Legionella Update and Sampling

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Pinchin Environmental Ltd.

- Pinchin Environmental, established in 1981, 250 employees
- Part of the Pinchin Group of Companies
- Over 30 offices across Canada, more than 450 employees
IAQ & Mould Services

- IAQ investigations
- Mould, bacteria contamination
- Legionella consulting, testing
- Management programs
- Construction infection control
- Building science investigations and repair

Laboratory Services

- Mould
- Legionella
- Asbestos
Background
Summary on Legionella

Legionella Origin

Water Supplies → Aerosol → Reservoir → Host → Infected Host
Legionnaires’ Disease

- Legionnaires’ disease is a form of pneumonia.
- Carries a fatality rate of approximately 10% to 15% in otherwise healthy individuals.
- Caused by inhalation of aerosols containing Legionella bacteria.

Bacteria Responsible

- *Legionella pneumophila*, one species of the family of Legionella, is the causative species of more than 90% of reported cases.
- *L. pneumophila* has several Serogroups:
  - Serogroup 1 is the most frequently identified form of the bacterium isolated from patients with Legionnaires' disease.
  - Serogroup 4 and 6 are the second and third types linked with Legionnaires' disease.
Routes of Exposure

• Contaminated water presents greatest risk when airborne and aerosolized in a size of 1 to 5 micrometers.
• This size can be inhaled as an aerosol (fine water droplets) deeply into the lung.
• Small droplets can be created by shower heads, aerators on faucets, spray nozzles, bubbles breaking up.

Recent Major Outbreak

• Toronto area Nursing Home, October 2005:
  • Approximately 135 persons became ill, 23 nursing home residents died.
  • Case reported in a passer-by.
  • $ 600 million class action suit approved – defendants claim against owner, engineering firm, maintenance firm, chemical supplier, alleging negligent sampling, diagnosis, maintenance, etc.
Legionella Contaminant Sources

• In studies conducted by Hodgson and Casey in 1998, several thousand Legionella samples collected from a variety of sources showed following colonization frequencies:
  • Domestic Hot Water Heaters 12.0%  
  • Potable Water Distribution Systems 7.0%  
  • Cooling Towers 6.3%

Legionella Contaminant Sources -- Water Temperature

• Legionella growth range in water, 20°C to 50°C.
• Ideal growth range in water 35°C to 46°C
• Water temperature
  • Hot water tank storage temperature 60°C or above.
  • Hot water delivered to source at a minimum of 50°C. May require thermostatic mixing valves to prevent scalding.
  • Cold water, no warmer than 20°C.
Legionella Contaminant Sources -- Cooling Tower

- Cooling tower operation:
  - Typical temperature ranges can be from 29°C to 35°C, “ideal growth range”.
  - Water droplets on discharge can be in a size range of less than 5 micrometers on older systems or those with poorly designed drift eliminators.
  - The air scrubbing action of the tower collects organic material and debris which serves as a nutrient for bacteria.

Typical Cooling Tower

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Update: Guidelines and Standards

ASHRAE STANDARD

• ASHRAE Guideline 12-2000.
• Minimizing the Risk of Legionellosis Associated with Building Water Systems.
• Provides specific environmental and operational guidelines for safe building operations to minimize risk of Legionella amplification.
ASHRAE Standard 12-200

- Provides best practices for:
  - System shutdown and start up.
  - Start up for drained system.
  - Start up for undrained (stagnant systems).
  - Emergency decontamination.
  - The Cooling Tower Institute provided emergency protocols.

ASHRAE STANDARD 12-2000 – Change

- Will be ASHRAE Standard SPC 188 - Prevention of Legionellosis Associated with Building Water Systems
- Is expected to be a risk Management Document modeled after HACCP food industry Hazard Analysis and Critical Control Points Methodology
ASHRAE STANDARD 12-2000 – Change

- ASHRAE Standard SPC 188 will be expected to include three directions to prevent Legionella:
  - Identify hazard: audits.
  - How is hazard controlled: establish SOP's, management programs etc.
  - Demonstrate control of hazard: Reporting and evidence that SOP's have controlled or eliminated hazard.

Cooling Technology Institute

- Guideline provides specific information and guidance to minimize Legionella in cooling towers.
- Recommends emergency disinfection when Legionella >1000 CFU/ml.
- Provides emergency procedure.
- Outlines design, maintenance procedures.
**Ministry of Labour**  
**Legionella Hazard Bulletin**

- MOL Information Bulletin  
  Workplace Health and Safety Guideline--Legionella  
  October 2005
- OH&S Act Section 25(2)(h), requires the employer “to take every precaution reasonable in the circumstances for the protection of a worker”.

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**Canadian Industry Standards**

- Construction Safety Association of Ontario (CSAO) issued a Health and Safety Advisory for cooling towers.
- Industrial Accident Prevention Association (IAPA) recommends preventative measures.
- CSA Z317.13-07 Health Care Facilities IPAC.
- CSA Z317.2-10 HVAC Health Care Facilities.
Regie du batiment Quebec

• Quebec Government provides recommendations to prevent Legionnaire’s disease from cooling towers:
  • Develop a written management program including instructions for inspections, maintenance, cleaning specific components etc.
  • Train staff and conduct water testing.

City of Hamilton
Cooling Tower Bylaw

• Proposing a Cooling Tower Registry Bylaw
  • Building owners to register towers, update records for cooling tower operation and follow maintenance procedures.
  • Penalties when information not updated or registered.
Environmental Sampling Media

- Sampling bottles, contain sodium thiosulphate:
  - 1000 mL for potable water.
  - 100 mL for cooling towers.
- Swabs contain a buffing solution.
Environmental Sampling Analysis

• Sampling and Methods
  • The “Gold Standard” - Culturing - swab or water samples are collected. Results within 10 -14 days.
  • Important that the laboratory that can identify:
    • Serotype 1, Serotype 2-14,
    • *Legionella pneumophila* species,
    • *Legionella* genus
    • Concentrations in CFU/mL

Water Sampling Why?

• Sampling* for Legionella may be appropriate if carried out for specific purpose:
  • Tracing source of outbreak.
  • Verifying effectiveness of water treatment protocol.
  • Verifying that decontamination procedures have been effective.
  • In Health Care, where patient risk to Legionella exposure is high.

* ASHRAE Standard 12-2000
Respiratory Protection

• Wear respiratory protection if potential for exposure to high concentrations of aerosols exists:
  • Cooling towers.
  • In a facility were an outbreak has been confirmed.
• Fit tested half face respirator with P100 filters.

Environmental Sampling Sites -- Potable Water

• Important to achieve a clear understanding of building/system operations:
  • Domestic cold and hot water systems, inclusive of incoming water main, HW storage tanks.
  • Any “Dead Legs”.
Environmental Sampling -- Potable Water

- Collect water samples from representative system points
  - Hot water systems, pre and post flush for faucets and storage vessels.
  - Cold water, first draw, flush.

Swab Sampling -- Biofilm

- Water samples cannot identify Legionella that may be entrapped in biofilm:
  - Biofilm can protect bacteria, reduce effectiveness of disinfection.
  - An issue on corroded surfaces e.g. domestic hot & cold water systems.
Environmental Swab Sampling -- Potable Water

• Swab samples collected to evaluate biofilm:
  • Collect swabs first behind aerators, shower heads.
  • Collect water samples with aerators removed.

Environmental Sampling -- Cooling Towers

• Ensure all electrical disconnects for tower and pumps are “locked out and tagged out”.
• Wear fit tested respirator.
Environmental water Sampling -- Cooling Towers

• Collect sample from each sump, even if water in sumps is combined.
• Collect samples away from ballcocks and chemical feed points.

Environmental Swab Sampling -- Cooling Towers

• Collect sample by lightly scrubbing and rolling, just above and below water line:
  • Drift eliminators
  • Exposed fill
  • Blank sample
Environmental Sampling -- Water Temperature

- Record water temperature during:
  - Pre and post flush from hot and cold water at faucets, showers. Collect nearest to source and furthest.
  - Pre and post flush from hot water storage tanks.
  - Cooling tower sumps.
Environmental Sampling Laboratory Selection

- Double check sample labeling numbering etc.
- Complete chain of custody.
- Pack samples in insulated containers with freezer packs---packs must not contact containers.
- Deliver to laboratory within 24 hours.

OSHA Guideline for Interpretation of Legionella Tests, Commercial Buildings

<table>
<thead>
<tr>
<th>Action</th>
<th>Cooling Tower (CFU/ML)</th>
<th>Domestic Water (CFU/ML)</th>
<th>Humidifier (CFU/ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prompt Cleaning and/or Biocide Treatment of the System</td>
<td>100</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Immediate Cleaning and/or Biocide Treatment. Take Prompt Steps to Prevent Employee Exposure</td>
<td>1,000</td>
<td>100</td>
<td>10</td>
</tr>
</tbody>
</table>
Closure

To minimize Legionella growth building operators should:
1. Evaluate complete building for potential sources.
2. Develop a Preventative Management Program.
3. Train staff.
4. Perform documented preventative procedure.
5. Be proactive on minimizing sources.

Questions?

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