

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Preventing Occupational Exposure to *Legionella*

Summary

The National Institute for Occupational Safety and Health (NIOSH) has conducted *Health Hazard Evaluations* (HHEs) in workplaces with reported cases of Legionnaires' disease among employees. After each of these evaluations, NIOSH made recommendations to employers to prevent conditions that lead to *Legionella* growth and spread in workplaces.

Exposure

Legionnaires' disease is a form of pneumonia that can be severe. It is caused by breathing in or aspirating small water droplets containing a pathogenic type of *Legionella* bacteria [CDC 2018b]. *Legionella* can also cause a less serious infection called Pontiac fever that has symptoms similar to a mild case of the flu. Historically, most outbreaks of Legionnaires' disease have occurred in buildings with large complex water systems. Workplaces that have been associated with outbreaks include hotels, hospitals, nursing homes, plastic injection molding manufacturers, and automobile manufacturers [CDC 2016a].

In recent years, community-wide outbreaks caused by construction-related disturbance to drinking water distribution lines or cooling towers have also been observed.

Legionella is usually not transmitted from person to person [Correia et al. 2016]. Risk factors for developing Legionnaires' disease include having chronic lung disease, a weakened immune system, liver or kidney failure, cancer, or diabetes; older age; and cigarette smoking [CDC 2016b,c; 2017a; NAS 2019].

Legionella grows in water sources when the following conditions occur [CDC 2016a,b, 2017a]:

- A water disinfection system fails:
 - Water not flowing.
 - Disinfectant levels are not maintained.
 - Presence or introduction of “deadlegs” into new construction or allowing plumbing to remain stagnant during construction or renovations of a building.
 - Unmanaged external changes to the building, such as nearby construction, affect potable water quality.
 - Water temperatures that are not hot or cold enough to prevent growth of *Legionella*.
- In the workplace, common sources of water that may contain *Legionella* include the following [CDC 2016b,c, 2017a; OSHA 2018]:
- Cooling towers for air-conditioning systems, evaporative condensers, and fluid coolers that use evaporation to reject heat. These include many industrial processes that use water to remove excess heat.
 - Humidifiers, decorative fountains, misters, tubs, therapeutic spas, garden hoses, and other devices that create a water spray and use water at temperatures favorable to *Legionella* growth. These systems may not have adequate disinfectant to control *Legionella* growth.
 - Safety equipment including fire sprinkler systems, eye wash stations, and safety showers
 - Hot water systems (including faucets and showers), especially those with thermal mixing valves and electronic eye actuators
 - Specialized medical devices (e.g., respiratory therapy equipment, hydrotherapy tubs, and heater-cooler units)



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- Recirculated process water, including vehicle water tanks used for street cleaning and dust control [Valero et al. 2017] and asphalt paving machines [Coscollá et al. 2010]
- Carbon filters to improve the odor and taste of drinking water fountains and ice machines

Guidelines to Control Exposure

To help building owners and managers reduce the risk of *Legionella* growth and transmission, guidelines and standards have been developed by a number of agencies and professional groups.

CDC

To help building owners and managers reduce the risk of *Legionella* growth and transmission, the Centers for Disease Control and Prevention (CDC) has developed a toolkit that provides step-by-step guidance on how to set up a water management program [CDC 2018c]. The CDC toolkit explains the information provided in the ANSI/ASHRAE Standard 188-2018 *Legionellosis: Risk Management for Building Water Systems* [ASHRAE 2018].

OSHA

The Occupational Safety and Health Administration (OSHA) has developed guidance dealing with potential exposures to *Legionella* [OSHA 2018]. The guidance provides information about the disease, how to identify likely environmental sources of *Legionella*, and methods to reduce exposure.

EPA

The Environmental Protection Agency (EPA) has developed a review of the commonly used disinfection strategies for *Legionella* control in premise plumbing systems [EPA 2016]. Disinfectants must comply with the EPA Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

AIHA

The American Industrial Hygiene Association (AIHA) published guidelines on the *Recognition, Assessment and Control of Legionella in Building Water Systems* [AIHA 2015]. These guidelines provide a framework for employers to carry out risk assessment for *Legionella* sources and to perform environmental sampling as part of routine or investigative assessments.

Case Study

This case study emphasizes *Legionella* exposures in an industrial setting. NIOSH visited an automobile and scrap metal shredding facility after four employees developed Legionnaires' disease. Automobile and scrap metal shredding is done in a large shredding machine (Figure 1) and generates

dusts, mists, and vapors. The shredding chamber inside the machine is cooled and lubricated using municipal water. The four employees with Legionnaires' disease performed shoveling and picking activities. Picking involves manually removing copper and other materials from the shredder conveyor belt.

NIOSH identified *Legionella* on a sterile swab sample taken from a wet conveyor belt that exited the shredder, in water dripping from the belt, and from a sterile swab sample taken on a wet conveyor belt inside the picking shed. In addition, clouds of water vapor were observed above the conveyor belt. NIOSH investigators also observed large quantities of standing water throughout the facility grounds. *Legionella* was identified in several puddles of water. Employees stood and shoveled in and around water, vehicles drove through water, and front-end loaders picked up and set down material in and around standing water, creating splashes. No employees wore respirators.

NIOSH investigators recommended that employers sanitize equipment, improve drainage, and implement a respiratory protection program for employees who do maintenance work and are exposed to water spray. NIOSH also recommended that employees avoid shoveling during shredding operations, and avoid smoking or eating in the plant production areas.



Photo by NIOSH

Figure 1. Water vapor emitted from shredding machine.

During a return visit 4 months later, NIOSH investigators observed that the facility grounds had been cleared of built-up dirt, improving drainage and revealing a previously blocked drain. A new, larger shredder that required only half the previous water flow had been installed. The plant manager reported that the picking room had been cleaned and sanitized, but not the rest of the facility. Some puddles of water

still existed, and *Legionella* was again detected in water samples taken from multiple puddles. *Legionella* was not detected in swab samples taken from the conveyor system. During this visit, employees wore N-95 respirators provided by the facility; but none had been fit-tested and some were wearing their respirators incorrectly.

NIOSH recommended that the ground drainage be improved to remove the remaining standing water, that the rest of the facility be cleaned and sanitized, and that employees wear respirators correctly and be fit-tested [NIOSH 2012].

Recommendations

Employees, employers, and building managers should take the following steps to reduce the risk of *Legionella* growth and transmission in the workplace [NIOSH 2012, 2016a].

Employees

Report signs or symptoms that might be pneumonia to your personal healthcare provider and (as instructed by your employer) to a designated individual at your workplace. If you have symptoms and work around aerosolized water, special tests are needed to determine whether you have Legionnaires' disease.

Healthcare Providers

Healthcare providers can ask employees with pneumonia symptoms whether they work around water that can be easily aerosolized and what jobs they do to get more information about possible exposures. Additional information for healthcare providers can be found at <https://www.cdc.gov/legionella/clinicians.html> [CDC 2017a]

Employers and Building Managers

For information about developing a water management program to reduce *Legionella* growth, consult CDC 2018c. In this setting, such a program could include the following*:

- Identifying and addressing areas of water stagnation, low flow, and low levels of or no disinfectant
- Regularly measuring residual disinfectant levels in municipal water supplied to the facility and at distal points of use throughout the facility in both hot and cold water systems.
- Improving surface drainage to eliminate standing water
- Keeping grounds clear of debris to facilitate drainage
- Monitoring and maintaining disinfectant levels and appropriate temperatures

* Healthcare facilities have additional considerations when developing a water management program to reduce *Legionella* growth.

Refer to the CDC toolkit and the OSHA Legionellosis webpage to identify potential sources of *Legionella* [CDC 2018c; OSHA 2018].

Develop and implement maintenance plans for all equipment.

Follow manufacturer guidelines on the safe use of disinfectants.

Develop and implement worker protection requirements following the hierarchy of controls that first relies on engineering controls and administrative controls, and then considers personal protective equipment (i.e. respirators).

Use respiratory protection if necessary to reduce exposure to aerosols that could contain *Legionella*. According to the hierarchy of controls, respirators should be used only when the hazards are not controlled by engineering and administrative controls [NIOSH 2016b]. Set up a respiratory protection program that includes all required elements in the OSHA 29 CFR 1910.134 respiratory protection standard [OSHA 2011].

Use an experienced company to perform environmental sampling. More information about working with consultants can be found in CDC 2018a.

Contact your state or local health department for additional support and resources to manage *Legionella* in the workplace.

Encourage employees to report any respiratory problems to supervisors or managers, and healthcare providers.

Have employees who work around processes that use water or create mist evaluated by a healthcare provider for possible Legionnaires' disease if they develop signs or symptoms that might be pneumonia.

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