

The Role of the IP in Construction, Renovation & Water Management

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MHA IP Bootcamp 2024

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Disclosure of Conflicts of Interest

- Barbara DeBaun, MSN, RN, CIC is a clinical consultant to:
 - Magnolia Medical
 - SplashBlocker



Has anyone ever survived a kitchen remodel?

Impact of healthcare construction or renovation

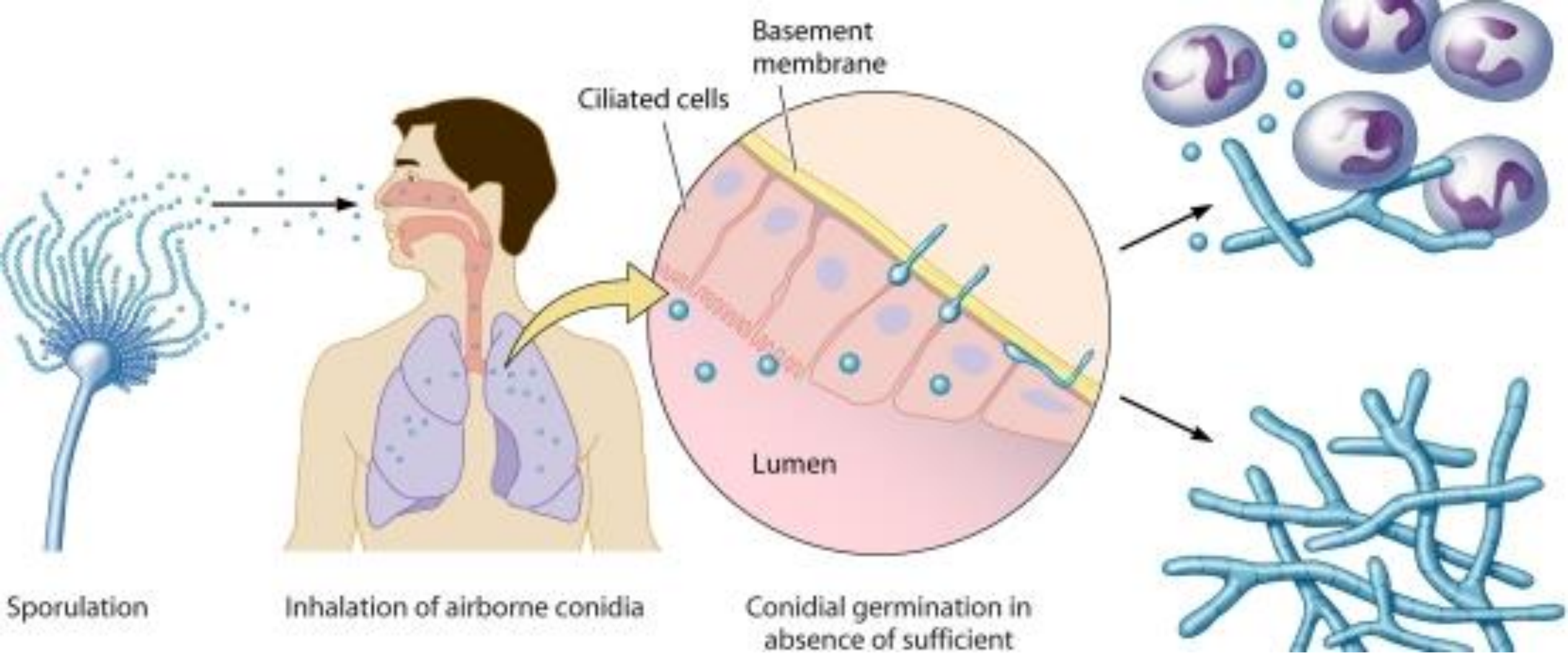
Healthcare associated infections related to construction and renovation account for >5,000 deaths per year in the US

Put patients at risk of mold infection (e.g., Aspergillus), Legionnaires disease, sleep deprivation, exacerbation of lung disease and even physical injury

Healthcare associated infections: Mold

Construction causes substantial dust contamination and scattering of large amounts of fungal spores

Most common mold is Aspergillus



Aspergillus

Review of Fungal Outbreaks and Infection Prevention in Healthcare Settings During Construction and Renovation

Hajime Kanamori,^{1,2} William A. Rutala,^{1,2} Emily E. Sickbert-Bennett,^{1,2} and David J. Weber^{1,2}

¹Hospital Epidemiology, University of North Carolina Health Care, and ²Division of Infectious Diseases, University of North Carolina School of Medicine, Chapel Hill

HEALTHCARE EPIDEMIOLOGY • CID 2015:61 (1 August)

Kanamori review of fungal infections

Review of fungal infections during hospital construction, renovation and demolition projects from 1976 to 2014

Identified 372 infected patients; 180 died

Majority of infections were due to *Aspergillus*

Other fungi included *Rhizopus*, *Candida* and *Fusarium*

Hematologic malignancies and stem cell transplant (76% of cases)

Legionnaires disease

Atypical pneumonia caused by *Legionella*

Legionella species are the bacteria most often associated with construction in hospitals as construction and demolition often result in collections of stagnant water

Primary mode of transmission is inhalation of contaminated mist or aerosols

Legionella species can colonize newly constructed hospital buildings within weeks of installation of water fixtures

Legionnaires' Disease

A severe form of pneumonia caused by Legionella bacteria, most commonly *Legionella pneumophila*, particularly serogroup 1

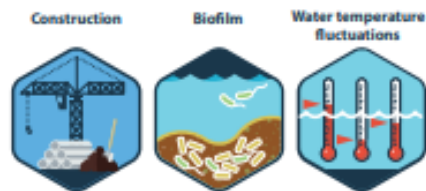
Fatal in 10% of cases overall, and in 25% of healthcare-associated cases

Outbreaks are associated with large or complex water systems

Risk factors include > age 50, smoking, chronic lung disease, immune system disorders, systemic malignancy, diabetes, renal/liver failure

How *Legionella* affects building water systems and people

1. Internal and external factors can lead to *Legionella* growth in building water systems.



2. *Legionella* grows best in large, complex water systems that are not adequately maintained.



3. Water containing *Legionella* is aerosolized through devices.



4. People can get sick when they breathe in small droplets of water or accidentally swallow water containing *Legionella* into the lungs. Those at increased risk are adults 50 years or older, current or former smokers, and people with a weakened immune system or chronic disease.



What Clinicians Need to Know about Legionnaires' Disease. (cdc.gov)

What Clinicians Need to Know about LEGIONNAIRES' DISEASE

Legionnaires' disease is a sometimes fatal form of pneumonia that is on the rise in the United States. Unfortunately, this disease is also underrecognized and underdiagnosed. Clinicians are in a unique position to make sure cases are detected, allowing rapid investigation by public health officials and prevention of additional cases.

Diagnosis and Testing

Clinical features of Legionnaires' disease include cough, fever, and radiographic pneumonia. Signs and symptoms for Legionnaires' disease are similar to pneumonia caused by other pathogens; the only way to tell if a pneumonia patient has Legionnaires' disease is by getting a specific diagnostic test. Indications that warrant testing include:

- Patients who have failed outpatient antibiotic therapy for community-acquired pneumonia
- Patients with severe pneumonia, in particular those requiring intensive care
- Immunocompromised patients with pneumonia*
- Patients with a travel history (patients who have traveled away from their home within 14 days before the onset of illness)
- All patients with pneumonia in the setting of a Legionnaires' disease outbreak
- Patients at risk for Legionnaires' disease with healthcare-associated pneumonia (pneumonia with onset ≥48 hours after admission)

* Clinicians may also consider testing for Legionnaires' disease in patients with other risk factors for this infection (see page 2).

Testing for healthcare-associated Legionnaires' disease is especially important if any of the following are identified in your facility:

- Other patients with healthcare-associated Legionnaires' disease diagnosed in the past 12 months
- Positive environmental tests for *Legionella* in the past 2 months
- Current changes in water quality that may lead to *Legionella* growth (such as low chlorine levels)

Infection control staff may have more information about these situations in your facility.

The preferred diagnostic tests for Legionnaires' disease are culture of lower respiratory secretions (e.g., sputum, bronchoalveolar lavage) on selective media and the *Legionella* urinary antigen test. Serological assays can be nonspecific and are not recommended in most situations. Best practice is to obtain both sputum culture and a urinary antigen test concurrently. Sputum should ideally be obtained prior to antibiotic administration, but antibiotic treatment should not be delayed to facilitate this process. The urinary antigen test can detect *Legionella* infections in some cases for days to weeks after treatment. The urinary antigen test detects *Legionella pneumophila* serogroup 1, the most common cause of Legionnaires' disease; isolation of *Legionella* by culture is important for detection of other species and serogroups and for public health investigation. Molecular techniques can be used to compare clinical isolates to environmental isolates and confirm the outbreak source.

Order both a culture of a lower respiratory specimen and a urinary antigen test when testing patients for *Legionella*.



In the United States, reported cases of Legionnaires' disease have grown by nearly nine times since 2000. Nearly 10,000 cases of Legionnaires' disease were reported in 2018, but this number is likely an underestimate as the illness is thought to be underdiagnosed.

More illness occurs in the summer and early fall, but Legionnaires' disease can happen any time of year.



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

Non-infection related impacts

Sleep
deprivation

Physical
injuries

Exacerbation
of lung
disease

Oversight and Requirements



The Joint Commission



APIC

Spreading knowledge.
Preventing infection.™

Bundle of Key Methods for Preventing Filamentous Fungal Infections

- Notification of IP prior to renovation/construction
- ICRA
- Control of airborne dissemination of spores
- Consider impact on involved and adjacent units
- Maintain surveillance and investigate any cases
- Visit renovation/construction sites regularly to assess compliance

Reference: CDC Guidelines for Environmental Infection Control in Health-Care Facilities 2015



Notification of IP:
they need to call you
before they even
think about starting



Nursing Staff

Knows the Patient Needs

- Highest Priority: Caring for patients



Facilities Manager

Knows the Facility

- Highest Priority: Keep systems operating and building safe

Those who are affected by the work

Those who complete the ICRA 2.0

Those who carry out the work defined by the ICRA 2.0

Those who approve the ICRA 2.0

Contractor

Knows the Work

- Highest Priority: Keep staffing and materials needs realistic to get the job done



Infection Preventionist

Knows Pathogen and Mitigation

- Highest Priority: Prevent infection and risk to patient and facility



“I am just painting a wall”

- Will you need to sand and patch first?
- Will you be pulling off wall covering?
- Might there be mold underneath that wall covering?
- Are you pulling electrical cables?
- Will any ceiling tiles need to come out?



Establish Expectations

- Know the Infection Control Risk Assessment (ICRA) results
- Understand requirements for working in ceilings (including pulling wire)
- Establish dust and debris control
- Maintain ventilation and environmental controls
- Develop pedestrian and equipment traffic control
- Schedule continuous work site clean up


Purpose of ICRA

Determine risk of patient exposure to dust and debris


What is classification of work involved?

What is impact on areas above, below and adjacent to the work?

ASHE ICRA 2.0™ Toolkit | ASHE



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ASHE ICRA 2.0™ Toolkit

Tap into a comprehensive toolkit to address the need for a unified ICRA process and improve patient protection. The purpose of the ICRA process is to ensure that patients, staff, workers, and visitors are properly protected from infectious diseases while we work on providing an improved healing environment.



Tools



Process Guide



Education



ASHE ICRA 2.0™

Matrix of Precautions for Construction, Renovation and Operations

Step One:

Using Table 1, Identify the Activity Type (A-D).

Table 1 - Activity Type:

Type A	Inspection and non-invasive activities. Includes but is not limited to: <ul style="list-style-type: none">• Removal of ceiling tile for visual inspection-limited to 1 tile per 50 square feet with limited exposure time.• Limited building system maintenance (e.g., pneumatic tube station, HVAC system, fire suppression system, electrical and carpentry work to include painting without sanding) that does not create dust or debris.• Clean plumbing activity limited in nature.
Type B	Small-scale, short duration activities that create minimal dust and debris. Includes but is not limited to: <ul style="list-style-type: none">• Work conducted above the ceiling (e.g., prolonged inspection or repair of firewalls and barriers, installation of conduit and/or cabling, and access to mechanical and/or electrical chase spaces).• Fan shutdown/startup.• Installation of electrical devices or new flooring that produces minimal dust and debris.• The removal of drywall where minimal dust and debris is created.• Controlled sanding activities (e.g., wet or dry sanding) that produce minimal dust and debris.
Type C	Large-scale, longer duration activities that create a moderate amount of dust and debris. Includes but is not limited to: <ul style="list-style-type: none">• Removal of preexisting floor covering, walls, casework or other building components.• New drywall placement.• Renovation work in a single room.• Non-existing cable pathway or invasive electrical work above ceilings.• The removal of drywall where a moderate amount of dust and debris is created.• Dry sanding where a moderate amount of dust and debris is created.• Work creating significant vibration and/or noise.• Any activity that cannot be completed in a single work shift.
Type D	Major demolition and construction activities. Includes but is not limited to: <ul style="list-style-type: none">• Removal or replacement of building system component(s).• Removal/installation of drywall partitions.• Invasive large-scale new building construction.• Renovation work in two or more rooms.



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Matrix of Precautions for Construction, Renovation and Operations

Step Two:

Using Table 2, identify the Patient Risk Group(s) that will be affected. If more than one risk group will be affected, select the higher risk group.

Table 2 - Patient Risk Group:

Low Risk	Medium Risk	High Risk	Highest Risk
Non-patient care areas such as:	Patient care support areas such as:	Patient care areas such as:	Procedural, invasive, sterile support and highly compromised patient care areas such as:
<ul style="list-style-type: none">• Public hallways and gathering areas not on clinical units.• Office areas not on clinical units.• Breakrooms not on clinical units.• Bathrooms or locker rooms not on clinical units.• Mechanical rooms not on clinical units.• EVS closets not on clinical units.	<ul style="list-style-type: none">• Waiting areas.• Clinical engineering.• Materials management.• Sterile processing department - dirty side.• Kitchen, cafeteria, gift shop, coffee shop, and food kiosks.	<ul style="list-style-type: none">• Patient care rooms and areas• All acute care units• Emergency department• Employee health• Pharmacy - general work zone• Medication rooms and clean utility rooms• Imaging suites: diagnostic imaging• Laboratory.	<ul style="list-style-type: none">• All transplant and intensive care units.• All oncology units.• OR theaters and restricted areas.• Procedural suites.• Pharmacy compounding.• Sterile processing department - clean side.• Transfusion services.• Dedicated isolation wards/units.• Imaging suites: invasive imaging.

Step Three:

Match the Patient Risk Group (*Low, Medium, High, Highest*) from Step Two with the planned Construction Activity Project Type (*A, B, C, D*) from Step One using Table 3 to find the Class of Precautions (*I, II, III, IV or V*) or level of infection control activities required. The activities are listed in Table 5 – Minimum Required Infection Control Precautions by Class.

Table 3 - Class of Precautions:

Patient Risk Group	Project Type			
	TYPE A	TYPE B	TYPE C	TYPE D
LOW Risk Group	I	II	II	III*
MEDIUM Risk Group	I	II	III*	IV
HIGH Risk Group	I	III	IV	V
HIGHEST Risk Group	III	IV	V	V



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Matrix of Precautions for Construction, Renovation and Operations

Step Four:

Assess potential risk to areas surrounding the project. Using Table 4, identify the surrounding areas that will be affected and the type of impact that will occur. If more than one risk group will be affected, select the higher risk group using Table 2 - Patient Risk Group.

Table 4 - Surrounding Area Assessment

Unit Below:	Unit Above:	Unit Lateral:	Unit Behind:	Unit in Front:
Risk Group:	Risk Group:	Risk Group:	Risk Group:	Risk Group:
Contact:	Contact:	Contact:	Contact:	Contact:
Phone:	Phone:	Phone:	Phone:	Phone:
Additional Controls: <input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Dust control <input type="checkbox"/> Ventilation <input type="checkbox"/> Pressurization <input type="checkbox"/> Vertical Shafts <input type="checkbox"/> Elevators/Stairs	Additional Controls: <input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Dust control <input type="checkbox"/> Ventilation <input type="checkbox"/> Pressurization <input type="checkbox"/> Vertical Shafts <input type="checkbox"/> Elevators/Stairs	Additional Controls: <input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Dust control <input type="checkbox"/> Ventilation <input type="checkbox"/> Pressurization <input type="checkbox"/> Vertical Shafts <input type="checkbox"/> Elevators/Stairs	Additional Controls: <input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Dust control <input type="checkbox"/> Ventilation <input type="checkbox"/> Pressurization <input type="checkbox"/> Vertical Shafts <input type="checkbox"/> Elevators/Stairs	Additional Controls: <input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Dust control <input type="checkbox"/> Ventilation <input type="checkbox"/> Pressurization <input type="checkbox"/> Vertical Shafts <input type="checkbox"/> Elevators/Stairs
Systems Impacted: <input type="checkbox"/> Data <input type="checkbox"/> Mechanical <input type="checkbox"/> Med Gases <input type="checkbox"/> Hot/Cold Water	Systems Impacted: <input type="checkbox"/> Data <input type="checkbox"/> Mechanical <input type="checkbox"/> Med Gases <input type="checkbox"/> Hot/Cold Water	Systems Impacted: <input type="checkbox"/> Data <input type="checkbox"/> Mechanical <input type="checkbox"/> Med Gases <input type="checkbox"/> Hot/Cold Water	Systems Impacted: <input type="checkbox"/> Data <input type="checkbox"/> Mechanical <input type="checkbox"/> Med Gases <input type="checkbox"/> Hot/Cold Water	Systems Impacted: <input type="checkbox"/> Data <input type="checkbox"/> Mechanical <input type="checkbox"/> Med Gases <input type="checkbox"/> Hot/Cold Water



Infection Control Risk Assessment 2.0

Matrix of Precautions for Construction, Renovation and Operations

Table 6 - Minimum Required Infection Control Precautions | Upon Completion of Work Activity

Class of Precautions	Mitigation Activities (Performed upon Completion of Work Activity)
Classes I, II and III	<p>Cleaning:</p> <ol style="list-style-type: none"> Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. <p>HVAC Systems:</p> <ol style="list-style-type: none"> Remove isolation of HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. Verify the HVAC systems meet original airflow and air exchange design specifications.
Classes III, IV and V	<p>Class III (Type C Activities only), IV, and V precautions require inspection and documentation for downgraded ICRA precautions.</p> <p>Construction areas must be inspected by an infection preventionist or designee and engineering representative for discontinuation or downgrading of ICRA precautions.</p> <p>Work Area Cleaning:</p> <ol style="list-style-type: none"> Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. <p>Removal of Critical Barriers:</p> <ol style="list-style-type: none"> Critical barriers must remain in place during all work involving drywall removal, creation of dust and activities beyond simple touch-up work. The barrier may NOT be removed until a work area cleaning has been performed. All (plastic or hard) barrier removal activities must be completed in a manner that prevents dust release. Use the following precautions when removing hard barriers: <ol style="list-style-type: none"> Carefully remove screws and painter tape. If dust will be generated during screw removal, use hand-held HEPA vacuum. Drywall cutting is prohibited during removal process. Clean all stud tracks with HEPA vacuum before removing outer hard barrier. Use a plastic barrier to enclose area if dust could be generated. <p>Negative Air Requirements:</p> <ol style="list-style-type: none"> The use of negative air must be designed to remove contaminants from the work area. Negative air devices must remain operational at all times and in place for a period after completion of dust creating activities to remove contaminants from the work area and before removal of critical barriers. <p>HVAC systems:</p> <ol style="list-style-type: none"> Upon removal of critical barriers, remove isolation of HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. Verify the HVAC systems meets original airflow and air exchange design specifications.

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Bundle of Key Methods for Preventing Filamentous Fungal Infections

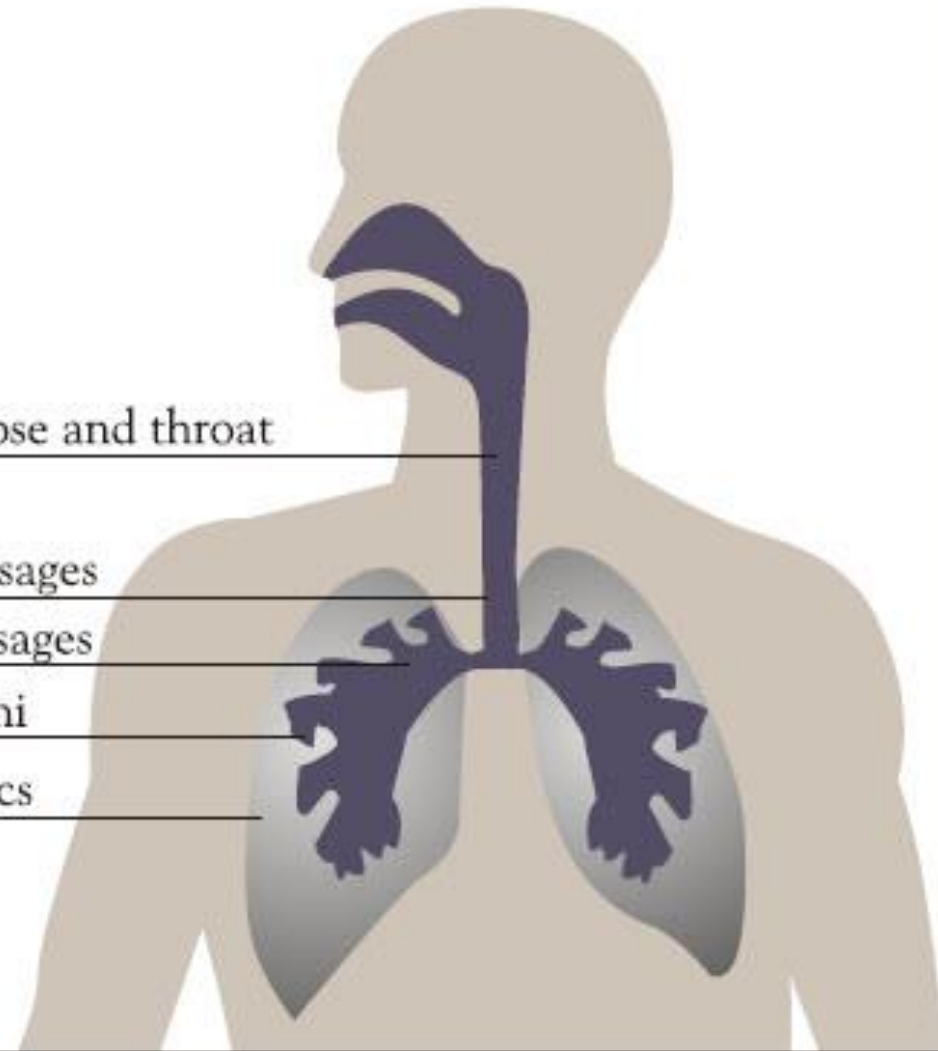
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Reference: CDC Guidelines for Environmental Infection Control in Health-Care Facilities 2015

Where airborne particulate go.

Particle Size	Effect
<u>5.5 - 9.2 microns</u>	Lodges in nose and throat
<u>3.3 - 5.5 microns</u>	Main breathing passages
<u>2.0 - 3.3 microns</u>	Small breathing passages
<u>1.0 - 2.0 microns</u>	Bronchi
<u>0.3 - 1.0 microns</u>	Air sacs

PM 10 refers to particulate matter that is less than 10 microns in size.



Working above the ceiling

- The ceiling is a prime area for major dust and debris
- Mold and bacteria grow above the ceiling.
- Infection Prevention Rules in *some but not all* hospitals:
 - When looking above the ceiling for 5 minutes or less no containment is needed.
 - If looking longer than 5 minutes or if working above the ceiling, (i.e., plumbing, replacing wiring, HVAC, cable pulls etc.) a containment **MUST** be used.



Ceiling Containment



Temporary

- • Good for smaller construction projects and maintenance tasks, such as replacing ceiling tiles or replacing fluorescent lamps.
- • Abatement offers two, cost-effective temporary construction enclosures for applications where it is not practical to build a rigid barrier around the work zone





Ventilation

If mandated by the ICRA, negative air pressure must be maintained in the construction area

Use of a HEPA Filter System, when possible, will help maintain negative air pressure

Supply ducts should be blocked off and return air ducts should be covered with pleated air filters

Exhaust fans may be used in conjunction with a HEPA Filter System and must run continuously

Traffic Control

- Entry and exit routes must be limited to those openings that result in the least amount of exposure to patients, staff, and visitors. When possible, use dedicated doors, elevators, and stairways.
- All trash must be completely covered when being removed from the work site. Watch for dust on the wheels of the cart also.
- Use the buddy system to clean dirt and debris from clothing to assure no dust is going out with you from the worksite (a vacuum equipped a HEPA filtration system can be used to remove dust from clothing.)

Clean up of work site

Walk off or tacky mats/ wet towels at the entrance and exit of each site

Workers are responsible for vacuuming walk-off dust mats frequently and as needed

Any dust or debris outside of the work site area must be vacuumed/damp mopped immediately

Vacuum cleaners must be equipped with a HEPA filtration system

Leaving the work site

- What comes in, STAYS IN!!
- When leaving the worksite on breaks or for meals, be sure to remove dust from clothes and shoes **AT THE WORK SITE.**
- Use the buddy system to make sure all dust is removed completely
- Make sure trash and equipment or covered before leaving work site



Trash and debris

- All debris removed from construction site **must be covered**
- Roll wheels over sticky mat/wet towel to remove dust
- Follow path with least patient/visitor involvement



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Maintain heightened awareness

Include in Infection
Prevention Program
Infection Control
Risk Assessment

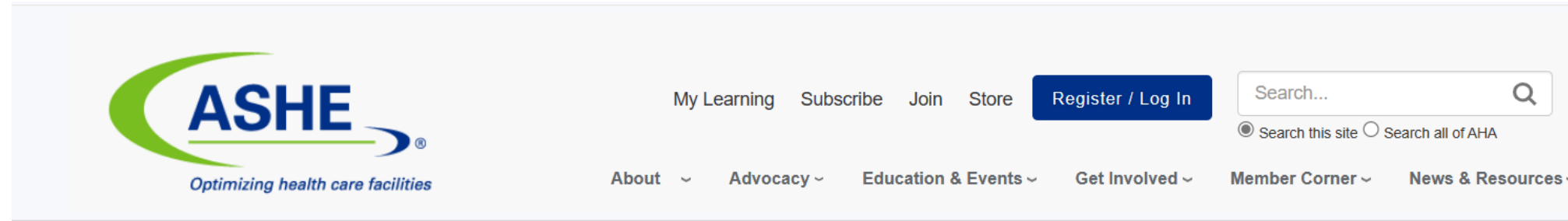
Communicate with
clinical laboratory

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Environmental Rounding Tool | ASHE




Environmental Rounding Tool



Facilities managers are experts at mitigating life and patient safety issues, but many struggle to control infection risks in the hospital environment during construction or while performing maintenance and repairs. What if we treated infection risk for facilities the same way we do with patients, where infection is defined as the "invasion and growth of germs in the building system"?

This tool helps facilities managers apply the tactics of building system maintenance to infection control by identifying opportunities for infection risk during rounding.

 [Download Tool](#)

Members download this tool. [Click here](#) to join ASHE!

Check out the related *HFM* magazine article, (coming soon)

Particle Counter

- Evaluate whether dust particles or mold spores are escaping when contractors enter or exit job site
- Verify that HEPA air machines are working properly
- First, measure the # of particles being drawn into the HEPA machine
- Then, measure the # coming out of the exhaust
- Calculate the percent reduction

$$\frac{(\text{Particle Count at Intake} - \text{Particle Count at Exhaust})}{\text{Particle Count at Intake}} \times 100$$



Differential Manometer

- Measure difference in pressure between two areas to confirm negative air on a construction site



Moisture Meter

- Water leak or plumbing issue drywall assessment



Environmental sources of water-associated infections

Potable water systems and cooling towers

Flush sinks

Faucet aerators

Hoppers and toilets

Eyewash/drench shower stations

Chest/ice machines

Water baths

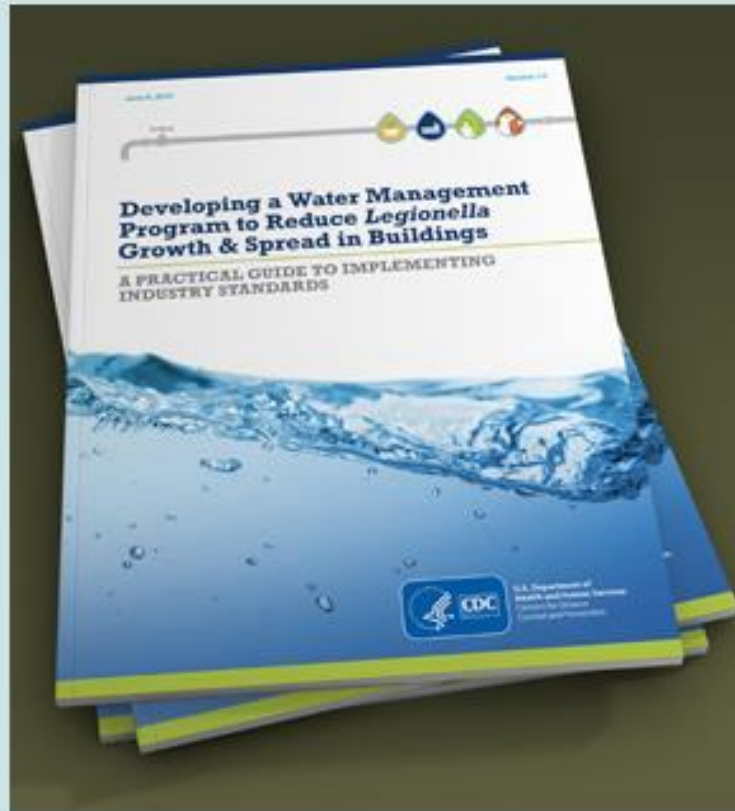
Whirlpool or spa-like baths

Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings

A PRACTICAL GUIDE TO IMPLEMENTING
INDUSTRY STANDARDS



Download the Toolkit



<https://www.cdc.gov/legionella/downloads/toolkit.pdf>

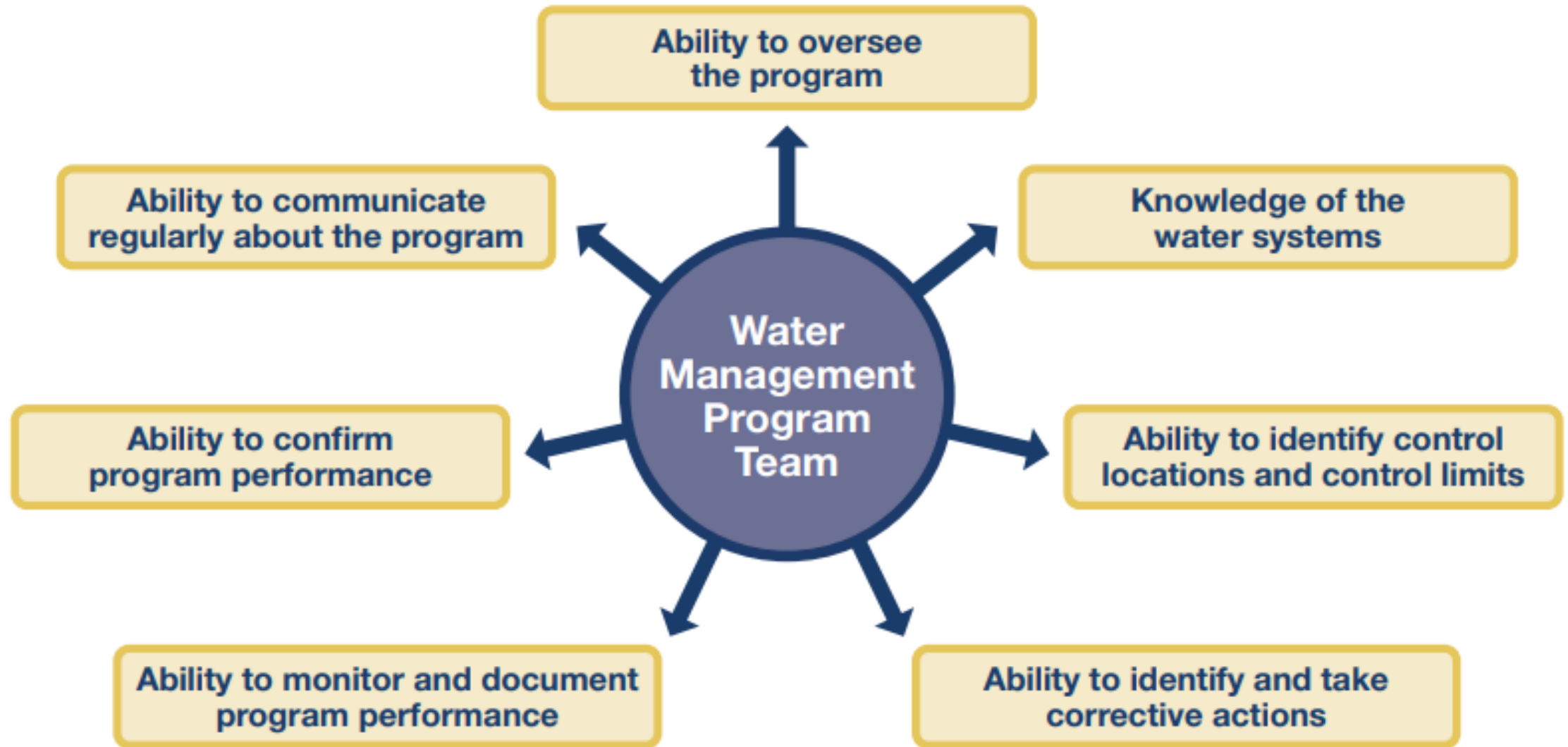
Identifying Buildings at Increased Risk

Survey your building (or property) to determine if you need a water management program to reduce the risk of *Legionella* growth and spread.

If you answer **YES to any of questions 1 through 4, you should have a water management program for *that building's* hot and cold water distribution system.**

Healthcare Facilities

- Yes ____ No ____ 1. Is your building a healthcare facility where patients stay overnight or does your building house or treat people who have chronic and acute medical problems[†] or weakened immune systems?
- Yes ____ No ____ 2. Does your building primarily house people older than 65 years (like a retirement home or assisted-living facility)?
- Yes ____ No ____ 3. Does your building have multiple housing units and a centralized hot water system (like a hotel or high-rise apartment complex)?
- Yes ____ No ____ 4. Does your building have more than 10 stories (including basement levels)?



Infection
Control
Training for
Construction
I UBC-ICRA



Summary/Tips for Success

Credit: Charles Ash and Christy Wisdom

Communicate

- Be present, respectful and nosy
- Be assertive, competent, helpful, and consistent

Emphasize safety

Start early and establish project timeline

Don't be afraid to ask for help

Learn about competing priorities

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