCR assay. More recently a new technology, digital droplet PCR, has been developed that can partition a sample into discrete "droplets" and the target gene is measured in each droplet resulting in a more precise quantification of the target gene in a sample. ISO/TS 12869 is a validated method for the molecular detection of *Legionella* spp. and *L. pneumophila* in water. In addition, laboratories performing molecular methods should follow the Minimum Information for Publication of Quantitative (MIQE) guidelines (Bustin *et al*, 2009) and the United States Environmental Protection Agency Quality Assurance/Quality Control (US

[1] AFNOR Certification; 11, rue Francis de Pressensé - 93571 La Plaine Saint-Denis Cedex –France Legiolert/Quanti-Tray Legiolert for the enumeration of Legionella pneumophila in water for human consumption and industrial water: Certificate IDX33/06-06/19. https://nf-validation.afnor.org/wp-content/uploads/2019/09/Synt-33-06-06-19_en.pdf

EPA QA/QC) guidance for PCR laboratories (US EPA, 2004) are excellent resources to validate the molecular methods used in the laboratory.

Commercially available kits and systems are available for the detection of *Legionella* and *Legionella pneumophila.* However, before using these products the laboratory should validate them to ensure the results are reliable and limitations are known. Many vendors may make claims that have not been independently verified. Table 1 presents some of the commercially available kits and systems that are available. For example, Hydrosense has several kits that can detect *Legionella* in potable water or non-potable waters in 25 min. A mobile phone app can scan the test strip and report a concentration in cfu/L.

*Table 1 Commercial Kits and Systems for Specific Detection of* Legionella

| Kit Name | Manufacturer | Technology | Targets | Specialized Equipment and Comments |
|---|---|---|---|---|
| HybriScan D *Legionella pneumophila* | ScanBec | Sandwich hybridization | Viable *L. pneumophila* | Microwell plate photo reader. 4-hour test. |
| **micro**proof *Legionella* | Biotecon Diagnostics, GmbH | Real-time PCR | *Legionella* spp., *L. pneumophila* and *L. pneumophila* sg1 detected in a single test | Thermocycler with at least 4 channels for multiplex assay. |
| Hydrosense Kits | Albagaia, Ltd., Linlithgow West Lothian, UK | unspecified | *L. pneumophila* sg1 | Kits come if different formats and with different detection limits. Results in 25 minutes. Mobile app to read results. |
| Gene-Disc | Pall Corporation, Port Washington, NY | Real-time PCR | *Legionella* spp., *L. pneumophila* individually or simultaneously | GeneDisc Cycler, GeneDisc Ultra-Lyser and GeneDisc with preloaded primers and probes specific for targets. AFNOR validated (ISO/TC12869). |
| Spartan Cube | Spartan Bioscience, Inc. Ottawa, ON | Real-time PCR | Viable *Legionella* | Cartridge loaded to small thermocycler with GU results available in 45 min. Unit is calibrated so 1 GU/mL is equal to 1 cfu/mL ISO13485 Certification |

While molecular methods can be inexpensive (once the equipment is purchased) and produce results more rapidly than the traditional culture methods for *Legionella*, no studies correlating the results between the two techniques have been conducted. Compounding the issue is that studies using the culture method have used a plethora of media formulations, concentration techniques, and different pretreatment strategies (such as heat or acid treatment, sonication, detergents, freeze-thaw cycles) to improve detection and recovery of *Legionella*. Additionally, amoebae are clearly an important factor in the replication, virulence and survivability of *Legionella* in water. Standardization and validation of a method for recovery and detection of *Legionella* in drinking water is a critical research need (National Academies of Sciences, Engineering, and Medicine, 2020).

# INTERPRETING LEGIONELLA TESTING RESULTS

## B.1 Reporting Requirements by Accreditation Bodies

Accreditation bodies have data reporting requirements that must be included in a test report. For example, TNI requires that each test report or calibration certificate include at least the following information, unless the laboratory has valid reasons for not doing so:

- A title (e.g. "Test Report" or "Calibration Certificate")
- The name and address of the laboratory, and the location where the tests and/or calibrations were carried out, if different from the address of the laboratory
- A unique identification of the test report or calibration certificate (such as the serial number), and on each page an identification in order to ensure that the page is recognized as a part of the test report or calibration certificate, and a clear identification of the end of the test report or calibration certificate
- The name and address of the customer
- Identification of the method used
- A description of, the condition of, and unambiguous identification of the item(s) tested or calibrated
- The date of receipt of the test or calibration item(s) where this is critical to the validity and application of the results, and the date(s) of performance of the test or calibration
- A reference to the sampling plan and procedures used by the laboratory or other bodies where these are relevant to the validity or application of the results
- The test or calibration results with, where appropriate, the units of measurement
- The name(s), function(s) and signature(s) or equivalent identification of person(s) authorizing the test report or calibration certificate
- Where relevant, a statement to the effect that the results relate only to the items tested or calibrated.

TNI also prescribes that hard copies of test reports and calibration certificates include the page number and total number of pages and that laboratories provide a statement specifying that the test report or calibration certificate shall not be reproduced except in full, without written approval of the laboratory. In addition to the requirements listed above, TNI requires that test reports must, where necessary for the interpretation of the test results, include the following:

- Deviations from, additions to, or exclusions from the test method, and information on specific test conditions, such as environmental conditions
- Where relevant, a statement of compliance/non-compliance with requirements and/or specifications

- Where applicable, a statement on the estimated uncertainty of measurement; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a customer's instruction so requires, or when the uncertainty affects compliance to a specification limit
- Where appropriate and needed, opinions and interpretations
- Additional information which may be required by specific methods, customers or groups of customers.

In addition, TNI states that test reports containing the results of sampling must include the following, where necessary for the interpretation of test results:

- The date of sampling
- Unambiguous identification of the substance, material or product sampled (including the name of the manufacturer, the model or type of designation and serial numbers as appropriate)
- The location of sampling, including any diagrams, sketches or photographs
- A reference to the sampling plan and procedures used
- Details of any environmental conditions during sampling that may affect the interpretation of the test results
- Any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned.

Other accreditation bodies, such as AIHA or A2LA, may have slightly different reporting requirements but generally the information that needs to be reported is the same as specified above. It is critical when submitting samples to the laboratory to ensure all information is provided that will help make an informed decision about the sample and data integrity. If any samples are sent to another laboratory, the report should clearly state which results were generated by the subcontractor laboratory. In addition, the report from the subcontractor laboratory should be provided.

### B.2 Interpreting Laboratory Reports

Reporting formats for *Legionella* vary from laboratory to laboratory with the actual results being the most important information to the client. However, it is imperative for the client to be familiar with the methods to understand how the results were generated. Briefly, potable water samples are often concentrated to improve detection of *Legionella* bacteria since they are generally present in low numbers. However, in situations where *Legionella* is suspected to be prevalent in the building water system it would be prudent to also plate potable water samples directly. Non-potable water, such as process water or cooling towers, generally have high concentrations of heterotrophic bacteria that can interfere with the detection of *Legionella* so when using culture methods samples are generally analyzed directly or diluted to reduce this interference. Samples

or concentrates are then treated to reduce interfering bacteria that inhibit the growth and detection of *Legionella*. Aliquots of the treated samples are then applied to agar plates and incubated for up to 10 days. Colonies that exhibit the characteristic morphology are subjected to confirmation assays as described in Section A.2. Confirmation results can provide identification of *Legionella* sp., *L. pneumophila* sg 1 or *L. pneumophila* sg 2-15 or, by using molecular methods can provide identification to species. If the laboratory uses Legiolert, this enumerative culture method only detects viable *L. pneumophila* which is responsible for a majority of the reported cases. The development of a brown color is interpreted as a positive result and confirmation assays can be conducted since the color development is subjective. The advantage of using Legiolert is larger volumes of the sample can be analyzed resulting in a lower reporting limit. Many organizations have published action criteria for cooling towers and building water systems based on the concentrations of *Legionella* detected by culture methods. A detailed discussion of the criteria is presented in the main body of the report. Copies of the methods are readily available on the internet and the client may request SOPs or copies of the reference methods from the laboratory.

The detection limit of an assay is, generally, the number of organisms that need to be present in the sample such that at least one organism is present in 95% of subsamples that are assayed. Analyzing larger water volumes or analyzing concentrated samples reduces the detection limit and makes a given method more sensitive, as long as larger volumes or concentration do not interfere with the method. Knowing the sample detection limit is critical in interpreting results. For example, an assay with a 100 organism/L detection limit is not useful in assessing whether *Legionella* in a sample exceed a 10 organism/L benchmark.

Ideally, laboratory reports include documentation of QA/QC conducted along with microbiological assays. The specific QA/QC that must be conducted and documented depends upon the method used and the requirements for the lab under the lab's accreditation requirements. Specific QA/QC elements that should be reported along with results are presented in section 1.6.1.

Following are discussions of reports from laboratories that participate in the ELITE program for recovery of *Legionella* in environmental samples. Example reports 1 and 2 are from a commercial laboratory accredited through AIHA-EMLAP for *Legionella* analyses. Example reports 3 and 4 are from an applied research laboratory that is not accredited but conducts all testing using the TNI standards and is an ELITE program participant.

Figure 1 provides example report 1. The laboratory has reported results for *Legionella pneumophila* using Legiolert (Quanti-Tray). Legiolert detects all serogroups of viable *L. pneumophila.* The report states a minimum reporting limit (MRL) of 1 MPN (most probable number)/100 mL. However, when looking at the results most are reported as <10 MPN/100 mL which indicates only a 10 ml volume was analyzed for each sample. Additional confirmation testing was performed on positive wells. The positive *L. pneumophila* samples in this report confirmed as belonging to serogroups 2- 15. The report lists the client and the laboratory project ID. All samples submitted

are assigned a unique ID starting with the project number and sequentially labelled. In addition, the laboratory report provides the client sample ID and sample location.

*Figure 1: Example Laboratory Report #1*

**Certificate of Analysis**

Medical Center of Anytown USA
123 Main Street
Anytown, USA 12345
Attn: Jill Jones
Project: **Medical Center of Anytown USA**
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 12/17/2019
Date Received: 12/18/2019
Date Analyzed: 12/30/2019
Date Reported: 12/30/2019
Project ID: 3333332
Page 1 of 3

**Test Code: 1015.4 Water, Legionella pneumophila Analysis - Legiolert (Quanti-Tray)**
Method: QUANTITRAY ANALYSIS FOR ENUMERATION OF Legionella pneumophila

**Results:** **MRL: 1 MPN/100mL**

| Client Sample Number | #1 | #2 | #3 |
|---|---|---|---|
| Sample Location | **POE Cold** | **Rm 1136 Cold** | **Rm 1136 Hot** |
| | **MPN/100 mL** | **MPN/100 mL** | **MPN/100 mL** |
| Lab Sample Number | **19057562-001** | **19057562-002** | **19057562-003** |
| *Legionella pneumophila* | <10.0 | <10.0 | <10.0 |
| Comments | | | |

| Client Sample Number | #4 | #5 | #6 |
|---|---|---|---|
| Sample Location | **Mech Rm 11 Hot** | **Mech Rm 11 Hot Return** | **Rm 270 Cold** |
| | **MPN/100 mL** | **MPN/100 mL** | **MPN/100 mL** |
| Lab Sample Number | **19057562-004** | **19057562-005** | **19057562-006** |
| *Legionella pneumophila* | <10.0 | <10.0 | <10.0 |
| Comments | | | |

The samples were analyzed using Legiolert/Quanti-Tray (Test code 1015.4). According to the laboratory's website this assay has a 24-hour hold time and a 7 to 12-day turnaround time. The dates collected, received, and reported are listed. One point of confusion is the date analyzed. At first glance the samples were received in the laboratory on 12/18/2019 and analyzed 12/30/2019. This could be interpreted that the samples were not put on test until 12/30/2019 but that is not the case. This laboratory interprets "date analyzed" as the date the results were final. The samples were put on test 12/19/2019 and removed from the incubator 12/26/2019. The wells that exhibited a brown color were subjected to the confirmation tests which were completed on 12/30/2019. The critical time in this assay is when the sample incubation is initiated with respect to the sample collection time. The CDC method does not prescribe a hold time but

does recommend that samples that cannot be analyzed within 72 hours of collection should be chilled. The sample condition upon receipt was listed as acceptable. One detail that is missing from this report is the method for determining how the serogroups were determined. It may be useful to have the laboratory issue a revised report that includes this information.

In example report #2 (Figure 2), the laboratory is reporting *Legionella* culture results using the CDC Method with confirmation by serogrouping. The results are difficult to interpret if the reader is not familiar with the method for processing these samples.

*Figure 2: Example Laboratory Report #2*

**Certificate of Analysis**
AIHA-LAP EMLAP# 102977

Medical Center of Anytown USA
123 Main Street
Anytown, USA 12345
Attn: Jill Jones
Project: **Medical Center of Anytown USA**
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 03/10/2020
Date Received: 03/11/2020
Date Analyzed: 03/21/2020
Date Reported: 03/22/2020
Project ID: 20021131
Page 2 of 4

Client Sample #: 1
Sample Location: Kitchen Sink - Potable Water
Test: 1015, WATER, Legionella Analysis, CDC Method: POTABLE SOP 2.35/SOP 2.22
Results: **2 CFU/mL**

Lab Sample #: 20021131-001
Liquid Volume: **250 (mL)**

| Organism(s) Isolated: | Raw Count | CFU/mL | % Total | MRL |
|---|---|---|---|---|
| Legionella pneumophila Serogroup 1 | 4 | 2 | 67 | 0.4 CFU/mL |
| Legionella pneumophila Serogroup 2-15 | 2 | <1 | 33 | 0.4 CFU/mL |
| | 6 | 2 | ~100% | |

For example, for sample #1, a 250-mL volume of the water was concentrated and resuspended in 10 mL of sterile water. A 0.1-mL volume of the concentrate was applied to the agar plate for culture. This 0.1-mL volume is equivalent to 2.5 mL of the original sample volume yielding a minimum reporting limit of 0.4 cfu/mL. Based on the raw counts, there were 4 colonies that were confirmed by serogrouping to be *L. pneumophila* sg 1. Therefore, the final result for *L. pneumophila* sg 1 was 4 cfu/2.5 mL or 1.6 cfu/mL which rounds to 2 cfu/mL. For the 2 colonies confirmed as *L. pneumophila* sg 2 -15 in sample #1 the calculated cfu/mL was 0.8 and therefore results are reported as <1 cfu/mL. Note that a reporting value of <1 does not mean non-detect of *L. pneumophila*; it is simply below the reporting limit of 1 cfu/mL.

The cooling tower samples (#5 - #6), shown in Figure 3, contain very high levels of interfering bacteria so smaller volumes must be analyzed thereby raising the minimum reporting limit. For the cooling tower samples analyzed the MRL is 10 cfu/mL meaning the laboratory analyzed a 0.1 mL volume. *Legionella* colonies were confirmed in cooling towers 1 and 2 at concentrations of 40

cfu/mL and 30 cfu/mL, respectively. These reported concentrations translate to 40,000 cfu/L and 30,000 cfu/L which require immediate remedial actions.

*Figure 3: Example Laboratory Report #2 (continued)*

**Certificate of Analysis**
AIHA-LAP EMLAP# 102977

Medical Center of Anytown USA
123 Main Street
Anytown, USA 12345
Attn: Jill Jones
Project: **Medical Center of Anytown USA**
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 03/10/2020
Date Received: 03/11/2020
Date Analyzed: 03/21/2020
Date Reported: 03/22/2020
Project ID: 20021131
Page 3 of 4

Client Sample #: 5
Lab Sample #: 20021131-005
Sample Location: Cooling Tower 1
Test: 1015, WATER, Legionella Analysis, CDC Method: NON-POTABLE SOP 2.35/SOP 2.22
Results: **40 CFU/mL**
Liquid Volume: **1 (mL)**

| Organism(s) Isolated: | Raw Count | CFU/mL | % Total | MRL |
|---|---|---|---|---|
| Legionella pneumophila Serogroup 2-15 | 4 | 40 | 100 | 10 CFU/mL |
| | 4 | 40 | ~100% | |

Client Sample #: 6
Lab Sample #: 20021131-006
Sample Location: Cooling Tower 2
Test: 1015, WATER, Legionella Analysis, CDC Method: NON-POTABLE SOP 2.35/SOP 2.22
Results: **30 CFU/mL**
Liquid Volume: **1 (mL)**

| Organism(s) Isolated: | Raw Count | CFU/mL | % Total | MRL |
|---|---|---|---|---|
| Legionella pneumophila Serogroup 1 | 3 | 30 | 100 | 10 CFU/mL |
| | 3 | 30 | ~100% | |

In example report #3 (Attachment 1), Legiolert was used to test the water samples. The report provides the reason the testing was conducted, a description of the sample collection procedure and field parameters measured and a detailed description of how the samples were processed. In addition, the laboratory provided an interpretation of the results and further recommendations for the client to consider. The laboratory did not report the volumes analyzed although the chain of custody record indicates the samples were collected in 125 mL bottles containing sodium thiosulfate. No negative *Legionella* results were reported but the one positive sample was reported as 4 MPN/100 mL.

In example report #4 (Attachment 2), the laboratory is reporting results on water samples that are having several assays performed including *Legionella* by Legiolert and the ISO 11731:2019 € method. The laboratory provides details of analysis and results and provides some interpretation

of results in the discussion portion of the report. No *Legionella* was detected in the samples analyzed by either method. The additional parameters tested *Legionella* spp., *Pseudomonas aeruginosa*, free-living and thermotolerant amoebae, non-tuberculous mycobacteria (NTM) and heterotrophic bacteria (HPC) were measured. HPC data provides a measure of bacterial load; the other microorganisms are opportunistic pathogens of concern in health care settings. Testing for these microorganisms develops baseline data on their occurrence and is important for understanding how well the water management plan when implemented, is able to control them in the water system.

### B.3 Further Considerations

When preparing to collect samples for analysis, the objective of the sampling needs to be considered. If it is routine sampling, then the analysis requested should be for *L. pneumophila* and serogroup identification. For sampling as part of an investigation related to a suspected case possibly linked to a building, positive sample isolates should be further tested beyond serogroup using molecular methods. This will allow any clinical isolates to be compared to those from the building water system to positively link the building and the case(s).

While not required, it may be beneficial to have QC samples analyzed and reported with the field samples collected. The client would need to make this request at the start of the process so the laboratory could accommodate the request. Analysis of the QC samples may incur additional fees. The QC samples could include a reagent water blank, a reagent water spike (containing *Legionella* at a known concentration) or a matrix spike (matrix sample containing a known number of *Legionella*). Analysis and reporting of these data would provide the client with some information about the data generated. Although not a common practice, blind samples can be submitted to a laboratory to determine the competency of the laboratory. Blind samples should be prepared by an experienced analyst and the spike material should be purchased from a reliable source. Wisconsin State Hygienic Laboratory, Sigma-Aldrich, and NSI Lab Solutions have standards that can be used to prepare the blind samples.

# REFERENCES

Barrette, I., 2019. Comparison of Legiolert and a conventional culture method for detection of Legionella pneumophila from cooling towers in Québec. J. AOAC Int. 102, 1235–1240

Boulanger, C.A., Edelstein, P.H., 1995. Precision and accuracy of recovery of Legionella pneumophila from seeded tap water by filtration and centrifugation. Appl. Environ. Microbiol. 61, 1805–1809.

Brindle, R.J., Stannett, P.J., Tobin, J.O., 1987. Legionella pneumophila: monoclonal antibody typing of clinical and environmental isolates. Epidemiol. Infect. 99, 235–239.

Bustin SA, Benes V, Garson JA, Hellemans J, Huggett J, Kubista M, Mueller R, Nolan T, Pfaffl MW, Shipley GL, et al. The MIQE guidelines: minimum information for publication of quantitative real-time PCR experiments. Clin Chem. 2009;55(4):611–622.

National Academies of Sciences, Engineering, and Medicine 2020. Management of Legionella in Water Systems. Washington, DC: The National Academies Press. https://doi.org/10.17226/25474.

Parr, A., Whitney, E.A., Berkelman, R.L., 2015. Legionellosis on the rise: a review of guidelines for prevention in the United States. J. Public Health Manag. Practice 21, E17–E26.

Rech, M.M., Swalla, B.M., Dobranic, J.K., 2018. Evaluation of Legiolert for quantification of Legionella pneumophila from non-potable water. Curr. Microbiol. 75, 1282–1289.

US EPA, 2004. Quality assurance/quality control guidance for laboratories performing PCR analyses on environmental samples. Washington DC: Office of Water, U.S. Environmental Protection Agency; 2004.

Whiley, H., Taylor, M., 2016. Legionella detection by culture and qPCR: comparing apples and oranges. Crit. Rev. Microbiol. 42, 65–74.

# Appendix I

## Legionnaires' Disease (clinical Legionellosis and related health effects) reporting form

**Legionnaire's Disease (clinical legionellosis and related health effects) reporting template.** Page 1 of 2.

This document is designed to help guide and standardize preventive medicine department patient investigation activities to ensure timely identification of public health threats. *Please complete according to the most accurate information available to you. If unknown, mark as such or leave blank.*

**Patient Demographics and Personal Information**

1. Today's date (DD/MM/YYYY) _____ / _____ / _____
2. Name (last, first) _____
3. DoD ID _____
4. Date of birth _____ / _____ / _____ (month / day / year)
5. Gender (biological sex) ☐ Male ☐ Female
6. Race ☐ White ☐ Black ☐ Hispanic ☐ Asian ☐ Other
7. Street address _____
8. City _____ 9. State _____ 10. Postal code _____ 11. Country _____
12. Housing type ☐ Private residence ☐ Government housing ☐ PPV housing ☐ Shipboard ☐ Other _____
13. Status ☐ Active Duty ☐ Reservist ☐ Civilian ☐ Contractor ☐ Dependent/family member ☐ Other _____
14. Medical record in AHLTA or Genesis? ☐ Yes ☐ No
15. Phone number (_____) _____ 16. Email _____@_____

**Workplace or School**

17. Name of command or school where patient worked or studied at time of illness _____
18. Street address where patient worked or studied at time of illness _____
19. City _____ 20. State _____ 21. Postal code _____ 22. Country _____

**Clinical Information**

23. Date of symptom onset _____ / _____ / _____ (month / day / year) ☐ Unknown
24. Check all symptoms experienced by this patient.
    - ☐ Fever
    - ☐ Myalgias
    - ☐ Cough
    - ☐ Sore throat
    - ☐ Fatigue
    - ☐ Headache
    - ☐ Other (list): _____
25. Date that patient first sought medical care for symptoms consistent with legionnellosis _____ / _____ / _____ (month / day / year) ☐ Unknown
26. Diagnosis (check only one)
    - ☐ Legionnaires Disease (pneumonia diagnosis clinically or on X-ray) ☐ Pontiac Fever (fever and myalgia without pneumonia)
    - ☐ Extrapulmonary legionellosis only (endocarditis, wound infection, sepsis)
27. Date of diagnosis _____ / _____ / _____ (month / day / year)
28. Laboratory confirmation? ☐ Urine antigen positive
    - ☐ Culture positive (☐blood ☐sputum ☐BAL fluid ☐pleural fluid ☐lung biopsy ☐other_____)
    - ☐ Four-fold rise serum antibody to ***L. pneumophila*** serogroup 1
    - ☐ Four-fold rise to antibody other than ***L. pneumophila*** serogroup 1
    - ☐ Direct fluorescent antibody or immunohistochemistry positive (☐blood ☐sputum ☐BAL fluid ☐pleural fluid ☐lung biopsy ☐other_____)
    - ☐ No lab confirmation
29. Was the patient hospitalized for this illness? ☐ Yes ☐ No
30. If hospitalized, name and state of hospital _____
31. If hospitalized, date of admission _____ / _____ / _____ (month / day / year)
32. Outcome ☐ Survived full recovery ☐ Survived with sequelae ☐ Still sick ☐ Died ☐ Unknown
33. Date illness reported to Public Health or Preventive Medicine _____ / _____ / _____ (month / day / year) (enter today's date if not previously reported)

02 October 2020

**Legionnaire's Disease (clinical legionellosis and related health effects) reporting template.** Page 2 of 2.

This document is designed to help guide and standardize preventive medicine department patient investigation activities to ensure timely identification of public health threats. *Please complete according to the most accurate information available to you. If unknown, mark as such or leave blank.*

## Exposure Information

34. List any overnight travel, hospitalizations, medical procedures, clinic visits, and group gatherings the patient participated in during the 14 days prior to symptom onset.

| | Place of Potential Exposure | Type (home, hotel, hospital, etc.) | Street address (including Country, if OCONUS) | Room number (if any) | Arrival date mm/dd/yyyy | Departure date mm/dd/yyyy |
|---|---|---|---|---|---|---|
| 1. | | | | | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |

35. In the 14 days before illness onset, did the patient use, participate in, or be exposed to the following? For all that apply, circle the number(s) corresponding to the rows in the above table, use H for exposures at home, use B for local businesses.

- **1 2 3 4 H B** Hot tub or jetted tub
- **1 2 3 4 H B** Cooling tower
- **1 2 3 4 H B** Dental water lines
- **1 2 3 4 H B** Evaporative condenser
- **1 2 3 4 H B** Fountain
- **1 2 3 4 H B** Grocer's fresh vegetable mist
- **1 2 3 4 H B** Humidifier
- **1 2 3 4 H B** Swimming or wading pool
- **1 2 3 4 H B** Shower
- **1 2 3 4 H B** Steam room or wet sauna
- **1 2 3 4 H B** Convention, party, or other gathering
- **1 2 3 4 H B** Construction or remodeling
- **1 2 3 4 H B** Natural soil, peat, or potting soil
- **1 2 3 4 H B** Gardening/gardening center
- **1 2 3 4 H B** Landscaping
- **1 2 3 4 H B** Treatment of sleep apnea or breathing condition

Type of water used in the device, if any:
☐ Bottled ☐ Distilled ☐ Sterile
☐ Tap ☐ Unknown

## Follow-up and Investigation

36. Date local health department contacted to notify or confirm awareness ____ / ____ / _____ (month / day / year) ☐ Not contacted

37. Does the patient know of similarly ill persons? ☐ Yes (specify _____) ☐ No

38. Is this patient's case associated with a known or suspected outbreak (cluster)? ☐ Yes (specify _____) ☐ No

39. Patient's primary care manager (PCM) is aware of the diagnosis and is assuming care for the patient as confirmed by
☐ Documentation from PCM ☐ PCM contacted ☐ PCM not aware ☐ Unknown

40. Date awareness of PCM confirmed ____ / ____ / _____ (month / day / year) ☐ Not confirmed

41. Date the overseer of the suspected source (municipal structure, housing authority, landlord, business, homeowner, etc.) was contacted to inform or confirm awareness of the potential exposure source ____ / ____ / _____ (month / day / year) ☐ Not contacted

42. Environmental (e.g., water) sampling performed? ☐ Yes ☐ No ☐ Unknown

43. Identifying information of samples (laboratory, samples, collector, codes, location, storage, etc.) if obtained

_____

_____

_____

_____

44. Investigator name (last, first) _____

45. Investigator phone (____) _____ 46. Investigator email _____ @ _____

47. Date completed ____ / ____ / _____ (month / day / year) 48. Investigator's UIC (for contractors, UIC of hiring command) _____

02 October 2020

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**NAVY AND MARINE CORPS PUBLIC HEALTH CENTER**

**Legionella Response Guidance for Navy Medicine** *Nov 2020*

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