Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

LEGIONELLOSIS: KEY CONSIDERATIONS FOR CASE AND ENVIRONMENTAL EXPOSURE INVESTIGATION.

Presenters:

Maurice Coppin, Communicable Disease Consultant, PHO

Valerie Nguyen, Public Health Inspector, MLHU

Dru Sahai, Environmental Science Specialist, PHO

Agenda

- Epidemiology: The Ontario picture.
- Ecology of legionella species
- Transmission of legionella species
- Disease manifestation
- Case exposure investigation
- Environmental investigation
- Case study

Objectives

- Provide a glimpse of Ontario's Legionellosis case incidence: 2010-current,
- Discuss significant manifestations of Legionella infections,
- Explore challenges faced by Legionnaires disease (LD) case investigators and
- Discuss key aspects of Legionellosis case exposure investigation using Public Health Ontario's 2014 Case Report Form (CRF).

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

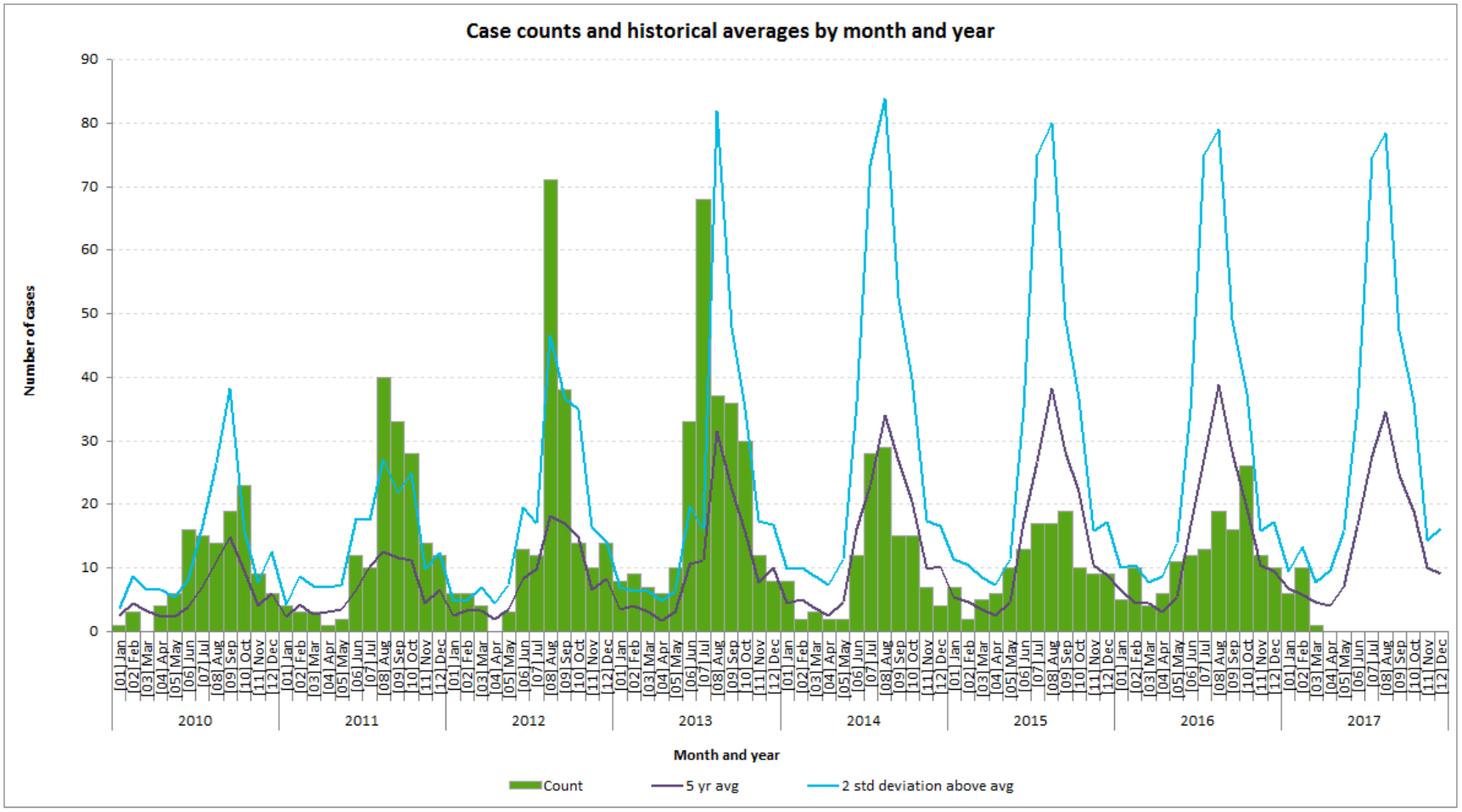
Epidemiology of Legionellosis in Ontario

Ontario
Agency for Health Protection and Promotion
Agence de protection et de promotion de la santé

Public Health Ontario | Santé publique Ontario

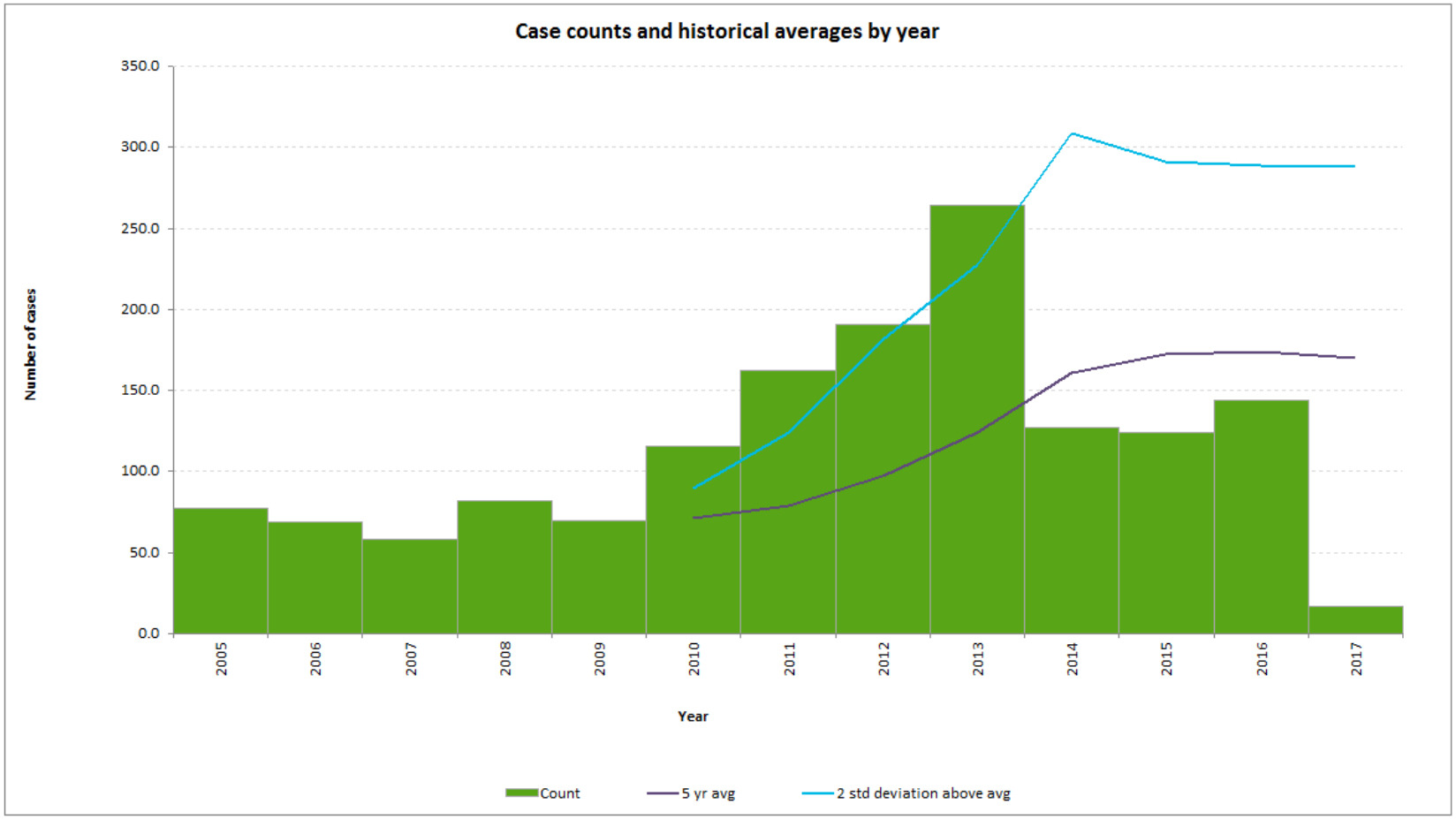
PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Legionella case count by month and year: Ontario, 2010– Apr 2017



Sources: Ontario data – Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario Ontario population – IntelliHEALTH Ontario, extracted by Public Health Ontario [2017/04/05].

Legionella case count by year: Ontario, 2005– Apr 2017

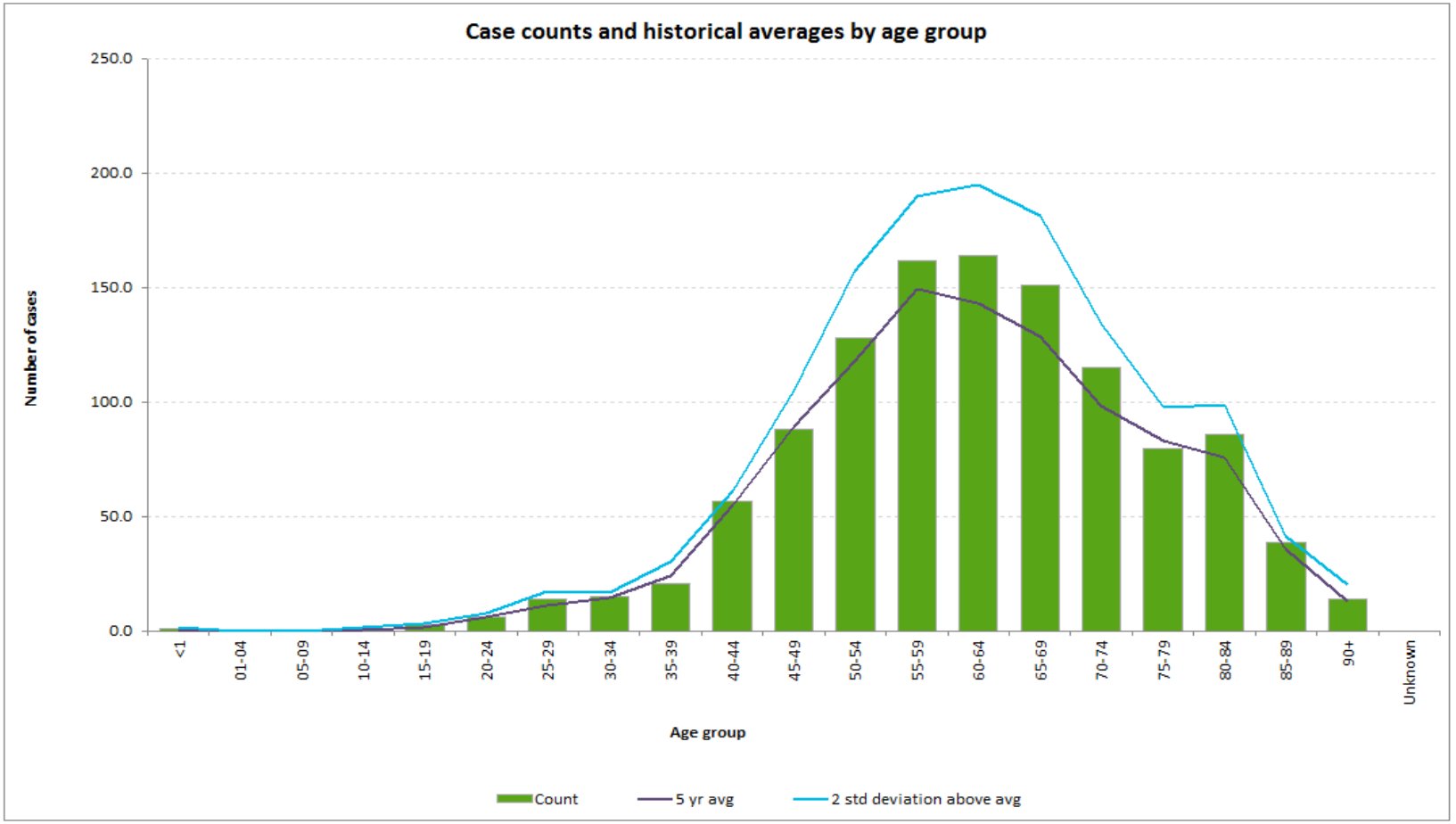


Sources: Ontario data – Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario. Ontario population – IntelliHEALTH Ontario, extracted by Public Health Ontario [2017/04/05].

Public Health Ontario | Santé publique Ontario

PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Legionella case counts by age-2010- Apr 2017

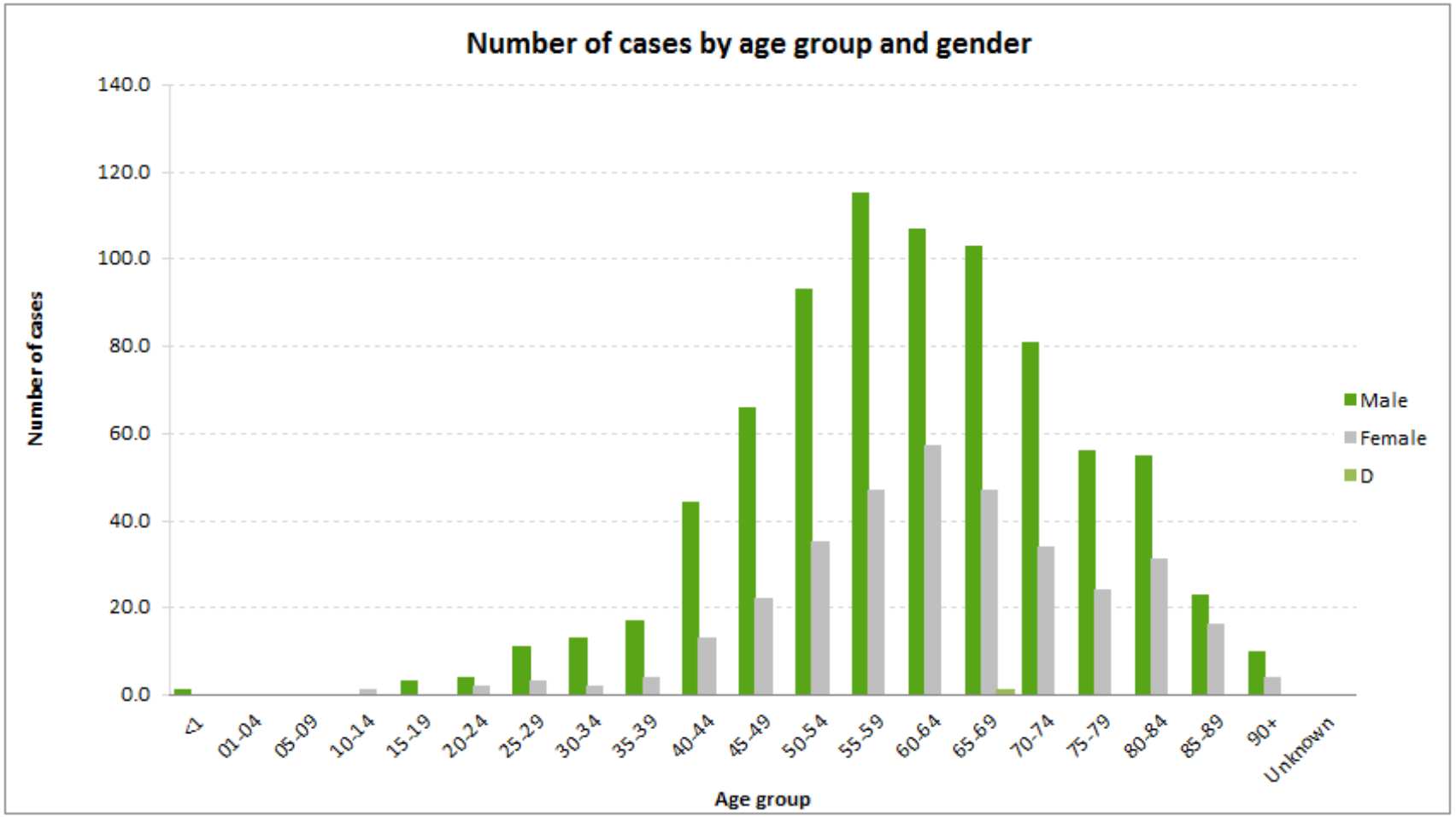


Sources: Ontario data – Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario Ontario population – IntelliHEALTH Ontario, extracted by Public Health Ontario [2017/04/05].

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

Incidence of Legionellosis by age and sex: Ontario, 2010- Apr 2017



Ontario Agency for Health Protection and Promotion (Public Health Ontario). Reportable diseases trends in Ontario, 2014. Toronto, ON: Queens Printer for Ontario; 2016

Public Health Ontario | Santé publique Ontario

PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

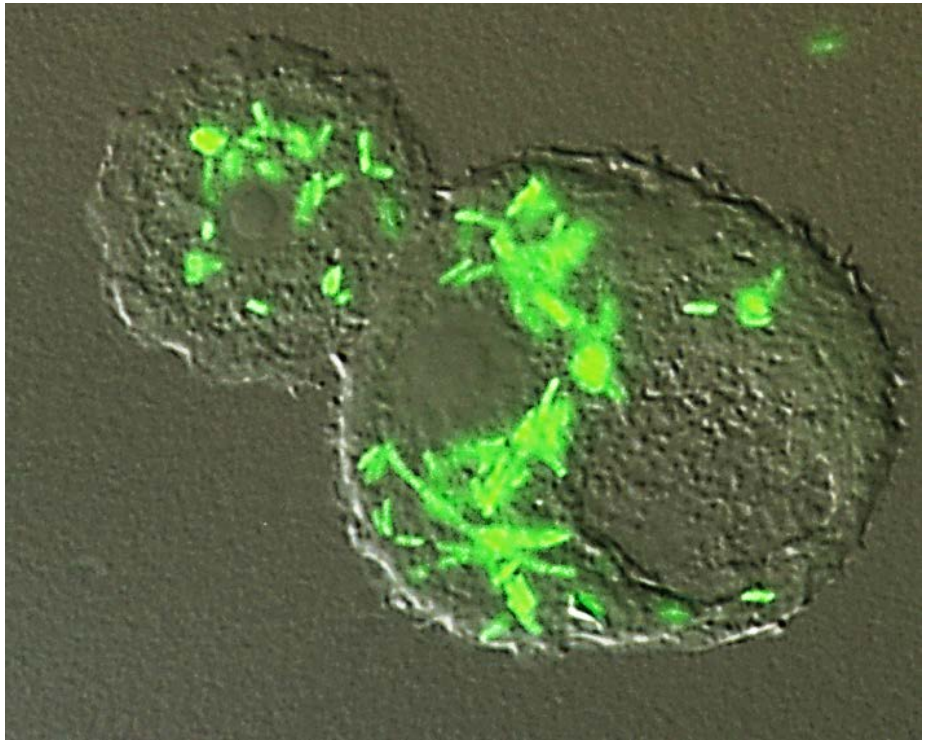
Selected health units legionellosis case counts and rates 2012-May 2017

Public Health Units	Year	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
	2012		2013		2014		2015		2016		2017			
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Total Count	Total Rate
Chatham-Kent Public Health Services	0	0	1	0.9	0	0	2	1.89	0	0	1	0.95	4	0.6
City of Hamilton Public Health Services	9	1.7	18	3.3	17	3.08	13	2.34	9	1.6	4	0.7	70	2.1
Elgin-St. Thomas Public Health	0	0	1	1.1	0	0	1	1.1	0	0	1	1.1	3	0.6
Grey Bruce Health Unit	0	0	1	0.6	0	0	0	0	1	0.61	0	0	2	0.2
Lambton Public Health	0	0	1	0.8	0	0	1	0.77	1	0.77	0	0	3	0.4
Middlesex-London Health Unit	8	1.7	4	0.9	4	0.86	3	0.64	4	0.84	1	0.21	24	0.9
Oxford County - Public Health & Emergency Services	0	0	3	2.7	2	1.8	0	0	0	0	0	0	5	0.7
Perth District Health Unit	0	0	0	0	0	0	0	0	2	2.55	0	0	2	0.4
Windsor-Essex County Health Unit	5	1.2	6	1.5	3	0.74	3	0.74	1	0.25	0	0	18	0.7

Sources: Ontario data – Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario Ontario population – IntelliHEALTH Ontario, extracted by Public Health Ontario [2017/04/05].

Ecology

Overview

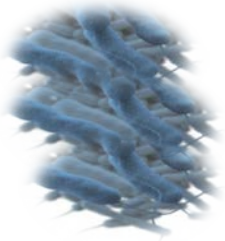


Abdel-Nour et al. 2013

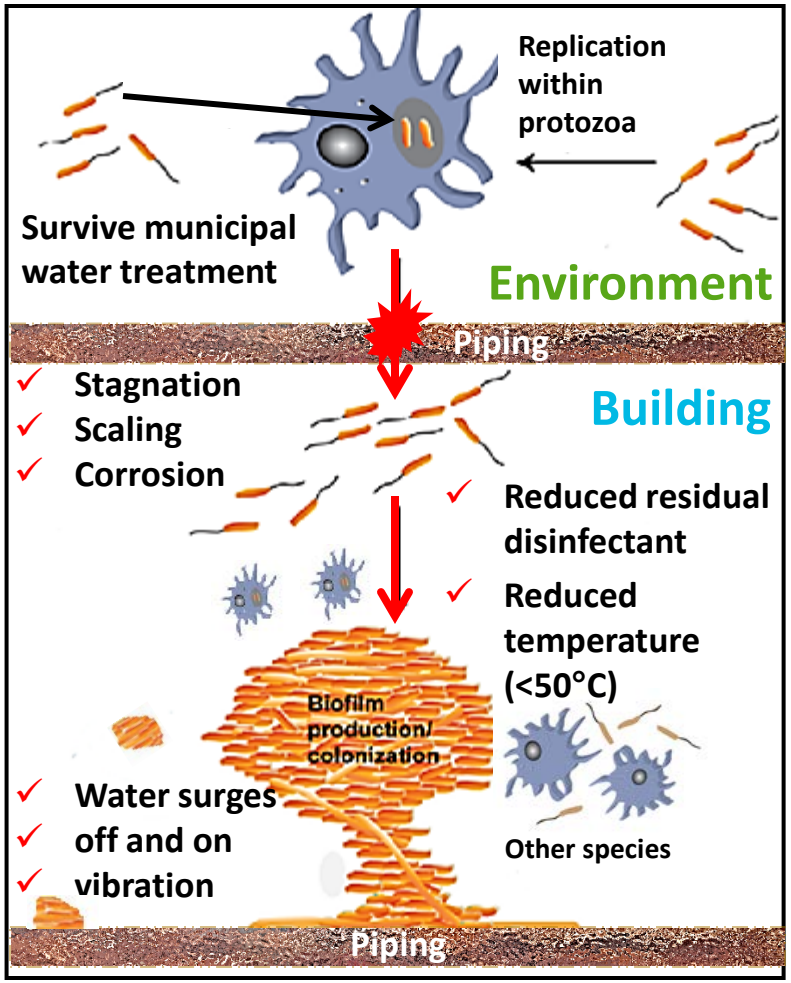
- Found in the natural environment including ground and surface water, moist soil (compost)
- Can exist in free floating form or within an amoeba host
- The amoeba (Acanthamoeba spp) provides nutrition and shelter
  - Protects *Legionella* from heat and disinfectants

Ecology: Overview (cont.)

Temperature

70 - 80°C	Dies very quickly
60°C	Survives several minutes
55°C	
>50°C	Survives several hours
20-50°C (25 – 42°C optimal growth conditions)	
<20°C	Survives but inactive

Biofilm



Source: Abdel-Nour et al. 2013 with modifications

Ecology: Overview (cont.)

- Biofilms can be difficult to eliminate once established even after thermal or chemical disinfection
- Water pressure surges, turning the system off and on, and vibration as experienced during construction can dislodge biofilm
  - Leads to large amounts of legionella in the water system
- The number of Legionella organisms will be greater in biofilm than water
  - Swab in addition to taking a water sample

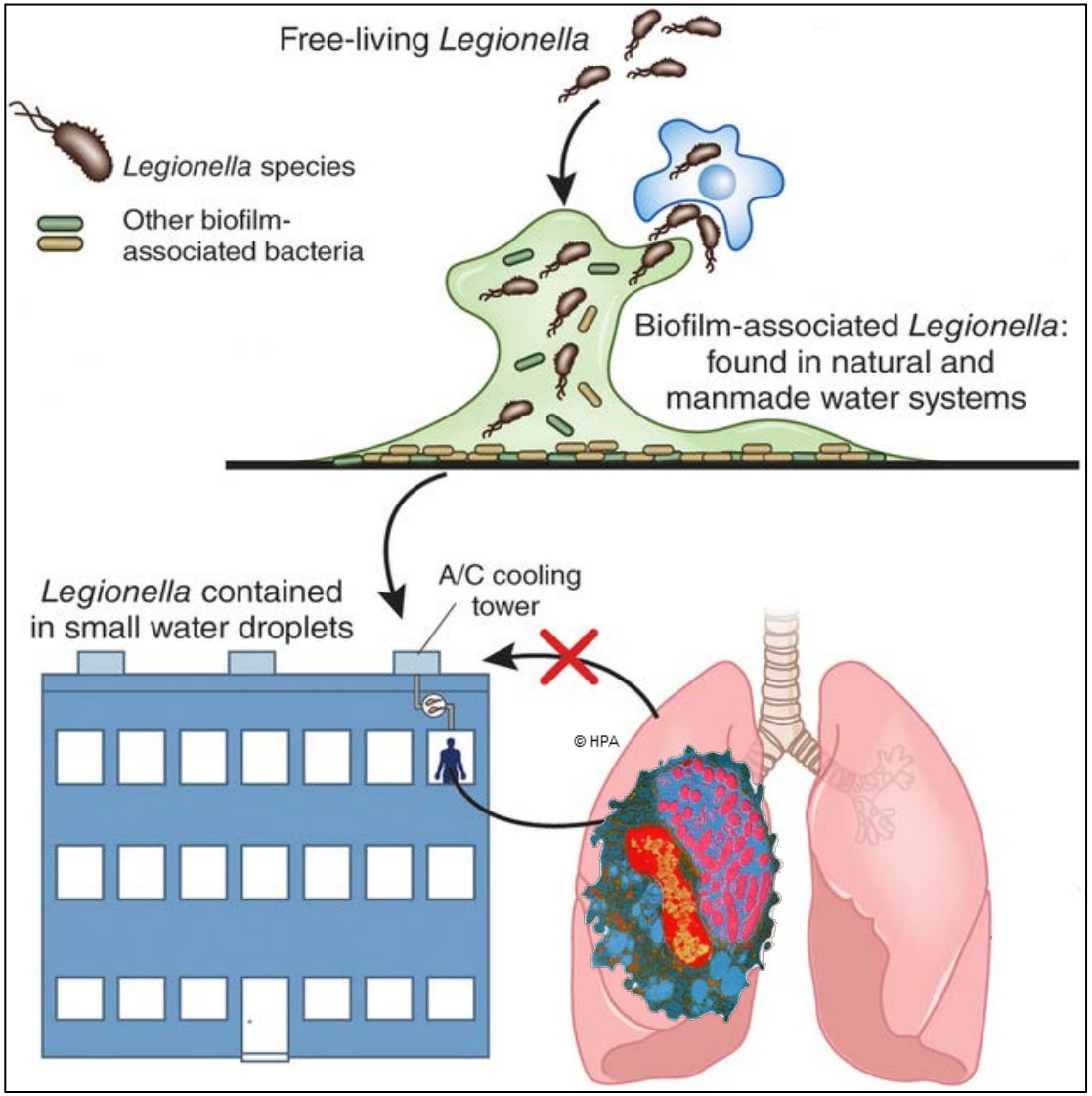
Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

Transmission

The risk of Legionella growth and transmission:

- A suitable temperature for multiplication (20°C and 50°C)
- A Lack of a biocide residual
- A source of nutrients
- A means of creating and disseminating aerosols that contain *Legionella*



Transmission

- Typically transmitted though inhalation of minute aerosolized water droplets that contains *legionella* (amoeba/*legionella*)
  - High humidity increases viability
- Can occur by aspiration/instillation of Legionella into the lungs
- Humans have traditionally been considered a dead-end host for *Legionella*
  - One probable case of person-to-person transmission has recently been reported (*N Engl J Med*. 2016;374;5:497-498).

Transmission

- Several infectious species (*Legionella pneumophila*, *Legionella longbeachae*) have been linked to exposures to soil, potting soil and compost
  - Mode of transmission?
- Typically acquired by a susceptible person
  - >50 years
  - Smoking/alcohol
  - Persons with underlying medical conditions
  - Immunosuppressed/immunocompetent
- LD has incubation period of 2 – 14 days (most commonly 2 – 10 days).

Manifestation

Pontiac Fever

Milder self-limiting flu-like illness

No pneumonia

Legionnaires' Disease

Severe and potentially fatal form of pneumonia

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

Case exposure investigation: PHO's CRF

Maurice Coppin,
Communicable Disease
Consultant, PHO

Ontario
Agency for Health Protection and Promotion
Agence de protection et de promotion de la santé

Case exposure investigation

Case exposure investigation

Environmental investigation

Laboratory investigation

Case exposure investigation

Surveillance & reporting

Legionella surveillance package

- Reviewed and updated, as needed, annually.
- Released to PHU in the ESD and Monitored Situations notice
- 2017 surveillance for the Legionella period started week of June 19

  - ❖ Legionellosis Case Report Form
  - ❖ Legionellosis Case Report Form instruction guide
  - ❖ Legionellosis Questions and Answers

PHUs that are interested in having this data included in PHO's supplementary analysis **may choose to send completed CRFs as attachments to iPHIS referrals to MOHLTC-PHD(0) CDOMINTAKE.** (Note: Files attached to iPHIS referrals must be under 5 MB in size per file).

Case Exposure Investigation

Case report form (CRF)

Objectives:

- To monitor legionellosis activity at the provincial level;
- To collect supplementary exposure data in a timely manner to:
  - Identifying clusters of cases based on potential common exposure locations.
  - Assessing the frequency of exposures reported among sporadic cases of legionellosis; and
- Provide public health units (PHUs) with a tool to guide general data collection required for iPHIS entry.

Case Exposure Investigation

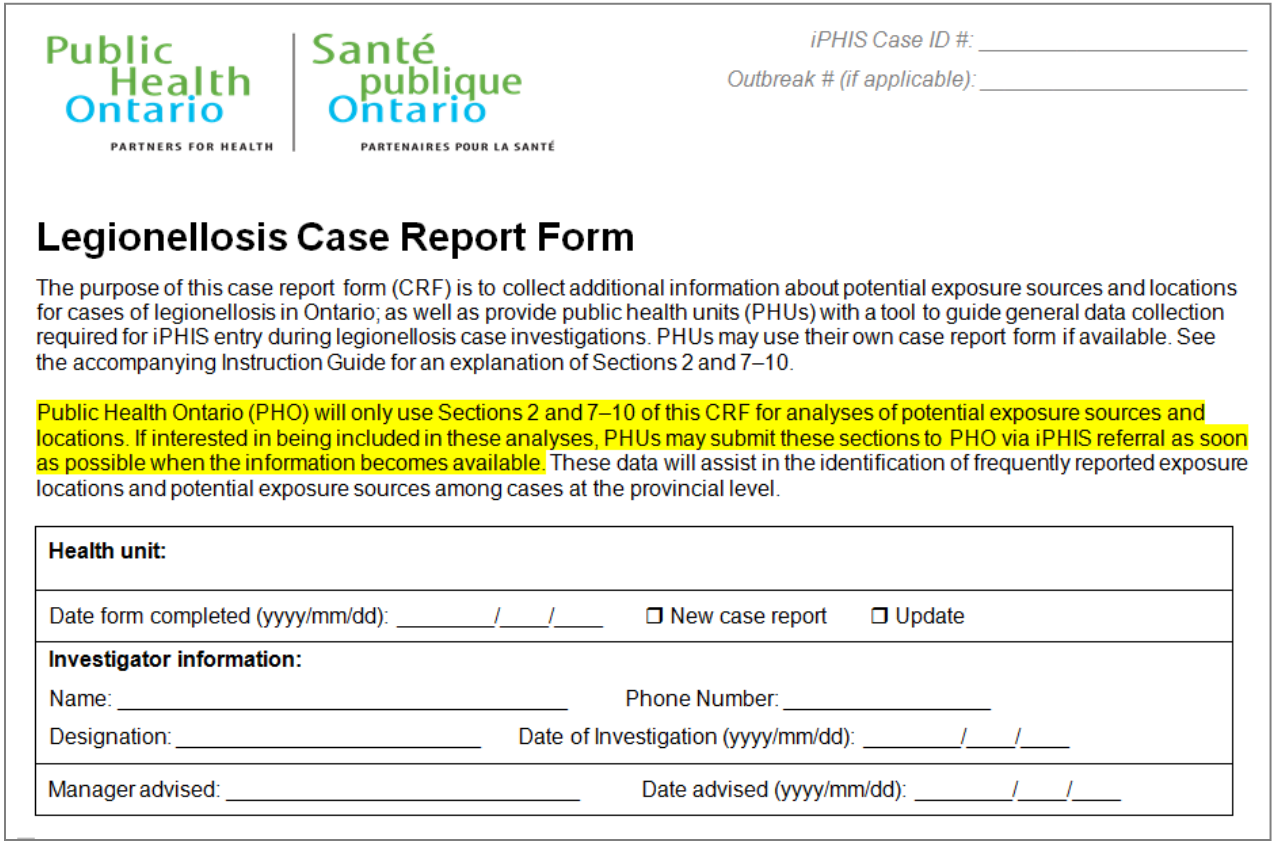
The CRF

- PHO encourages voluntary submission of CRFs via iPHIS referral from health units.
- Submission allows **cases that are reported on or after the start of the annual legionella season** to be included in the provincial analysis.
- PHO will collate CRF data (Sections 2, 7–10) for analysis of potential exposure location and sources.
- Enhanced Surveillance Directive (ESD) may be issued if incidence increases above expected.

Case Exposure Investigation

Legionellosis CRF

- Health units may submit via iPHIS referral for **all cases reported on or after June 1, 2017**
- Only Sections 2 and 7–10 of the CRF will be analysed by PHO



Public Health Ontario — PARTNERS FOR HEALTH | Santé publique Ontario — PARTENAIRES POUR LA SANTÉ

iPHIS Case ID #: _____

Outbreak # (if applicable): _____

Legionellosis Case Report Form

The purpose of this case report form (CRF) is to collect additional information about potential exposure sources and locations for cases of legionellosis in Ontario; as well as provide public health units (PHUs) with a tool to guide general data collection required for iPHIS entry during legionellosis case investigations. PHUs may use their own case report form if available. See the accompanying Instruction Guide for an explanation of Sections 2 and 7–10.

Public Health Ontario (PHO) will only use Sections 2 and 7–10 of this CRF for analyses of potential exposure sources and locations. If interested in being included in these analyses, PHUs may submit these sections to PHO via iPHIS referral as soon as possible when the information becomes available. These data will assist in the identification of frequently reported exposure locations and potential exposure sources among cases at the provincial level.

Health unit:
Date form completed (yyyy/mm/dd): ____/____/____ ❒ New case report ❒ Update
Investigator information: Name: _____ Phone Number: _____ Designation: _____ Date of Investigation (yyyy/mm/dd): ____/____/____
Manager advised: _____ Date advised (yyyy/mm/dd): ____/____/____

Case Exposure Investigation

Legionellosis CRF

1. CASE DETAILS

Health unit:
Date form completed (yyyy/mm/dd): _____/____/____ ❒ New case report ❒ Update
Investigator information: Name: _____ Phone Number: _____ Designation: _____ Date of Investigation (yyyy/mm/dd): _____/____/____
Manager advised: _____ Date advised (yyyy/mm/dd): _____/____/____

1. CASE DETAILS	
Aetiologic agent	❒ *L. pneumophila* ❒ *Legionella*, species unspecified ❒ Other *Legionella* species (specify): _____ **Serogroup:** _____ ❒ Unknown
Classification	❒ Confirmed ❒ Probable ❒ Person under investigation ❒ Does not meet Classification date (yyyy/mm/dd): _____/____/____

Legionellosis Case Report Form

2. CLIENT DEMOGRAPHICS

2. CLIENT DEMOGRAPHICS

Initials: | Gender: ❒ Male ❒ Female ❒ Transgender ❒ Other ❒ Unknown

Date of Birth (yyyy/mm/dd): _____/____/____ Age:_____(years) ❒ Unknown

Primary residence: ❒ Home ❒ LTCH ❒ Retirement home ❒ Acute care hospital ❒ Homeless
❒ Other (specify):_____

Address: _____ Apt #: _____

City: _____ **Postal code:** _____ Phone (Home/Cell): (_____)_____

If applicable, name of facility: _____

Admission date (yyyy/mm/dd): _____/____/____ Discharge date (yyyy/mm/dd): _____/____/____

Work: ❒ Employed ❒ Unemployed ❒ Retired ❒ Not specified ❒ Other (specify): _____

Occupation: _____

Place of employment: _____

Address: _____ Suite #: _____

City: _____ **Postal code:** _____ Phone (Work): (_____)_____

If applicable, type of facility: ❒ LTCH ❒ Acute care hospital ❒ Retirement home

If applicable, please indicate last day at work (yyyy/mm/dd): _____/____/____

Did the client visit a LTCH, acute care hospital or retirement home during the incubation period? ❒ Yes ❒ No ❒ Unknown

If yes, type of facility: ❒ LTCH ❒ Acute care hospital ❒ Retirement home ❒ Other (specify): _____

Name of facility: _____

Address:_____ Suite #: _____

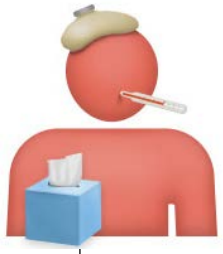
City: _____ **Postal code:** _____ Phone (Work): (_____)_____

Most recent visit date (yyyy/mm/dd): _____/____/____ Frequency of visits (e.g., weekly, daily, etc.): _____

Public Health Ontario | Santé publique Ontario
PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Legionellosis Case Report Form

3. SYMPTOMS



3. SYMPTOMS									
Symptom	**Yes**	**No**	**Don't know**	**Not asked**	**Refused**	**USE AS ONSET (X only one)**	**Onset date/time (yyyy/mm/dd)**	**Recovery date/time (yyyy/mm/dd)**	**Duration (in days)**
Anorexia (loss of appetite)									
Chills									
Confusion									
Cough, productive									
Cough, non-productive (dry)									
Diarrhea									
Fever (Specify: ____ °C)									
Nausea									
Headache									
Malaise (feeling unwell)									
Myalgia (muscle aches/pain)									
Pneumonia									
Other, specify below:									

Public Health Ontario | Santé publique Ontario

PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Legionellosis Case Report Form

4. CLINICAL INFORMATION & 5. RISK FACTORS

4. CLINICAL INFORMATION

Chest X-ray performed: ❒ Yes ❒ No ❒ Don't know If yes, date (yyyy/mm/dd): _____/_____/_____

Chest X-ray results: _____

If case had pneumonia, indicate how the diagnosis was determined:

❒ Radiological evidence ❒ Clinical diagnosis ❒ Pathological evidence (upon autopsy)

Was case hospitalized? ❒ Yes ❒ No ❒ Unknown

If yes, name of hospital: _____ City:_____

Admission diagnosis: _____

Admission date (yyyy/mm/dd): _____/_____/_____ Discharge date (yyyy/mm/dd): _____/_____/_____

ER Visit Only	❒ Yes	❒ No	❒ Unknown	Date: (yyyy/mm/dd): _____/_____/_____
Admitted to ICU	❒ Yes	❒ No	❒ Unknown	Date: (yyyy/mm/dd): _____/_____/_____
On Ventilator	❒ Yes	❒ No	❒ Unknown	Date: (yyyy/mm/dd): _____/_____/_____

5. RISK FACTORS

Check all that apply:

- ❒ Chronic illness/underlying medical condition (specify): _____
- ❒ Immunocompromised (specify): _____
- ❒ Diabetes
- ❒ Use of respiratory therapy equipment
- ❒ Alcohol abuse
- ❒ Smoker
- ❒ Other (specify): _____

Legionellosis Case Report Form

6. OUTCOME & 7. ENVIRONMENTAL SAMPLING

6. OUTCOME

Recovered ❒ Yes ❒ No ❒ Unknown If yes, discharge date (yyyy/mm/dd): _____/_____/____
Death ❒ Yes ❒ No ❒ Unknown If yes, date of death (yyyy/mm/dd): _____/_____/____

If death occurred, was legionellosis the:
❒ Underlying cause ❒ Contributing factor ❒ Unrelated ❒ Cause of death is unknown

7. ENVIRONMENTAL SAMPLING

Were environmental samples collected? ❒ Yes ❒ No ❒ Unknown
If yes, indicate sample collection location(s): ❒ Home ❒ Health care facility ❒ Community

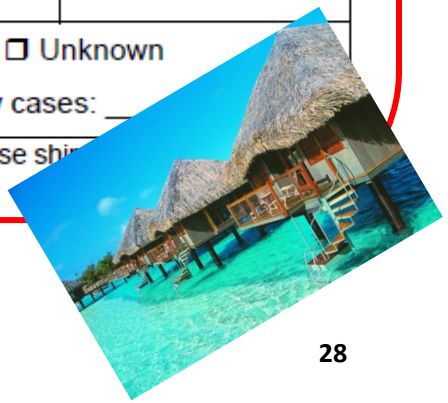
Public Health Ontario
PARTNERS FOR HEALTH
Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

Legionellosis Case Report Form

8. TRAVEL WITHIN INCUBATION PERIOD

8. TRAVEL WITHIN INCUBATION PERIOD					
Provide the details specified below if the case travelled outside the health unit jurisdiction in the 14 days before the onset of symptoms of legionellosis. This includes single day trips.					
City	Province *If outside of Ontario*	Country *If outside of Canada*	Accommodation/destination*	Dates of visit/stay (yyyy/mm/dd) From	To
				____/____/___	____/____/___
				____/____/___	____/____/___
				____/____/___	____/____/___
				____/____/___	____/____/___
				____/____/___	____/____/___
If suspected that the case was exposed during travel, are any other confirmed or probable cases linked to the same location?				❒ Yes ❒ No ❒ Unknown If yes, how many cases: ___	

*Accommodation/destination may include, for example: Hotel/motel, bed and breakfast, resort, hostel, lodge, cruise shi
residence.



Public Health Ontario | Santé publique Ontario

PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Legionellosis Case Report Form

9. EXPOSURE HISTORY

9. EXPOSURE HISTORY

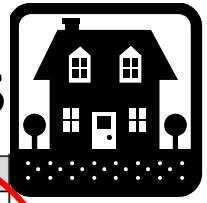
Please report all relevant exposures that occurred during the **14-day period prior to symptom onset**. Refer to the *Legionella* CRF Instruction Guide for definitions of exposures provided in the table below; however, please also report additional exposures to aerosolized water that may be associated with the acquisition of *Legionella* infection.

14-day period covers (yyyy/mm/dd): _____/_____/_____ to _____/_____/_____

In the 14 days before the onset of symptoms of legionellosis, did/was the case:

Exposure type	Yes	No	Unable to assess	Date(s) (yyyy/mm/dd)	Location(s) of exposure (include address if available)
Exposed to a whirlpool spa/hot tub					
Take a shower outside the home					
Exposed to vegetable/fruit mister machine (e.g,. in grocery store)					
Exposed to respiratory therapy equipment that uses water					
Visit the dentist for a check-up or treatment					
Exposed to decorative/ornamental fountains or other water displays					
Exposed to water storage systems, not otherwise specified here					

Legionellosis Case Report Form



10. MOST FREQUENT POTENTIAL EXPOSURE LOCATIONS

10. MOST FREQUENT POTENTIAL EXPOSURE LOCATIONS

This section is intended to capture the **locations where the case spent the most time** during the incubation period for *Legionella* (i.e., 14 days before symptom onset). Any location identified in the Exposure history section must be captured here; these locations are *inclusive of home, work, shopping centers and hotels*. Please provide a **Postal code** for all reported potential exposure locations.

14-day incubation period covers (yyyy/mm/dd): _____/_____/_____ to _____/_____/_____

PLEASE REPORT LOCATIONS IN DECREASING ORDER, BASED ON AMOUNT OF TIME AT THE LOCATION.

Location 1 – MANDATORY (Place where the case spent the most time)

❒ Home ❒ Work ❒ LTCH ❒ Retirement home ❒ Acute care hospital ❒ Other (specify): _____

Location name: _____

Address: _____ **Postal code:** _____

Exposure date range (yyyy/mm/dd): FROM _____/____/____ TO _____/____/____ (only enter TO date if applicable)

Location 2

❒ Home ❒ Work ❒ LTCH ❒ Retirement home ❒ Acute care hospital ❒ Other (specify): _____

Location name: _____

Address: _____ **Postal code:** _____

Exposure date range (yyyy/mm/dd): FROM _____/____/____ TO _____/____/____ (only enter TO date if applica

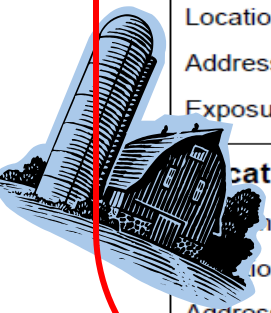
cation 3

ne ❒ Work ❒ LTCH ❒ Retirement home ❒ Acute care hospital ❒ Other (specify): _____

ion name: _____

Address: _____ **Postal code:** _____

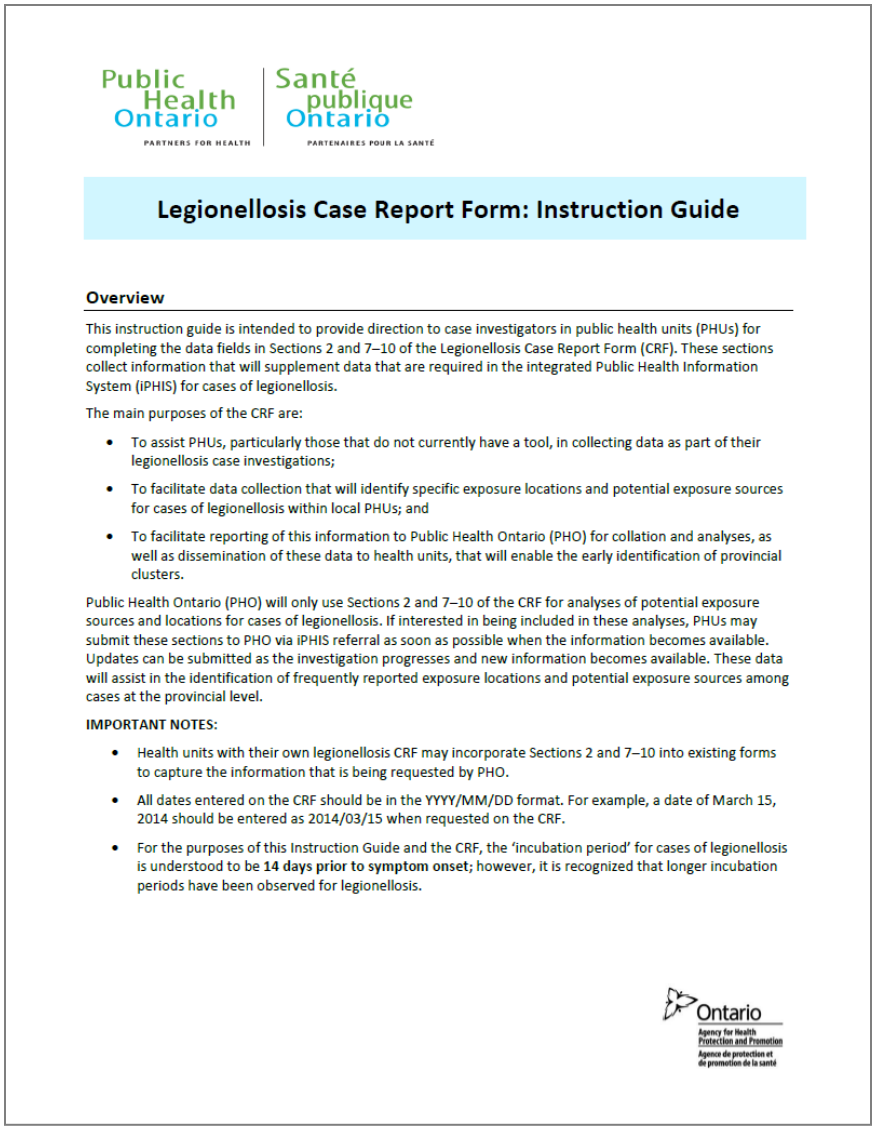
Exposure date range (yyyy/mm/dd): FROM _____/____/____ TO _____/____/____ (only enter TO date if applicable)



Legionellosis Case Report Form

Legionellosis CRF Instruction Guide

- Developed to assist investigators in completing the legionellosis CRF
- Provides direction for completing sections of the CRF that PHO will use for analyses
- Provides definitions for many of the exposure types



Public Health Ontario | Santé publique Ontario

PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Legionellosis Case Report Form: Instruction Guide

Overview

This instruction guide is intended to provide direction to case investigators in public health units (PHUs) for completing the data fields in Sections 2 and 7–10 of the Legionellosis Case Report Form (CRF). These sections collect information that will supplement data that are required in the integrated Public Health Information System (iPHIS) for cases of legionellosis.

The main purposes of the CRF are:

- To assist PHUs, particularly those that do not currently have a tool, in collecting data as part of their legionellosis case investigations;
- To facilitate data collection that will identify specific exposure locations and potential exposure sources for cases of legionellosis within local PHUs; and
- To facilitate reporting of this information to Public Health Ontario (PHO) for collation and analyses, as well as dissemination of these data to health units, that will enable the early identification of provincial clusters.

Public Health Ontario (PHO) will only use Sections 2 and 7–10 of the CRF for analyses of potential exposure sources and locations for cases of legionellosis. If interested in being included in these analyses, PHUs may submit these sections to PHO via iPHIS referral as soon as possible when the information becomes available. Updates can be submitted as the investigation progresses and new information becomes available. These data will assist in the identification of frequently reported exposure locations and potential exposure sources among cases at the provincial level.

IMPORTANT NOTES:

- Health units with their own legionellosis CRF may incorporate Sections 2 and 7–10 into existing forms to capture the information that is being requested by PHO.
- All dates entered on the CRF should be in the YYYY/MM/DD format. For example, a date of March 15, 2014 should be entered as 2014/03/15 when requested on the CRF.
- For the purposes of this Instruction Guide and the CRF, the 'incubation period' for cases of legionellosis is understood to be **14 days prior to symptom onset**; however, it is recognized that longer incubation periods have been observed for legionellosis.

Ontario
Agency for Health Protection and Promotion
Agence de protection et de promotion de la santé

Case Exposure Investigation

New developments and next steps

- Currently using a detection algorithms to detect case threshold signaling:
  - The start of the season, and
  - Abnormal increases within the season.
- Testing the use of a spatial cluster surveillance detection tool
  - use of postal codes to identified common potential exposure location/s for possible case cluster:
    - All addresses and associated postal codes linked to a case during the incubation period should be entered into iPHIS.
    - HU within an identified defined potential exposure location will be notified.

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

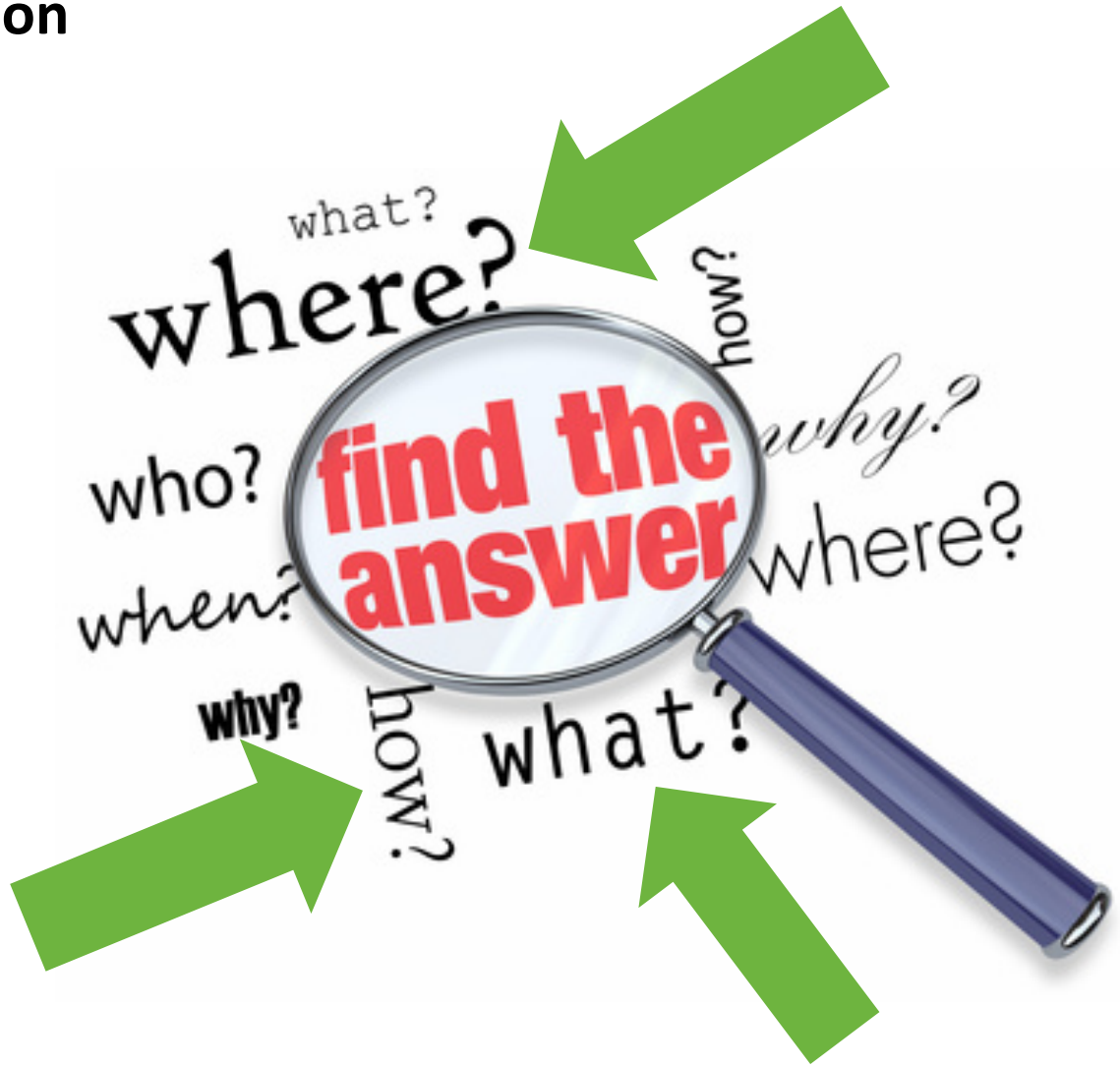
Case exposure investigation: Case interview

Valerie Nguyen, Public Health Inspector
MLHU

Ontario
Agency for Health Protection and Promotion
Agence de protection et de promotion de la santé

Case exposure investigation

Introduction



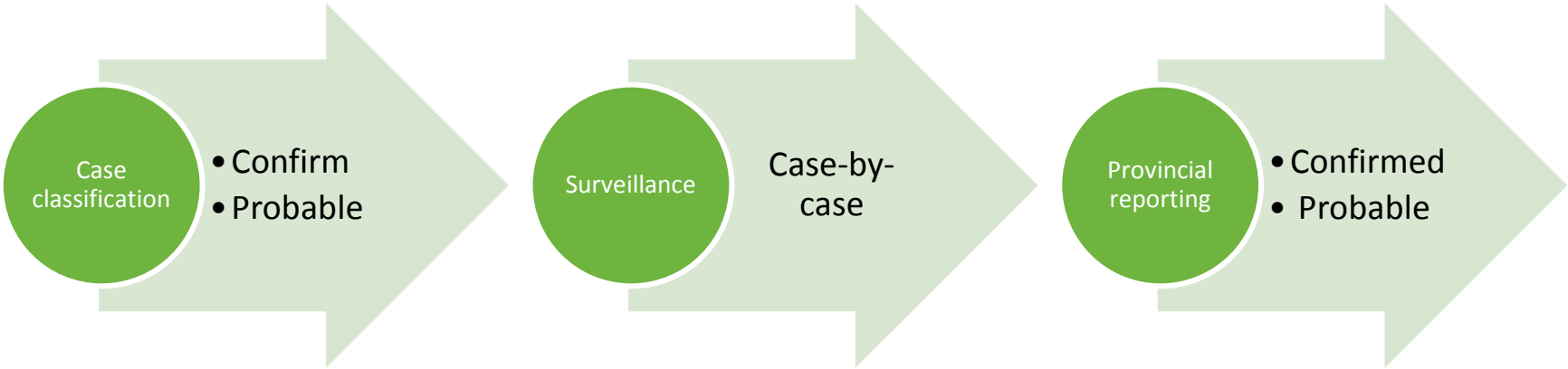
Case exposure investigation

Typical process

- Case presents to acute care facility.
- Case reported to HU in accordance with *HPPA, R.S.O 1990, c, H.7. Specification of Infectious Diseases, O. Reg 558-559/91*.
- Investigator consults: *Appendix A* and *Appendix B* of ID protocol.
- Investigation initiated by public health nurse (PHN) or public health inspector (PHI) .
- Case interview done by phone (may be done in person if needed)
- A standardize questionnaire is used to collect risk factors and potential exposure locations and sources.

Case exposure investigation

Surveillance & reporting



Case exposure investigation

Types of outbreaks/clusters:

Institutional

- Health care and correctional facilities

Travel related

- Hotels and cruise ships

Community

- Workplaces and sporadic

- Outbreaks (cluster) account for only 4% of cases
- LD is substantially underdiagnosed and under-reported
- Seasonal (June to November), peak -July
- Overall case fatality rate 5-30% (9% on average)
- US (2011-2013) 98% of cases hospitalized; 44 % in IC

✓ *Important that all potential sources of Legionella are rendered safe ASAP especially in healthcare settings.*

✓ *Workplace exposure should be reported to the Ministry of Labour.*

Case exposure investigation

Case Interviews

Legionellosis Case Report Form (CRF)

- Available from PHO – to assist in collecting additional information about potential exposure sources and locations for cases in Ontario.
- May be used as a tool to guide general data collection required for iPHIS entry
- PHUs may use their own case report form

Public Health Ontario | Santé publique Ontario
PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Case exposure investigation

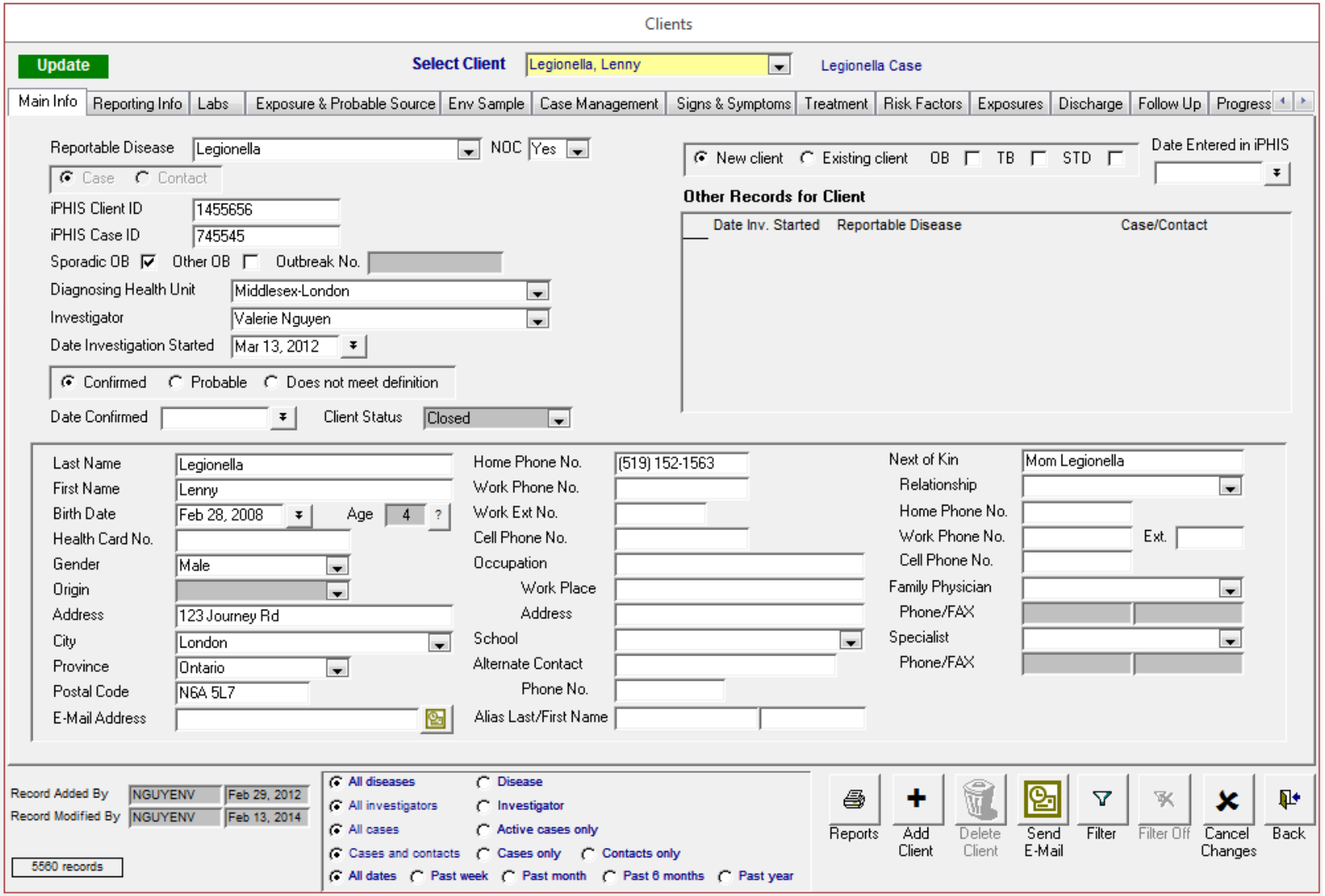
Challenges

- Time between onset of symptoms and confirmation of diagnosis.
- Severity of the disease process.
- Case inability to recall potential locations and sources of exposure.
- One effect of the disease process is sh
- Individuals who live alone.
- Distraught family members.

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

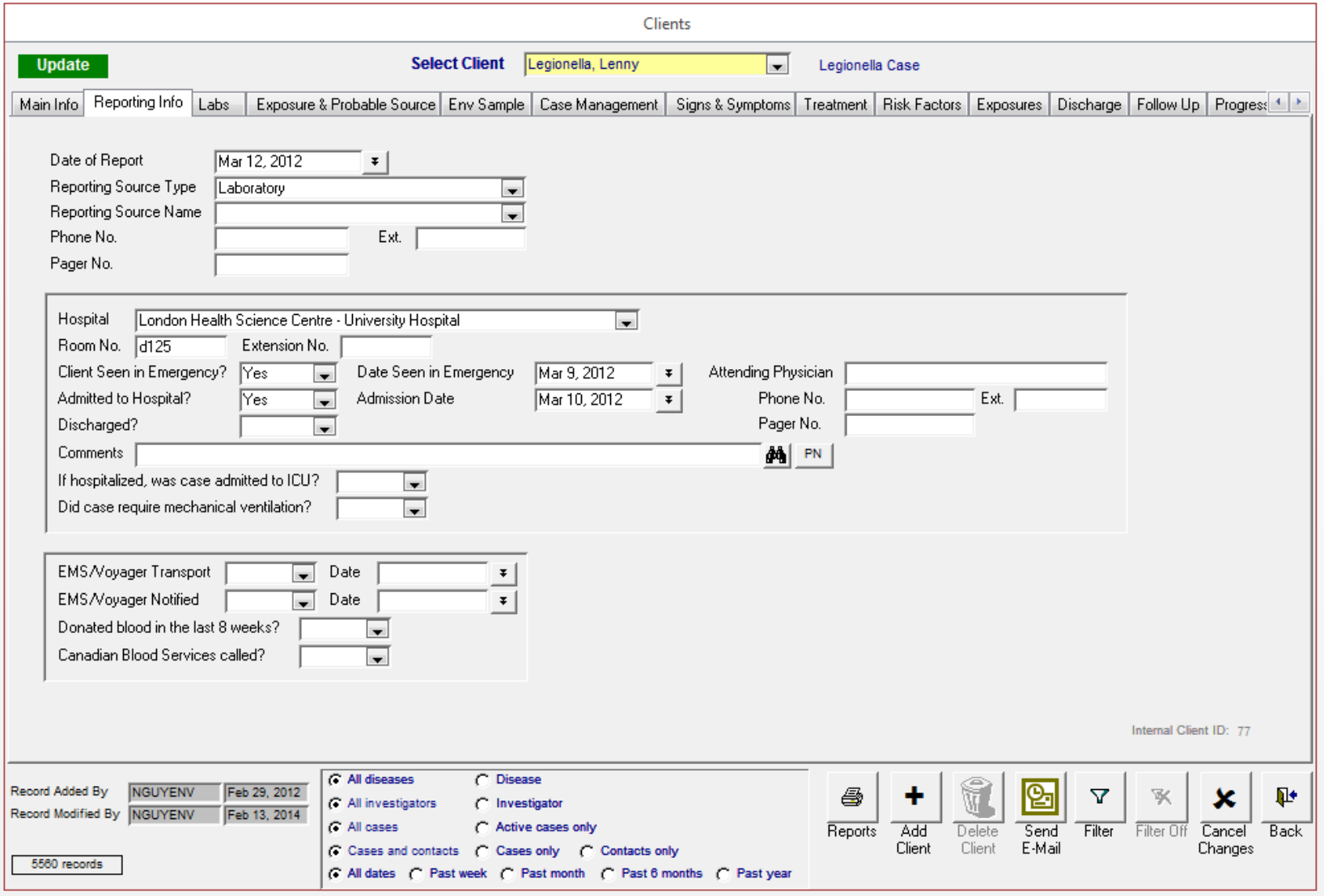
Middlesex-London Database



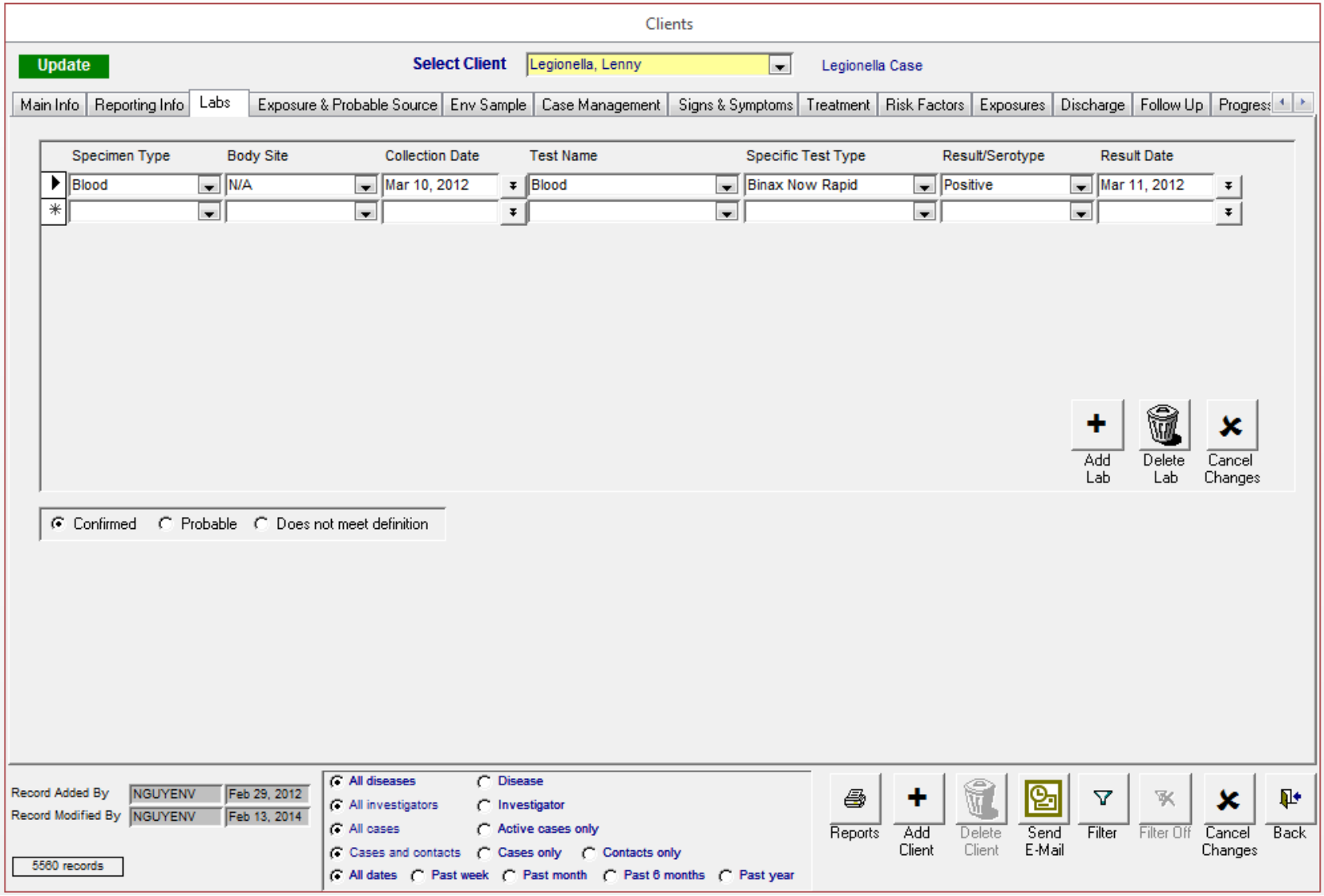
Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

Reporting Info



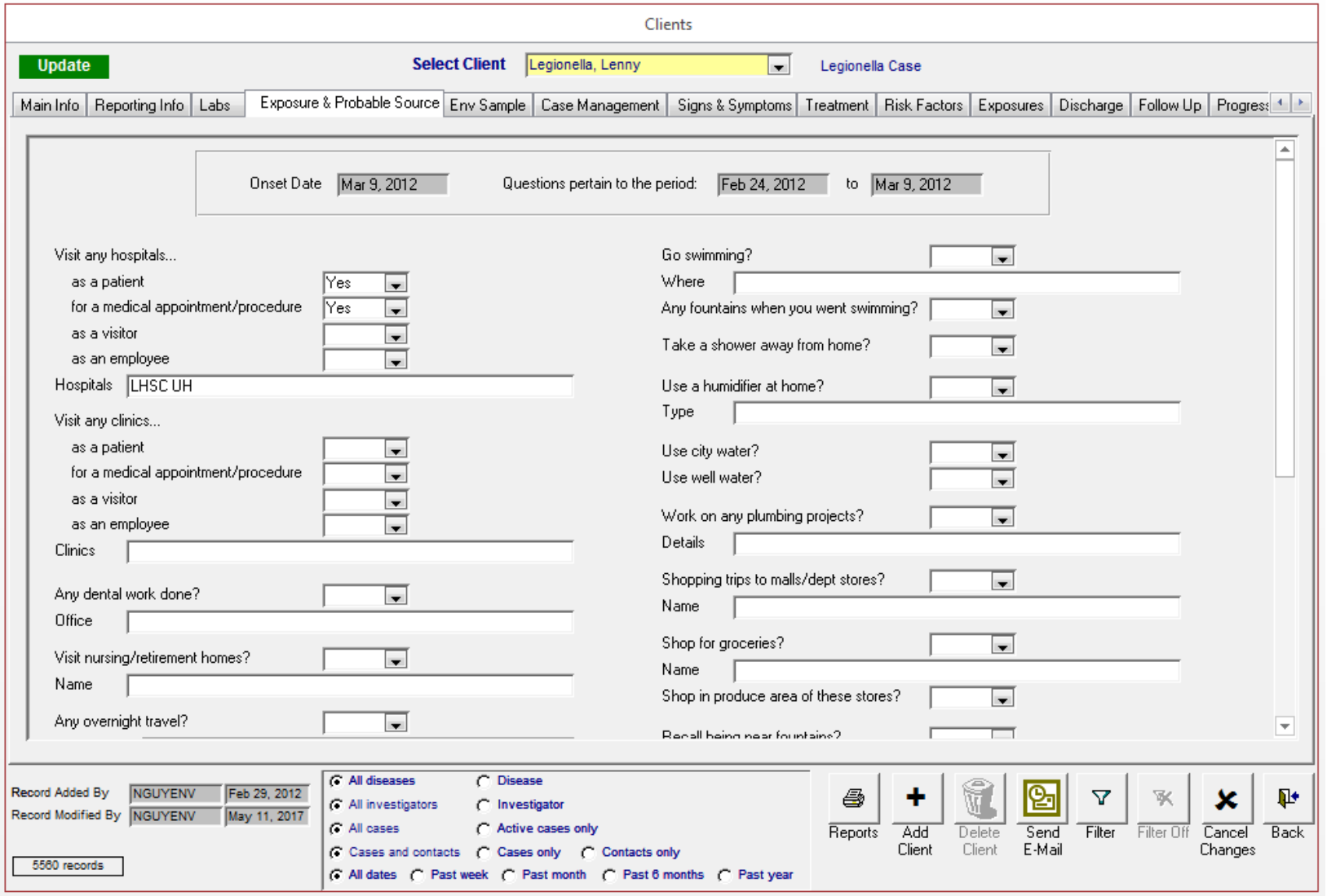
Labs


Clients
Update
Select Client
Legionella, Lenny
Legionella Case
Main Info
Reporting Info
Labs
Exposure & Probable Source
Env Sample
Case Management
Signs & Symptoms
Treatment
Risk Factors
Exposures
Discharge
Follow Up
Progress
Specimen Type
Body Site
Collection Date
Test Name
Specific Test Type
Result/Serotype
Result Date
Blood
N/A
Mar 10, 2012
Blood
Binax Now Rapid
Positive
Mar 11, 2012
Add Lab
Delete Lab
Cancel Changes
Confirmed
Probable
Does not meet definition
Record Added By
NGUYENV
Feb 29, 2012
Record Modified By
NGUYENV
Feb 13, 2014
5560 records
All diseases
Disease
All investigators
Investigator
All cases
Active cases only
Cases and contacts
Cases only
Contacts only
All dates
Past week
Past month
Past 6 months
Past year
Reports
Add Client
Delete Client
Send E-Mail
Filter
Filter Off
Cancel Changes
Back

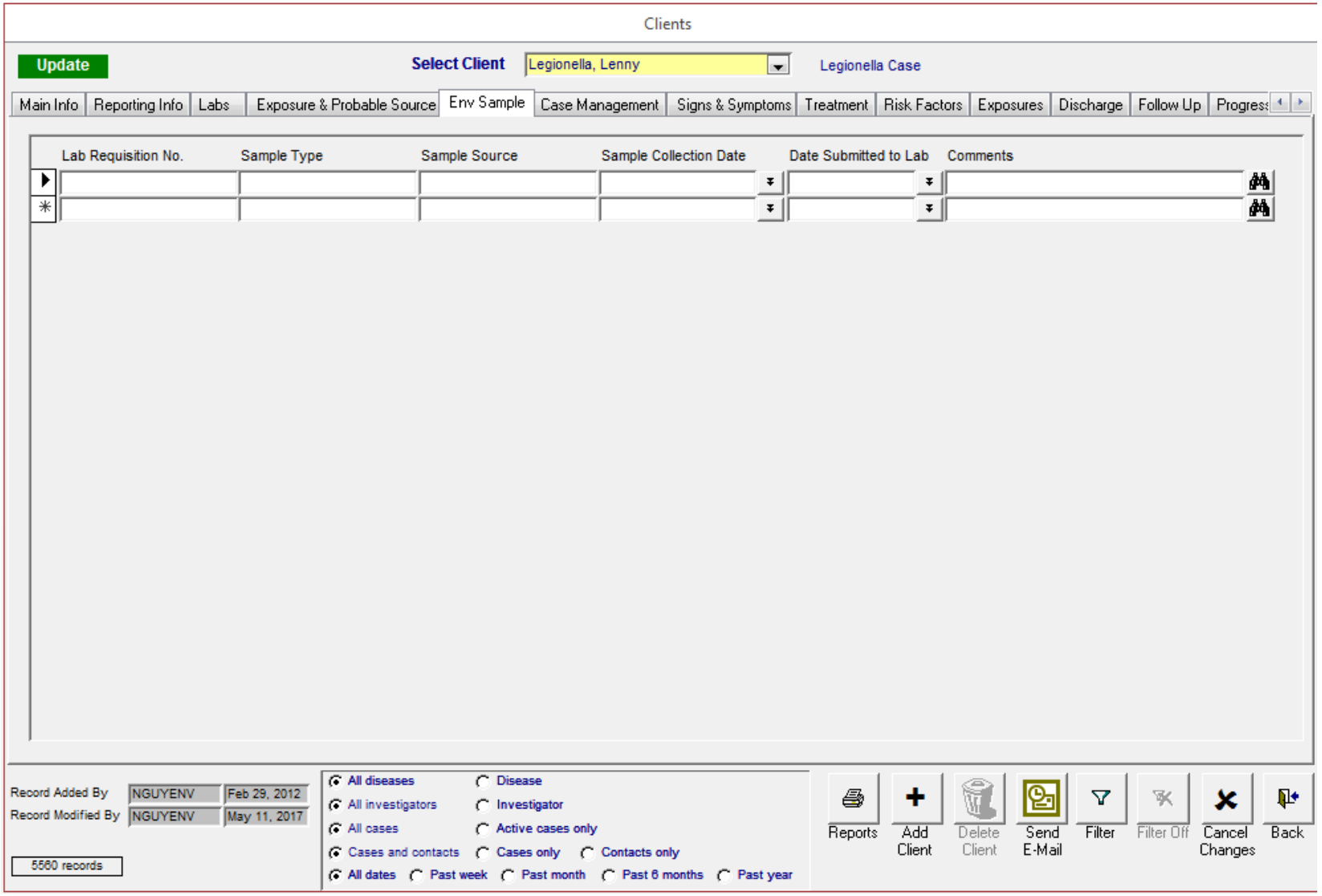
Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

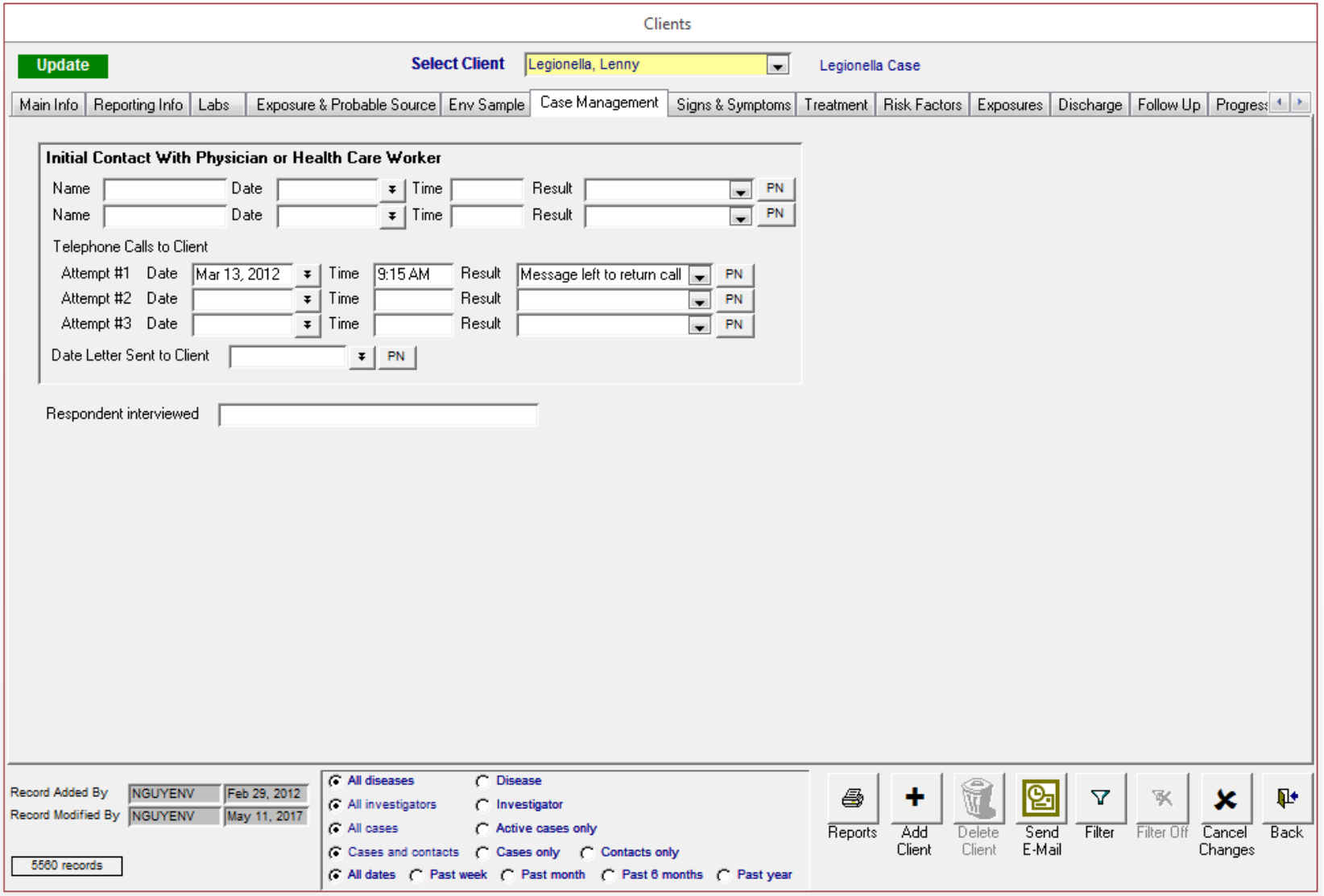
Exposure & Probable Source



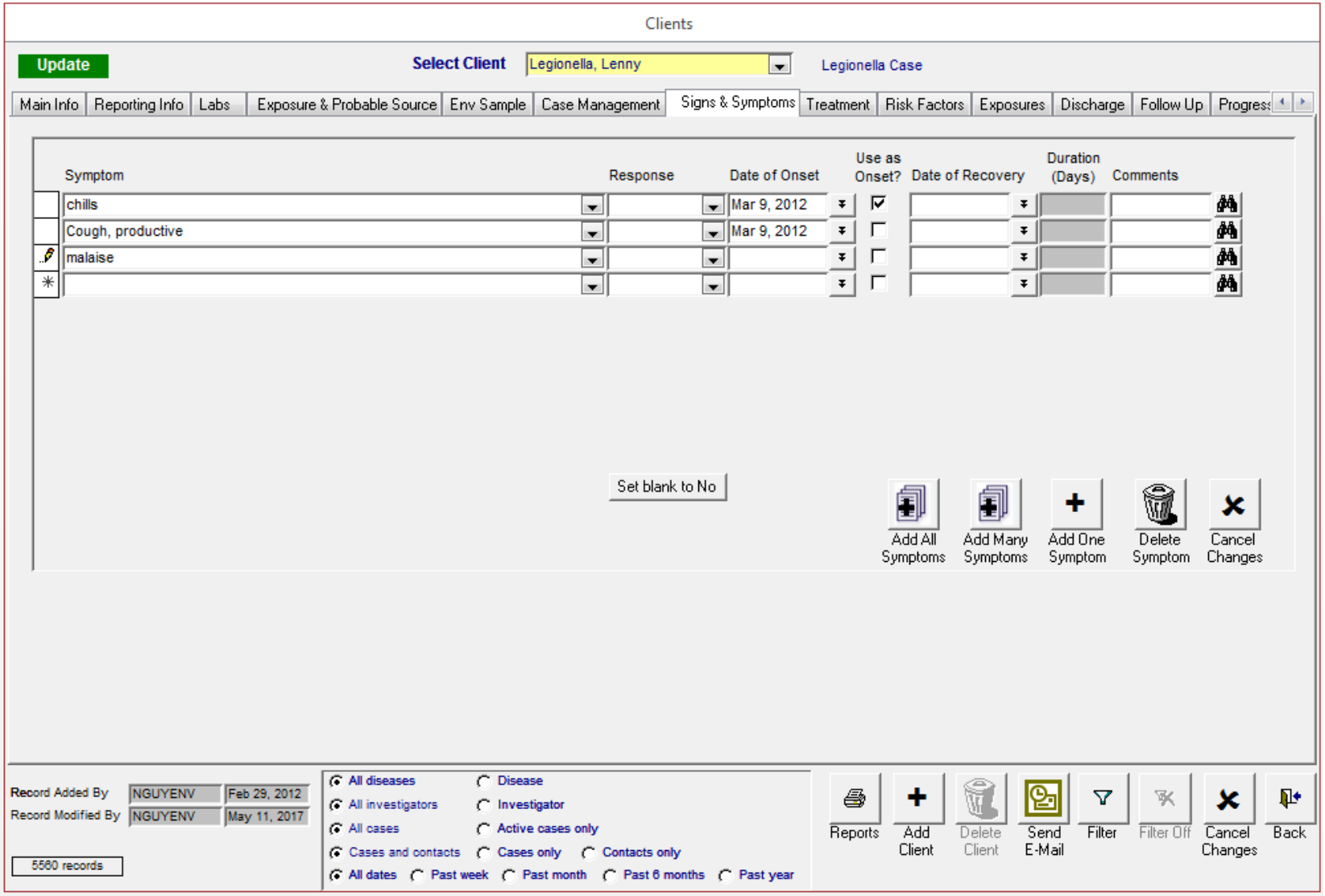
Environmental Sampling



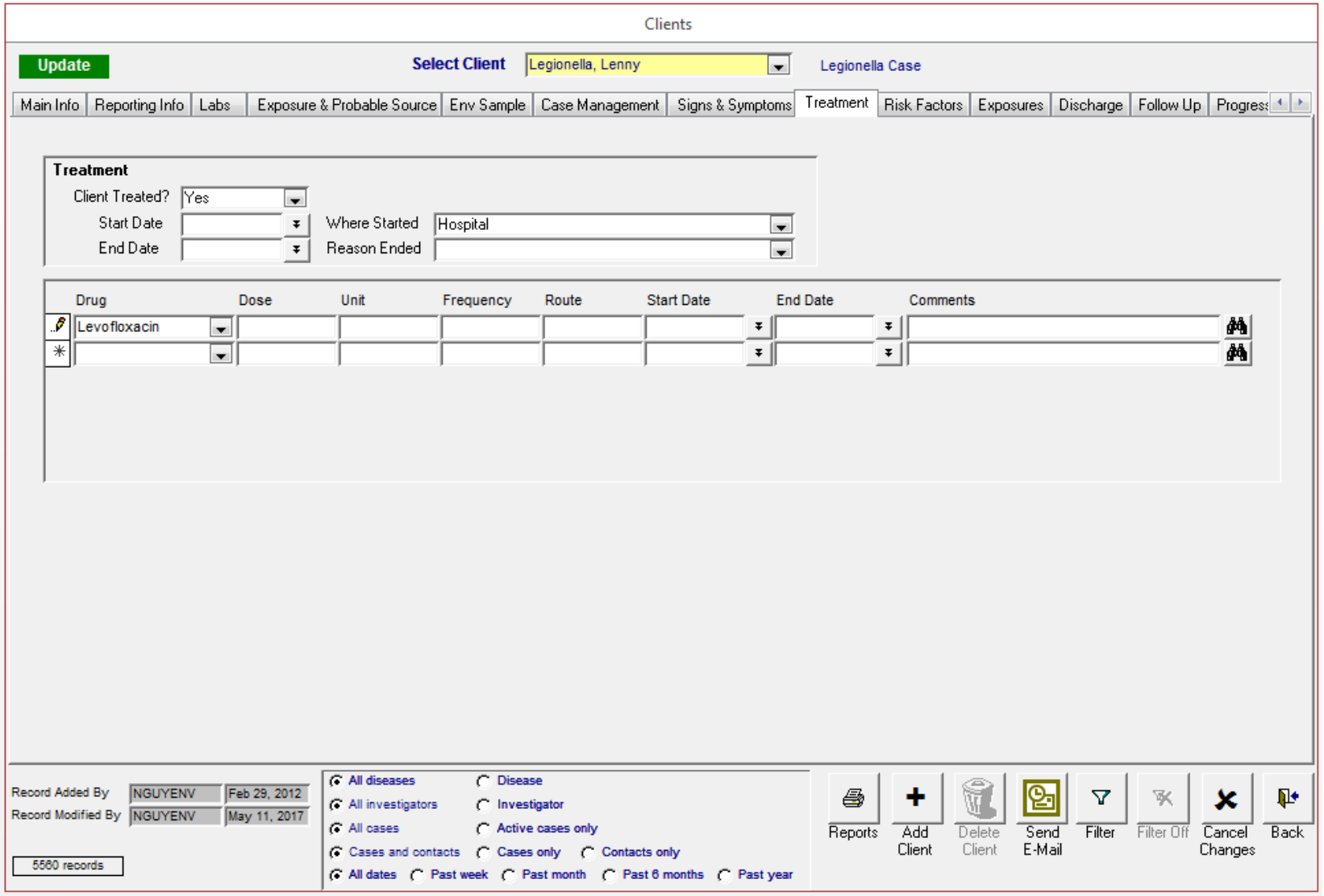
Case Management



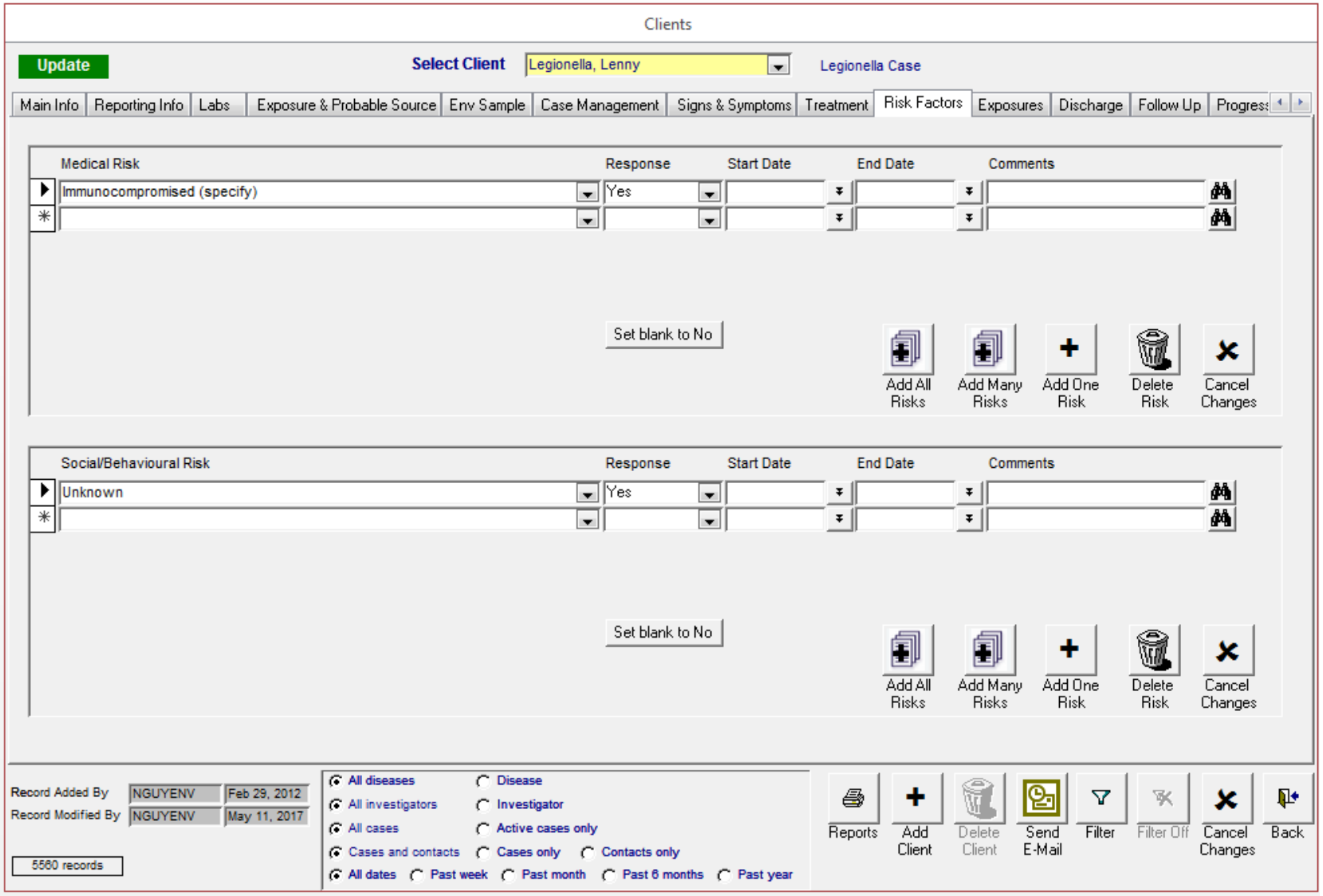
Signs & Symptoms



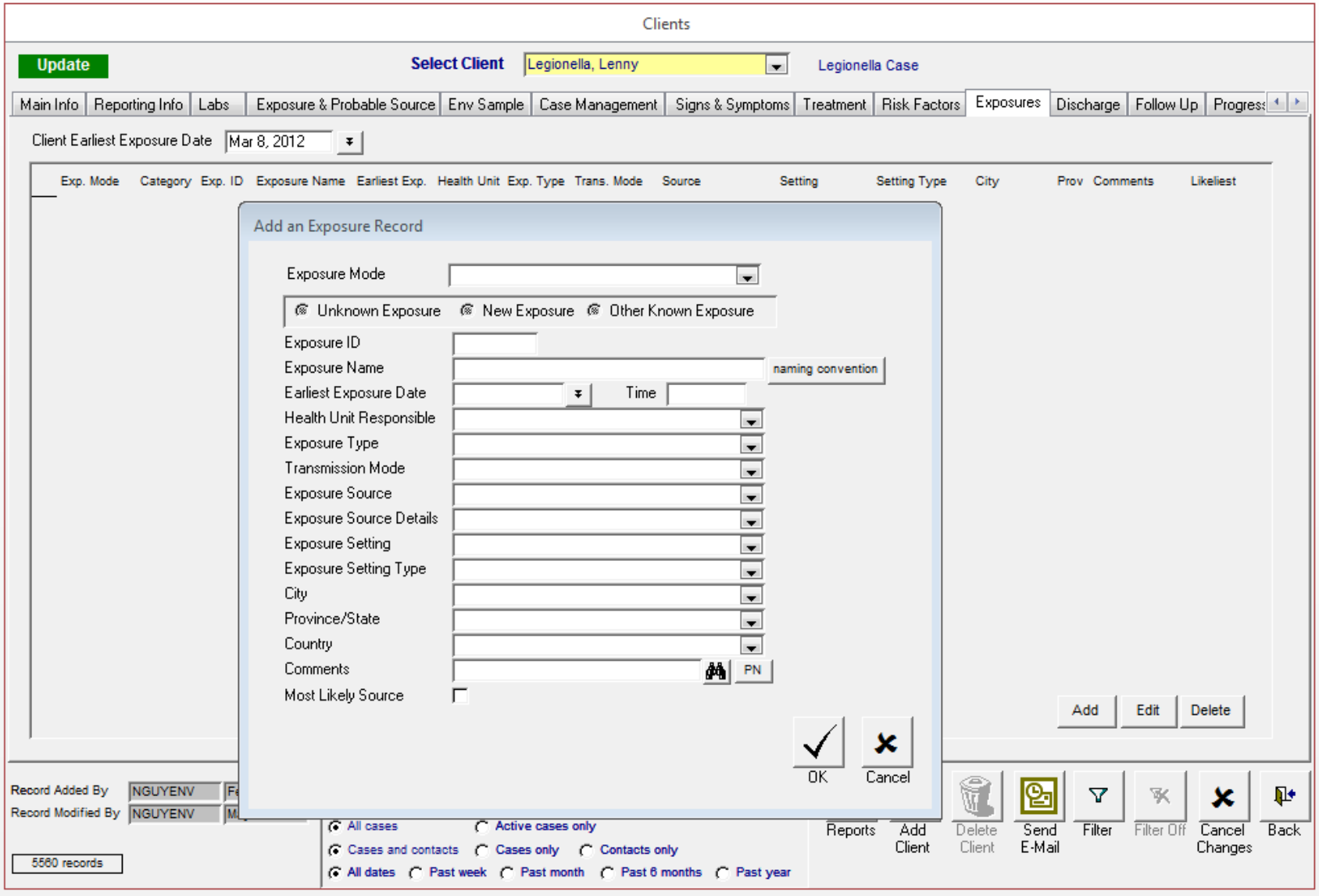
Treatment


Clients
Update
Select Client
Legionella, Lenny
Legionella Case
Main Info
Reporting Info
Labs
Exposure & Probable Source
Env Sample
Case Management
Signs & Symptoms
Treatment
Risk Factors
Exposures
Discharge
Follow Up
Progress
Treatment
Client Treated?
Yes
Start Date
End Date
Where Started
Hospital
Reason Ended
Drug
Dose
Unit
Frequency
Route
Start Date
End Date
Comments
Levofloxacin
Record Added By
NGUYENV
Feb 29, 2012
Record Modified By
NGUYENV
May 11, 2017
5560 records
All diseases
Disease
All investigators
Investigator
All cases
Active cases only
Cases and contacts
Cases only
Contacts only
All dates
Past week
Past month
Past 6 months
Past year
Reports
Add Client
Delete Client
Send E-Mail
Filter
Filter Off
Cancel Changes
Back

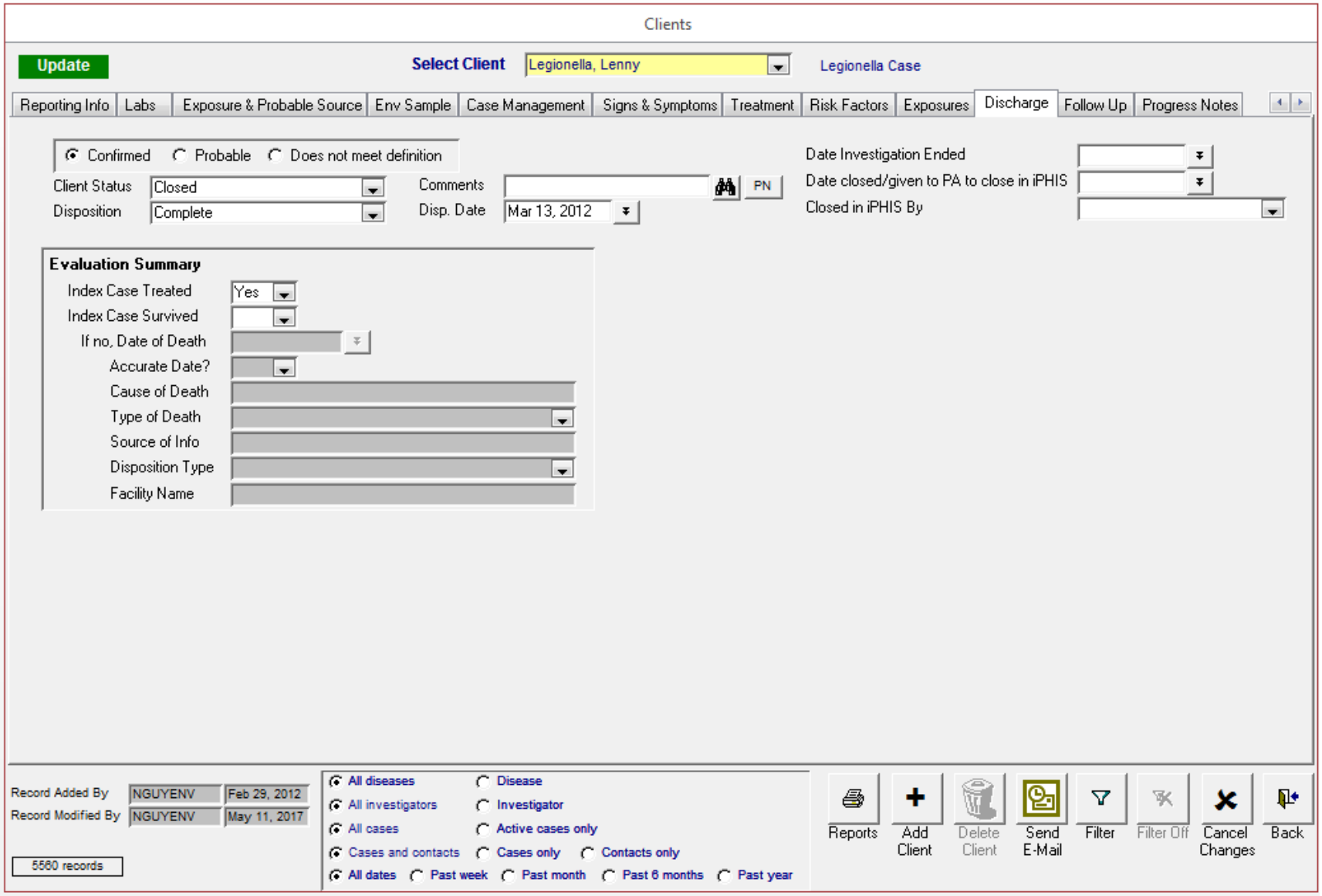
Risk Factors



Exposures


Clients
Update
Select Client
Legionella, Lenny
Legionella Case
Main Info
Reporting Info
Labs
Exposure & Probable Source
Env Sample
Case Management
Signs & Symptoms
Treatment
Risk Factors
Exposures
Discharge
Follow Up
Progress
Client Earliest Exposure Date
Mar 8, 2012
Exp. Mode
Category
Exp. ID
Exposure Name
Earliest Exp.
Health Unit
Exp. Type
Trans. Mode
Source
Setting
Setting Type
City
Prov
Comments
Likeliest
Add an Exposure Record
Exposure Mode
Unknown Exposure
New Exposure
Other Known Exposure
Exposure ID
Exposure Name
naming convention
Earliest Exposure Date
Time
Health Unit Responsible
Exposure Type
Transmission Mode
Exposure Source
Exposure Source Details
Exposure Setting
Exposure Setting Type
City
Province/State
Country
Comments
PN
Most Likely Source
OK
Cancel
Add
Edit
Delete
Record Added By
NGUYENV
Record Modified By
NGUYENV
5560 records
All cases
Active cases only
Cases and contacts
Cases only
Contacts only
All dates
Past week
Past month
Past 6 months
Past year
Reports
Add Client
Delete Client
Send E-Mail
Filter
Filter Off
Cancel Changes
Back

Discharge


Clients
Update
Select Client
Legionella, Lenny
Legionella Case
Reporting Info
Labs
Exposure & Probable Source
Env Sample
Case Management
Signs & Symptoms
Treatment
Risk Factors
Exposures
Discharge
Follow Up
Progress Notes
Confirmed
Probable
Does not meet definition
Client Status
Closed
Disposition
Complete
Comments
PN
Disp. Date
Mar 13, 2012
Date Investigation Ended
Date closed/given to PA to close in iPHIS
Closed in iPHIS By
Evaluation Summary
Index Case Treated
Yes
Index Case Survived
If no, Date of Death
Accurate Date?
Cause of Death
Type of Death
Source of Info
Disposition Type
Facility Name
Record Added By
NGUYENV
Feb 29, 2012
Record Modified By
NGUYENV
May 11, 2017
5560 records
All diseases
Disease
All investigators
Investigator
All cases
Active cases only
Cases and contacts
Cases only
Contacts only
All dates
Past week
Past month
Past 6 months
Past year
Reports
Add Client
Delete Client
Send E-Mail
Filter
Filter Off
Cancel Changes
Back

Case Review

- Nine-day old female admitted to hospital with fever, poor feeding and irritability.
- Query suspect meningitis.
- Given antibiotics.
- Continued to worsen.
- Further clinical workup included: CSF culture, respiratory culture.
- At 4-weeks old, legionella spp. was detected in a tracheal aspirate sample, along with pseudomonas spp, and a non-fermenting gram negative rod.

Case Review continued

- Home water birth using a private hot tub
- Hot tub was cleaned and disinfected, refilled with water from a garden hose, held at 104F for 3-4 days, then turned down to 98F for birthing process
- Birthing process in the water was 30 minutes
- Attempted environmental sampling, however, due to unforeseen circumstances, sampling was not conducted
- After legionella was detected, appropriate antibiotic therapy was started and the infant improved

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

Environmental outbreak investigation of Legionnaires' disease

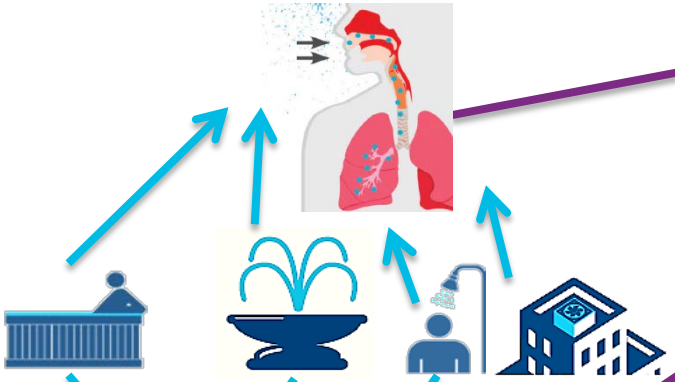
Dru Sahai, Environmental Science Specialist
PHO

Ontario
Agency for Health Protection and Promotion
Agence de protection et de promotion de la santé

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

Components of an outbreak investigation



Remediate

The **laboratory investigation** conducts environmental and clinical testing. Seeks evidence linking the two

The **environmental investigation** aims to Identify potential sampling sites by conducting an environmental assessment. Helps to identify the source through environmental sampling (ES)

The **case exposure investigation**
Collects clinical history and exposure details to identify a location.
Focuses the environmental investigation

Potential sources of contamination

Main sources

- Cooling towers

- Potable water systems
  - Water heaters, hot water storage tanks, heat exchangers, water-hammer arrestors, expansion tanks, water filters, flow restrictors, aerators, pipes, electronic and manual faucets, showerheads and hoses
- Spas

- Decorative fountains

Potential sources of contamination

Other potential sources

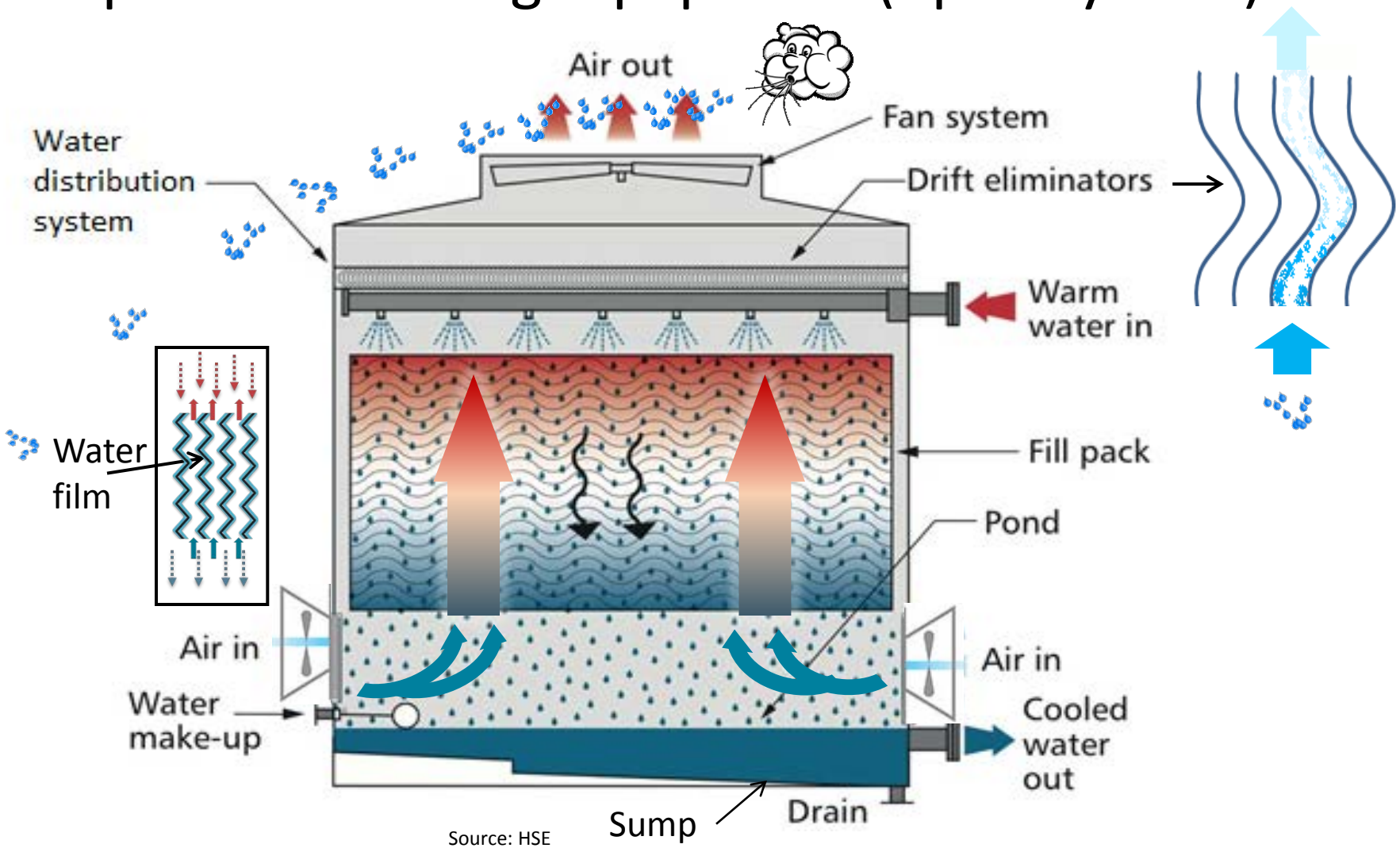
- Aerosol producing humidifiers
- Misting devices (grocery and cooling)
- Wastewater treatment plants
- Air scrubbers
- Birthing baths (aspiration)
- Vehicle washers
- Powered dental equipment
- Garden hoses
- Non-disposable medical equipment
  - nebulisers, ventilators and other respiratory therapy equipment that uses water for filling or cleaning
- Soil (usually potting) - *L longbeachae*
  - Mode of transmission?
- Ice machines
  - aspiration

Potential sources of contamination

Cooling towers

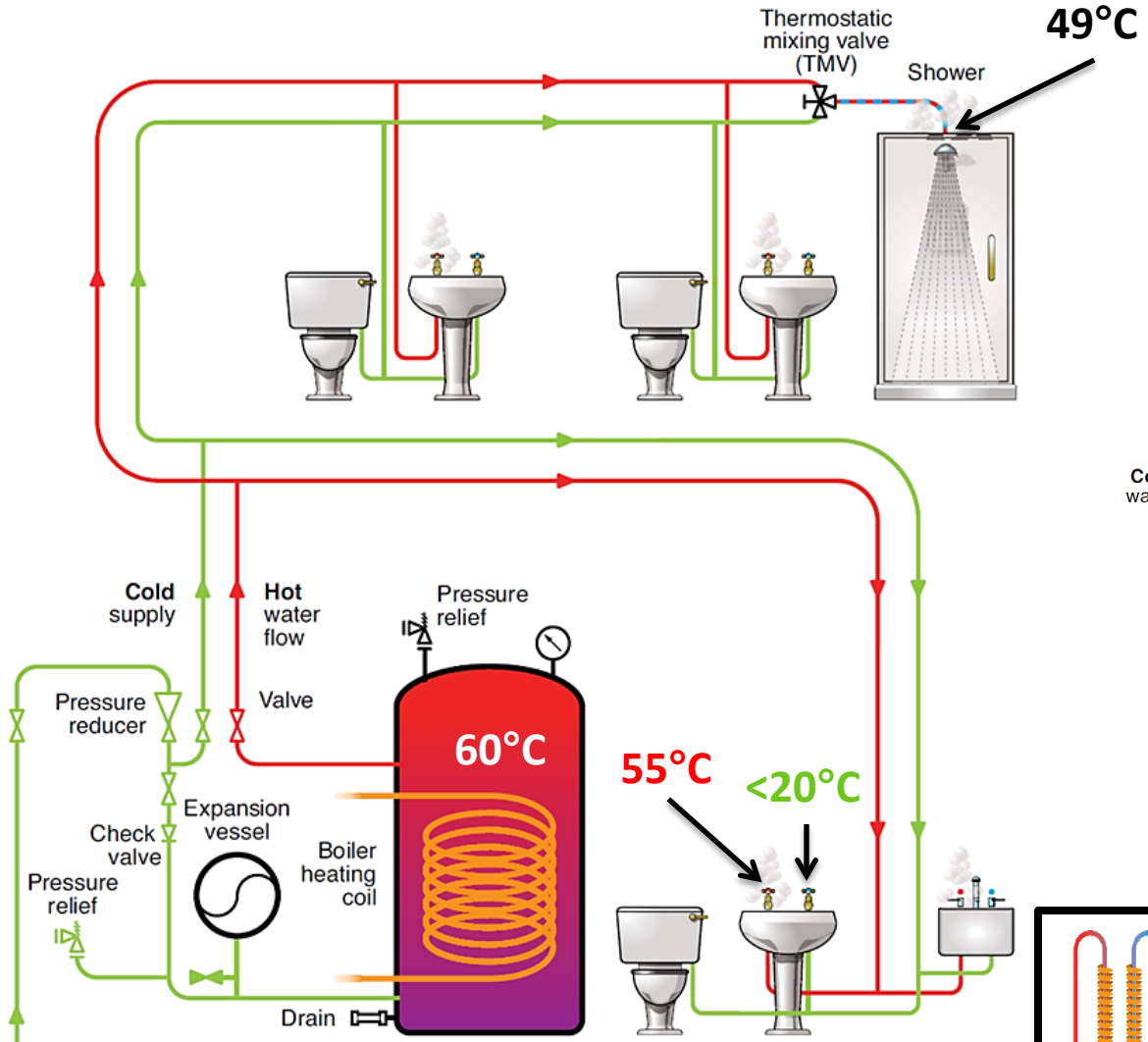
Potential sources of contamination

Evaporative cooling equipment (open system)



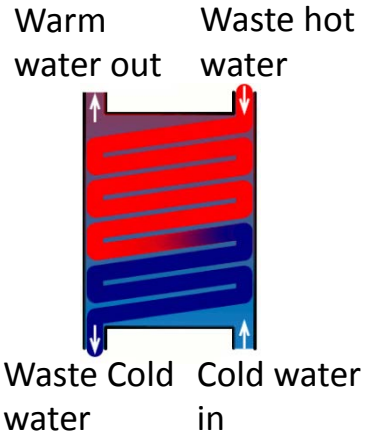
Source: HSE

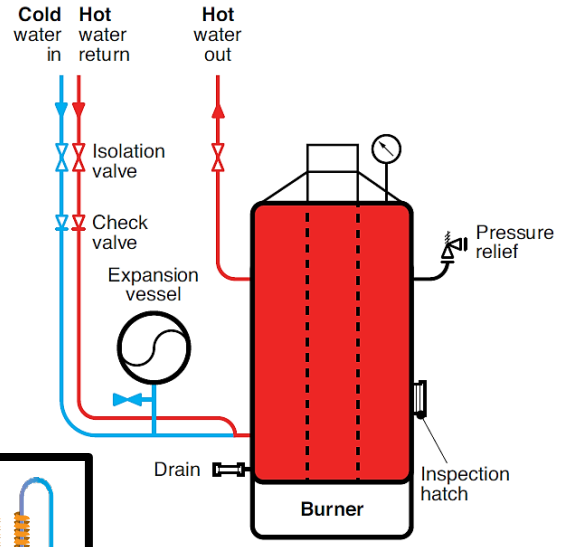
Potable water system

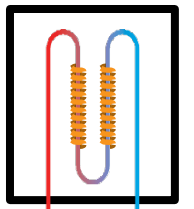


Source: HSE

Heat Exchangers







Instantaneous water heaters

Other potential sources

Spas

- Water temperature (39- 40°C) is ideal for legionella (and other organisms) growth
- Disinfectant is rapidly lost because of high temperature and high bather load
- Equipped with jet and air blowers which can generate aerosols
- Persons using the spa are at most risk but a passerby also can be exposed

Decorative Fountains

- Lack disinfectant
- lack maintenance protocol
- Underwater heating source (lighting)

Other potential sources

Grocery mister

Environmental investigations

Case exposure information focuses the investigation

- Cluster within a section of an institution
  - Rehab department, Neonatal, Transplant unit
- May be that cases visited a specific community location
  - Supermarket, hotel, restaurant

Environmental investigations (cont.)

Involves more than taking samples!

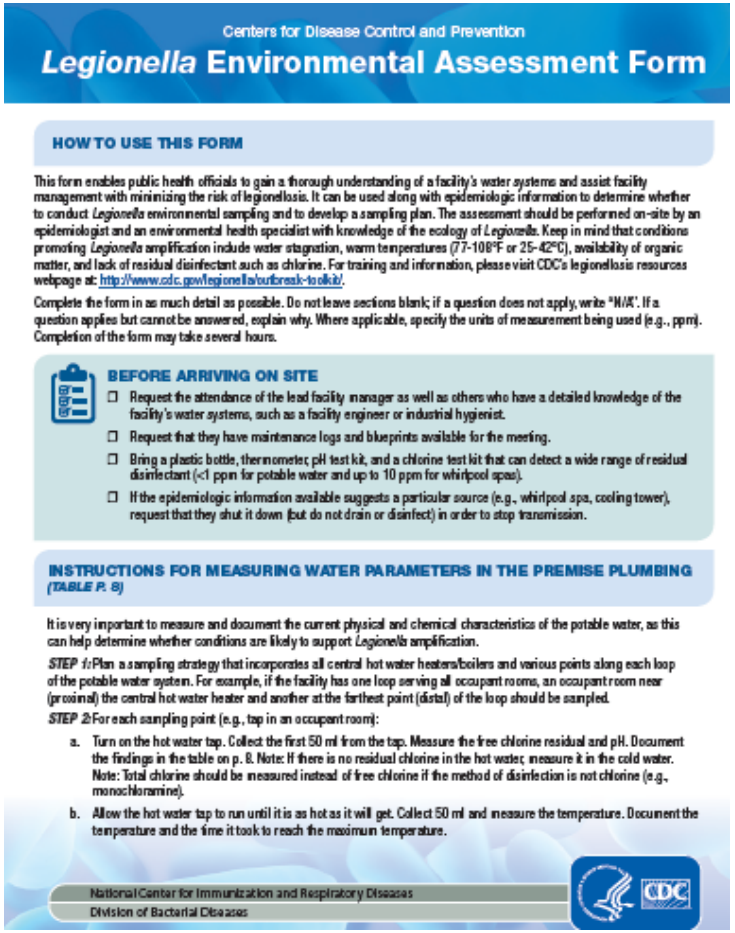
- Environmental risk assessment
  - Identify potential sources and to prioritize sampling locations
  - Generally concerned about aerosol-generating devices
- Developing a sample plan
  - Sampling
  - Health and safety
- Confirming the source
- Remediation

Health Department staff needed

- PHI (X2)

PHO/L (available for consultation)

Environmental Assessment



Centers for Disease Control and Prevention

Legionella Environmental Assessment Form

HOW TO USE THIS FORM

This form enables public health officials to gain a thorough understanding of a facility's water systems and assist facility management with minimizing the risk of legionellosis. It can be used along with epidemiologic information to determine whether to conduct *Legionella* environmental sampling and to develop a sampling plan. The assessment should be performed on-site by an epidemiologist and an environmental health specialist with knowledge of the ecology of *Legionella*. Keep in mind that conditions promoting *Legionella* amplification include water stagnation, warm temperatures (77-108°F or 25-42°C), availability of organic matter, and lack of residual disinfectant such as chlorine. For training and information, please visit CDC's legionellosis resources webpage at: http://www.cdc.gov/legionella/outbreak-toolkit/.

Complete the form in as much detail as possible. Do not leave sections blank; if a question does not apply, write "N/A". If a question applies but cannot be answered, explain why. Where applicable, specify the units of measurement being used (e.g., ppm). Completion of the form may take several hours.

BEFORE ARRIVING ON SITE

- ☐ Request the attendance of the lead facility manager as well as others who have a detailed knowledge of the facility's water systems, such as a facility engineer or industrial hygienist.
- ☐ Request that they have maintenance logs and blueprints available for the meeting.
- ☐ Bring a plastic bottle, thermometer, pH test kit, and a chlorine test kit that can detect a wide range of residual disinfectant (<1 ppm for potable water and up to 10 ppm for whirlpool spas).
- ☐ If the epidemiologic information available suggests a particular source (e.g., whirlpool spa, cooling tower), request that they shut it down (but do not drain or disinfect) in order to stop transmission.

INSTRUCTIONS FOR MEASURING WATER PARAMETERS IN THE PREMISE PLUMBING *(TABLE P. 8)*

It is very important to measure and document the current physical and chemical characteristics of the potable water, as this can help determine whether conditions are likely to support *Legionella* amplification.

STEP 1: Plan a sampling strategy that incorporates all central hot water heaters/boilers and various points along each loop of the potable water system. For example, if the facility has one loop serving all occupant rooms, an occupant room near (proximal) the central hot water heater and another at the farthest point (distal) of the loop should be sampled.

STEP 2: For each sampling point (e.g., tap in an occupant room):

a. Turn on the hot water tap. Collect the first 50 ml from the tap. Measure the free chlorine residual and pH. Document the findings in the table on p. 8. Note: If there is no residual chlorine in the hot water, measure it in the cold water. Note: Total chlorine should be measured instead of free chlorine if the method of disinfection is not chlorine (e.g., monochloramine).

b. Allow the hot water tap to run until it is as hot as it will get. Collect 50 ml and measure the temperature. Document the temperature and the time it took to reach the maximum temperature.

National Center for Immunization and Respiratory Diseases
Division of Bacterial Diseases

CDC

[CDC: Legionella Environmental Assessment Form]

Institutional environmental assessment

BEFORE ARRIVING ON SITE

- PHI should:
  - Contact the Public Health Ontario Lab (PHOL) at the beginning of the *Legionella* investigation to:
    - Make them aware of the case/outbreak
    - Obtain testing materials (e.g., water bottles, swabs, requisition forms)
  - Request meeting with the building manager (or other contractors)
  - Instruct facility to temporarily discontinue the use of aerosol-generating items as a precautionary action pending sampling

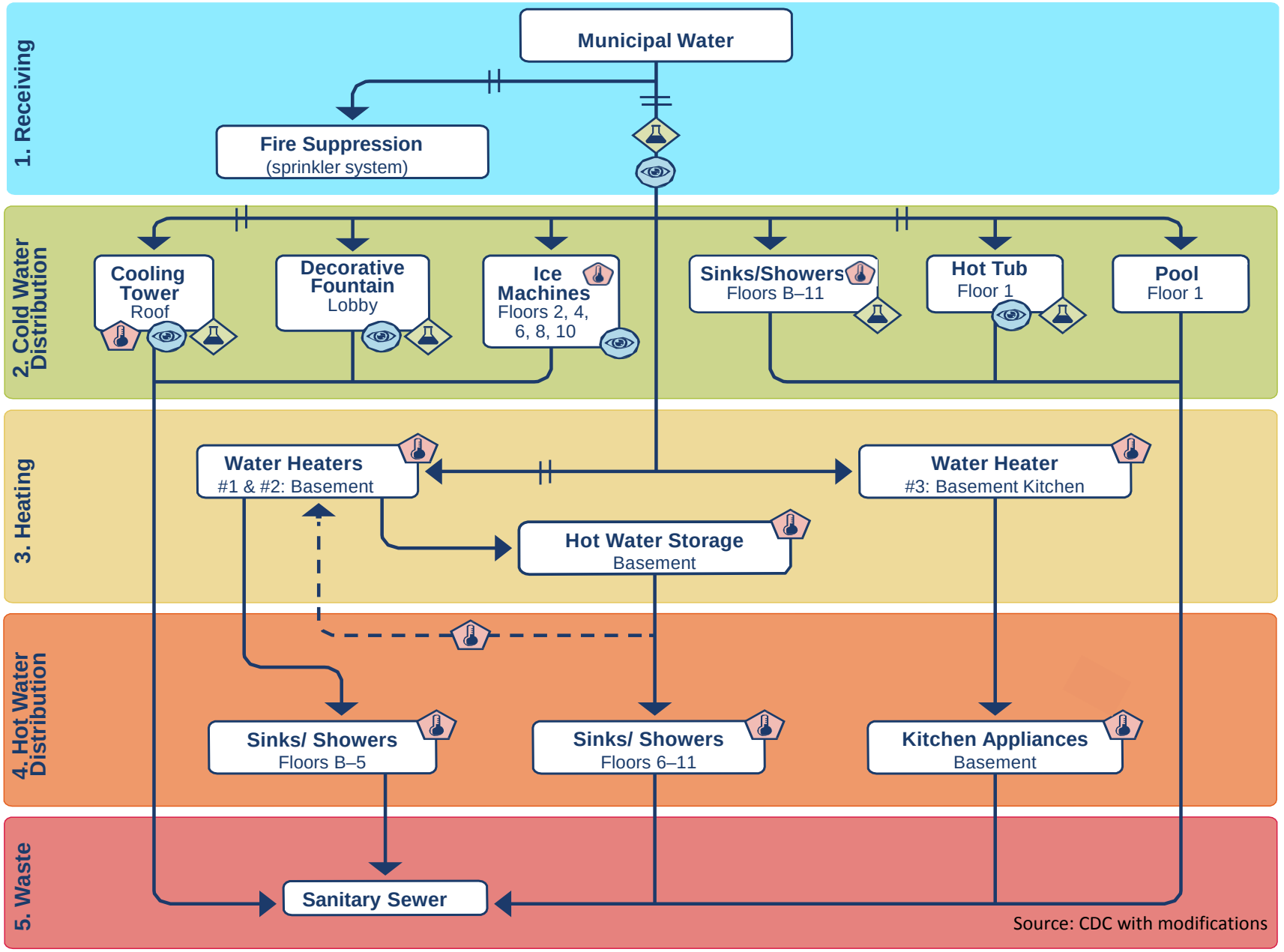
But advise them not to super chlorinate, clean, drain or change/disturb any of the filter systems

Institutional environmental assessment (cont.)

AFTER ARRIVING ON-SITE

- **Review the building water schematic**
  - Generally concerned about aerosol generating devices
- **Collecting information about any:**
  - Building water systems (BWS) that are infrequently used (low occupancy)
  - Recent construction, renovation, maintenance work
  - Note any changes to potable water quality (for example, taste, odour, flavour and appearance)
- **Review any onsite maintenance logs (disinfectant residual, microbiological results)**
- **Ask about previous outbreaks or cases**
  - High chance of reoccurrence
- **May have an outside contractor (BWS, cooling towers, pool)**

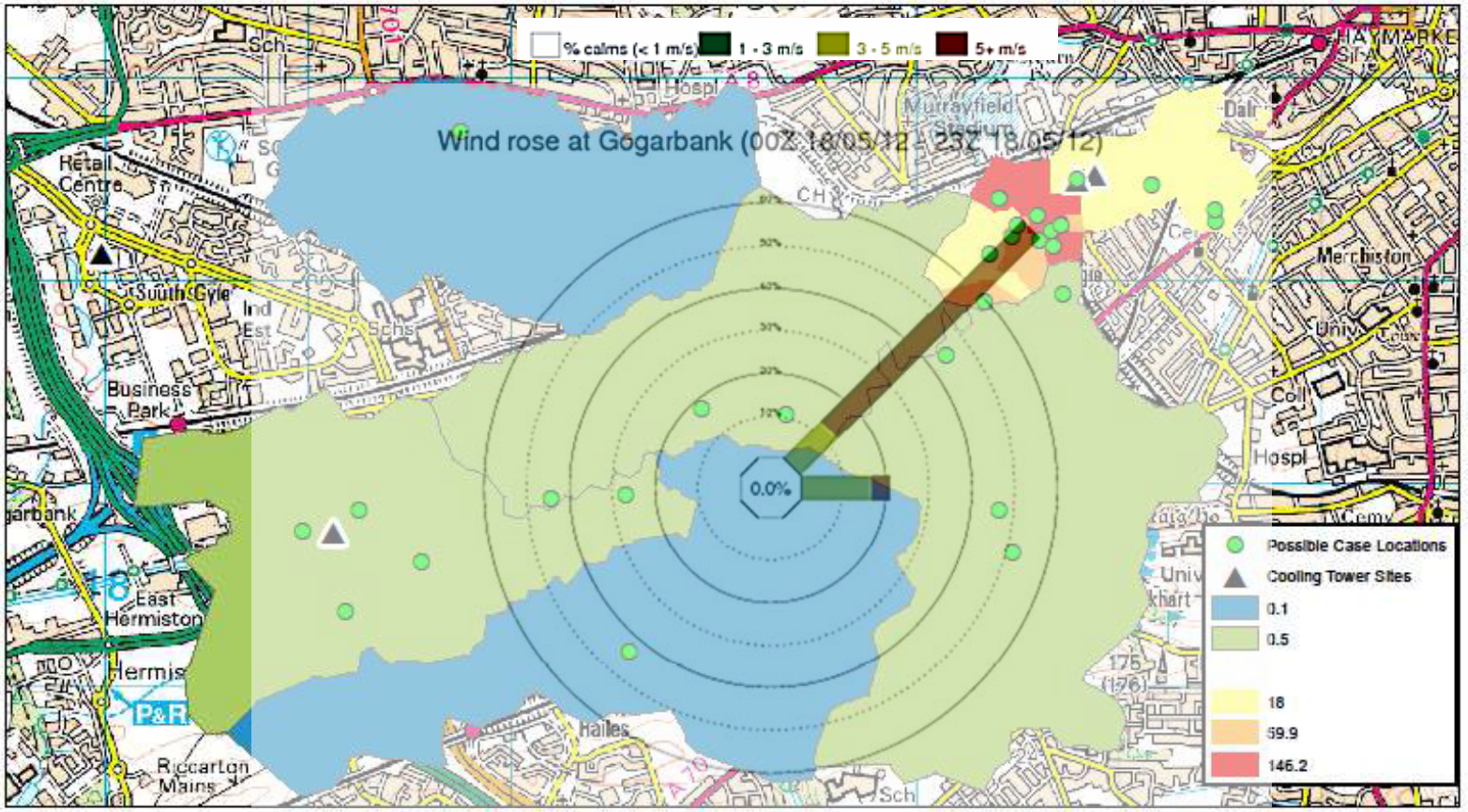
Physical assessment



Community Outbreak

- Case interviews may identify a link in time and location for further assessment of aerosol-generating sources
  - e.g., all visited a retail with spa display or restaurant/hotel with a decorative fountain, supermarket, car wash, public fountain
- If the case investigation data does not reveal an association with a single building or other common source of Legionella exposure:
  - Suspect a cooling tower (CT) if there is a high attack rate in a small area
    - How to locate all the CT?
    - With dozens of potential sources best to start within 0.5 KM of the middle of the cluster and work outwards
    - Meteorological condition may help to identify source/cases

Attack ratio analysis using postcode geography using data received 22/6/2012 (attack ratio per 10,000 population)



Map Created: 22/06/2012 at 15:31
Produced by Microbial Risk Assessment, Emergency Response Department. Health Protection Agency, Porton Down, Salisbury, SP4 0JG.

Sampling plan

- The purpose for sampling is to identify the source of transmission
  - Matching clinical and environmental strains
- Sampling points should be prioritized based on the case investigation data and the environmental assessment
- It is not a haphazard process!
- Types of sample that can be collected :
  - Water: Pre-flush – preferred sampling for outbreaks
  - Swab of biofilm
  - Bulk sample - soil, sludge, filter material (backwash sample)

Sampling plan (cont.)

- Aerosol sources that the case(s) may have been exposed to should be sampled first
  - Case patient room
    - Pre-flush sample from sink and showers, (instantaneous water tank)
    - Ask facilities to remove showerhead and aerators from faucets; swab hoses, inside of the pipe, faucet aerator, shower head,
  - Common exposure sources (humidifiers, fountains (indoor and outdoor), CT, misting machines, ice machines, spas)
- Followed by other high-risk sources (i.e., sites that potentially contain the highest numbers of Legionella bacteria e.g. hot water tank, storage tanks, heat exchanger, expansion vessels)

Sampling plan (cont.)

Useful to sample

- At the point of entry to the building
- The re-circulating hot water returning to the heater
- Rooms at the distal end of the water distribution system
- Randomly selected rooms from residents who were not sick
- Sampling points should be continually reassessed as the investigation progresses and as more results and information become available to locate the source of the Legionella

Sampling plan (cont.)

- Taking samples from cold water for Legionella culture is not generally done, but
  - Cold water can be contaminated with Legionella if it gets warm enough to support its growth (hot summer)
    - Poor insulation of tanks and pipes
    - Ice machines can get warm
    - Measuring temperature is useful in deciding whether to sample

- Temperature and disinfectant residual and pH testing of the hot water systems should be conducted when sampling

Public Health Ontario | Santé publique Ontario
PARTNERS FOR HEALTH | PARTENAIRES POUR LA SANTÉ

Possible sampling site

Spas

Water in the pool/balance tank	W
Biofilm above the water line	S
Water jets	S
Back wash from filter	W

Decorative Fountain

Fountain reservoir	W
Fountain trough	S
Material such as foam in the fountain	S,B

Cooling tower

Collection basin (area below the tower for collection of cooled water)	W,S
Sump (section of the basin from which water is pumped back). Silt and sludge may also be collected here	W,S,B
Drift eliminator	S

W	Water
S	Swab
B	Bulk

Health and safety

- Take appropriate precautions during sampling to minimize aerosols.
  - Taps should be turned on and run gently
  - Susceptible staff should not be involved in sampling
  - Respiratory protection (NIOSH, fit-tested, N-95), safety glasses, hard hat and safety shoes, impermeable gloves (nitrile), and high visibility vests
- PHIs should be accompanied by a health and safety committee member/facilities manager
  - This person can provide access to restricted area and remove fixtures

Environmental Sampling

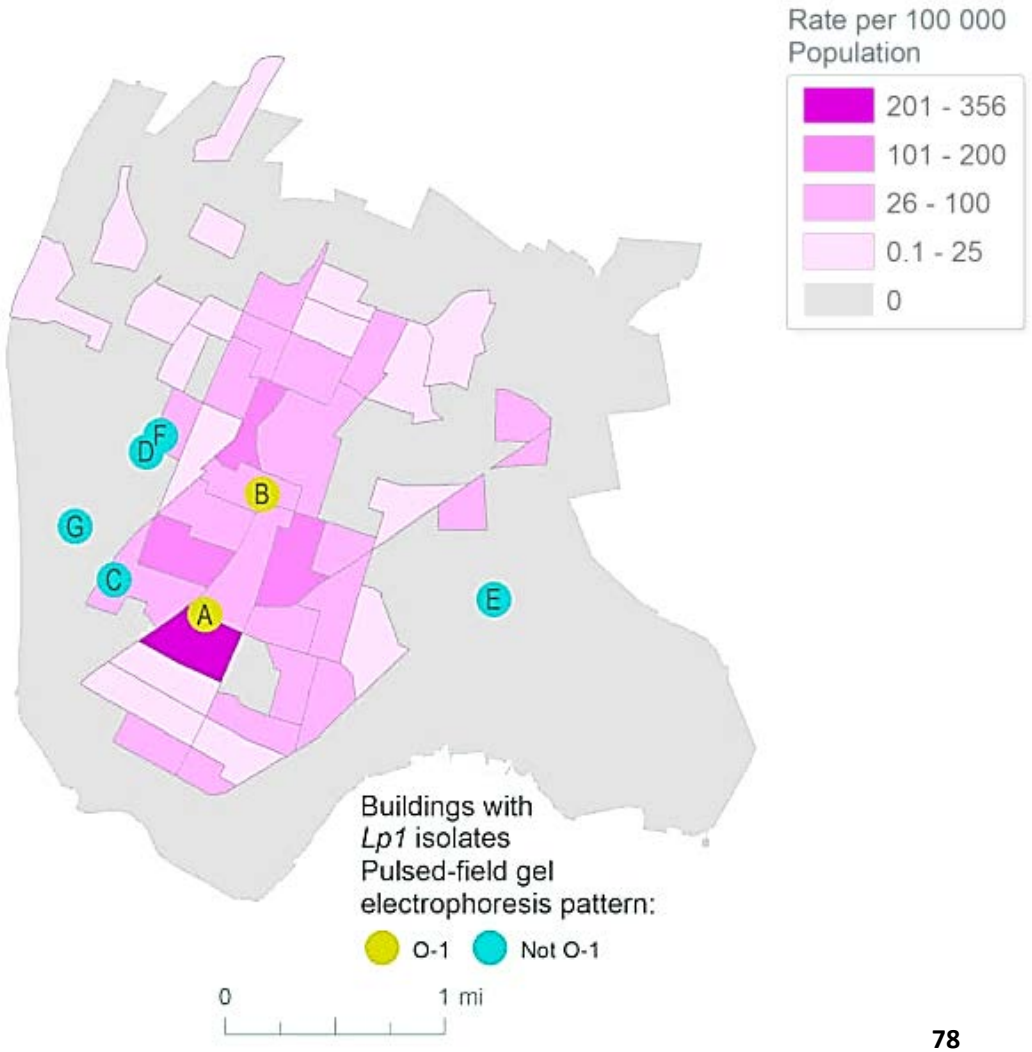
- PHO's document, Public Health Inspector's Guide to the Principles and Practices of Environmental Microbiology provides basic guidance on *Legionella* sampling instructions
- Allana Murphy, Senior Laboratory Lead for the Environmental Microbiology Section at Public Health Ontario Laboratory (PHOL)
- Anna Majury, Clinical Microbiologist

Reasons for no match

- Lag time between exposure to *legionella* contaminated water and time of sampling—conditions may have changed
- Didn't locate the source
- Shock disinfection before sampling occurred
- Not culturally viable
- Overloaded

More than one match

- Sequence based typing involves identifying only seven genes ∴possible to get more than one match
- New test - whole genome sequencing
- Involves reading the entire DNA sequence of the bacteria
- If WGS not available then go with epi info



Source: Weiss et al.,Public Health Reports, 2017

Remediation and Emergency Control Measures

- Once the environmental source has been identified
  - Implement a remediation action plan
- May wish to hire an environmental consultant
- The most common methods
  - Thermal disinfection and/or
  - Chemical disinfection

Remediation and Emergency Control Measures

- Thermal Disinfection
  - Maintain water heater temperatures at 71—77 degrees C while progressively flushing each outlet for up to 30 minutes at 65 degrees C
  - Thermal disinfection will not disinfect downstream of TMV
  - Some researchers recommended that thermal disinfection be followed with chemical disinfection of the water system

Remediation and Emergency Control Measures

- Chemical Disinfection
  - The most common chemical used for chemical disinfection is chlorine (shock chlorination) .
  - The level of chlorine should be dosed at 50 mg/L for an hour
  - After disinfection is complete, the outlet should be flushed
  - The plumbing components should be able to withstand this level of chlorination

Remediation and Emergency Control Measures

Point-of-use Filters

- Commercially available membrane filters fitted to water outlets
  - Effective in preventing *Legionella* from being released at the point of use
- Filters can be installed immediately and may be a better alternative than restricting showering and providing bottled water.
- Does not eliminate *Legionella* from the potable water system
- Follow the manufactures instructions on change out schedule

Post-Remediation Sampling

- After remediation, all previously contaminated sources should be resampled, to ensure that the re-colonization of *Legionella* has not occurred
- **Biofilms can be difficult to remove even with thermal and chemical disinfection and they may serve as a reservoir for persistent *Legionella* contamination**

Long term Prevention

- Most effective strategy for reducing the risk of Legionnaires' disease is
  - Supplemental disinfection
  - Eliminating stagnant water conditions
  - Proper water temperature management
- *Legionella* water safety plan
  - ANSI/ASHRAE Standard 188-2015

    Legionellosis: Risk Management for Building Water Systems

    Best practices document which focuses on identifying hazardous conditions and applying control measures to interrupt Legionella growth and transmission.
  - CDC — Developing a Water Management Program to Reduce Legionella Growth and Spread in Buildings: A Practical Guide to Implementing Industry Standard
    http://www.cdc.gov/legionella/downloads/toolkit.pdf

Public Health Ontario
PARTNERS FOR HEALTH

Santé publique Ontario
PARTENAIRES POUR LA SANTÉ

Questions/Comments

Dru.sahai@oahpp.ca
Maurice.coppin@oahpp.ca
Valerie.Nguyen@mlhu.on.ca