Legionella in the Bronx: Lessons Learned in Minimizing Complex Risk

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Circumstances can force your hand. So think ahead!

—Robert A. Heinlein,
American Science Fiction Writer
**Legionella in the Bronx:** Lessons Learned in Minimizing Complex Risk

| Howard N. Apsan, PhD, University Director of Environmental, Health, Safety, and Risk Management, The City University of New York |

**Introduction**

It was a typical summer evening in the Bronx. As the local weather broadcasters like to say, it was Triple-H: hot, humid, and hazy. But that didn’t stop hundreds of people from lining up around the block so they could have a chance to squeeze into the basement auditorium of the Bronx Museum and hear Dr. Mary Bassett, the New York City Health Commissioner, reassure them that the city was doing everything that it could to keep them safe. This was not a gathering of doctors or politicians, mind you, although there were certainly enough of both in the room. No, this was a crowd of neighbors in the South Bronx, the perceived epicenter of what was being referred to as a *Legionella* outbreak. Many shared a familiarity with poverty; many were not native English speakers; and few if any understood the concepts of toxicology and epidemiology that were being discussed. What they did know is that 12 of their neighbors got sick and died from some mysterious droplets of cooling tower water that seem to be sprinkling off every rooftop.

The auditorium was packed to capacity. News crews squeezed their cameras into every vacant space; politicians finally gave up trying to work the room; and frightened residents of the South Bronx struggled to sit, stand, or lean wherever they could to hear the commissioner’s reassuring words. And that is exactly what they heard. Yes, they heard from the commissioner of the Department of Health and Mental Hygiene (DOHMH), the agency responsible for preventing the spread infectious diseases throughout New York City, but they were really listening to Mary Bassett, a physician born and raised in the same city that she was sworn to protect. She seemed to be one with her audience, and the people responded in kind. She told them what she knew and what the city planned to do, and then she opened the floor to questions and proceeded to answer every one with patience and empathy—even though she was responding more or less to the same questions over and over—and she never looked at her watch.

What she told them was that she was issuing a Health Commissioner’s Order requiring every building with water recirculating cooling towers within the City of New York to do the following:

1. Obtain the services of an environmental consultant with demonstrated experience performing disinfection in accordance with current standard industry protocols including, but not limited to, American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) Standard 188P and Cooling Technology Institute Guidelines WTB-148;
2. Under supervision of the environmental consultant, evaluate the cooling tower and associated equipment for the presence of organic material, biofilm, algae, and other visible contaminants; and regardless of the outcome of the evaluation required by item (2) above, direct the environmental consultant to carry out a disinfection/treatment sufficient to remove organic material, biofilm, algae, and other contaminants and disinfect in a manner sufficient to control for the presence of *Legionella* organisms within 14 days of receipt of this letter; and
3. Maintain records on-site of the consultant’s inspection and remediation, and make them available upon request to the City of New York in person, or by fax or email as requested.
4. If an identical assessment and any disinfection procedure has been conducted at this building within the past 30 days, in lieu of the items...
Legionnaires’ Disease: From Legionella to Legionellosis

Legionnaires’ disease got its name from a deadly outbreak of pneumonia among attendees at an American Legion convention at the Belleview Stratford Hotel in Philadelphia in July 1976. The strain of bacteria that infected hundreds of convention attendees, and is believed to have caused the death of dozens, became known as Legionella, and the disease became known as Legionellosis. Much has been written about the origins of Legionnaires’ disease, but epidemiologists, such as those at the Centers for Disease Control (CDC), have compiled and updated information on the disease, its causes, and methods of prevention.

“About the Disease

Legionellosis is a respiratory disease caused by Legionella bacteria. Sometimes the bacteria cause a serious type of pneumonia (lung infection) called Legionnaires’ disease. The bacteria can also cause a less serious infection called Pontiac fever that has symptoms similar to a mild case of the flu.

“Causes and Common Sources of Infection

Legionella is a type of bacterium found naturally in freshwater environments, like lakes and streams. It can become a health concern when it grows and spreads in human-made water systems like hot tubs that aren’t drained after each use, hot water tanks and heaters, large plumbing systems, cooling towers, and decorative fountains.

This bacterium grows best in warm water.

“How It Spreads

People are exposed to Legionella when they breathe in mist (small droplets of water in the air) containing the bacteria. One example might be from breathing in droplets sprayed from a hot tub that has not been properly cleaned and disinfected. … In general, Legionnaires’ disease and Pontiac fever are not spread from one person to another.

“Treatment

Legionnaires’ disease requires treatment with antibiotics ...and most cases of Legionnaires’ disease can be treated successfully. Healthy people usually get better after being sick with Legionnaires’ disease, but they often need care in the hospital. Possible complications of Legionnaires’ disease include lung failure and death. About 1 out of every 10 people who get sick with Legionnaires’ disease will die due to complications from their illness.

“Signs and Symptoms

Legionnaires’ disease is very similar to other types of pneumonia, with symptoms that include cough, shortness of breath, high fever, muscle aches, and headaches. Legionnaires’ disease can also be associated with other symptoms such as diarrhea, nausea, and confusion. Symptoms usually begin 2 to 10 days after being exposed to the bacteria, but it can take longer so people should watch for symptoms for about 2 weeks after exposure.
“Prevention
There are no vaccines that can prevent legionellosis. Instead, the key to preventing legionellosis is making sure that the water systems in buildings are maintained in order to reduce the risk of growing and spreading Legionella.”

“People at Risk
Most healthy people do not become infected with Legionella after exposure. People at higher risk of getting sick are older people (usually 50 years or older), current or former smokers, people with a chronic lung disease (like chronic obstructive pulmonary disease or emphysema), people with a weak immune system from diseases like cancer, diabetes, or kidney failure, and people who take drugs that suppress the immune system.”

Because Legionnaires’ disease has been so well studied, state and local health departments have been relatively successful in controlling its spread. Nevertheless, when an outbreak does occur, epidemiologists and other public health officials really earn their keep.

Keeping the Disease Detectives Busy
The New York City DOHMH has a storied history as a leader in protecting public health. In a comprehensive study by John M. Barry on the Spanish flu of 1918, we see some of the epidemiological work of last century’s health detectives under extraordinary circumstances. The contemporary health detectives are just as diligent. When 12 people were diagnosed with Legionella in 2014, the Health Department discovered the source to be the cooling towers of a Bronx housing project. When the 2015 outbreak occurred, the Health Department suspected the cooling towers again.

There are numerous descriptions of the 2015 outbreak in the Bronx, from dramatic to clinical. The CDC, which served as a spectator as well as a player, posted the following epidemiological summary of the outbreak on its website:

“When cooling towers are not properly maintained, they can become a home for Legionella bacteria, which thrive in untreated warm water. If people with certain health risks breathe in water droplets contaminated with these bacteria, they may develop Legionnaires’ disease. If people are getting sick with Legionnaires’ disease, how can health officials find out the source of the bacteria? A team of city, state, and CDC epidemiologists (disease detectives), laboratory scientists, and environmental health experts was able to do just that with an outbreak this summer in New York City.”

“Recognizing the Outbreak
Legionella bacteria are found naturally in fresh water and can live in most any warm water that isn’t properly treated with chemicals. Most people exposed to Legionella bacteria don’t get sick, but those who are older or already have health problems are at risk for developing Legionnaires’ disease. It’s not surprising for large cities to report several cases of the disease every year. However, epidemiologists are always on the lookout for an increase in cases that might suggest an outbreak of the disease. This past July, after noticing a spike in reports from clinics and hospitals in the Bronx, New York City investigators sprang into action.”

“Identifying the Source
After mapping the places of work and residence of all the patients identified, the investigators noticed a pattern that indicated the source was likely a cooling tower. Then, using state-of-the-art computer modeling programs, the geographic area most likely to contain the contaminated cooling tower was identified. A team of environmental health experts from New York and the CDC then collected samples from every cooling tower in that area and sent those samples to public health laboratories. Legionella are very challenging bacteria to work with, but after weeks of testing, city, state, and
CDC laboratories were able to solve the mystery. The DNA “fingerprint” from the bacteria found in each of the patients was identical to that of the bacteria found in one of the cooling towers, confirming that it was the specific Legionella bacteria from that cooling tower that infected each of those patients.17

“Containing the Outbreak
Even before the source was confirmed, the suspected cooling tower and those in the surrounding area were cleaned and treated. Then officials worked with the building owners to ensure that industry standards for treatment of their cooling tower were met. After weeks of a collaborative epidemiologic, environmental health, and laboratory investigation by the city, state, and CDC, the outbreak was declared over by New York City officials.18

“Keeping an Eye on Cooling Towers
With 128 people infected and 12 deaths attributable to the outbreak as of August 20, 2015, this was the largest outbreak of Legionnaires’ disease ever recorded in New York City. In response, the City passed new legislation that requires registration of all cooling towers and defines maintenance standards. The collaborative efforts of public health professionals from city, state, and federal agencies made it possible for this outbreak to be identified, solved, and contained as quickly as possible. Investigators like these stationed all over the United States, at CDC, and across the globe are working every day to detect, respond to, and prevent public health threats.”19

The New York City health detectives and their federal and state colleagues worked well together and made quick and significant inroads to identifying the disease and its source. Of course, in this case, the health issue was not just an epidemiological exercise; it had become a full-fledged health crisis, with the attendant political and media attention.

How Did The City University of New York Get Involved?
The City University of New York (CUNY) is the country’s largest urban university system and the third largest university system in the United States. In 2015, it had 24 colleges, graduate schools, and professional schools; served approximately 520,000 matriculated and non-matriculated students;20 had almost 44,000 full- and part-time faculty and staff;21 and had more than 26 million square feet of space in approximately 300 buildings located throughout New York City’s five boroughs.22

CUNY has many students that live in the South Bronx, and one of its campuses, Hostos Community College, is located in the epicenter of the outbreak. As a result, Hostos simultaneously became a suspected source—because it has cooling towers—and a valuable resource because it is an ideal staging area for the many agencies that would soon be involved.

To help address the Legionella outbreak, New York State marshalled its Health Department and its Division of Homeland Security and Emergency Services and sent significant resources from Albany and elsewhere around the state to the South Bronx. The Governor’s Office asked if Hostos could serve as the Emergency Operations Center for the Legionella response, and CUNY happily acquiesced.

As was noted in a 2008 URMIA Journal article,23 and referenced in a follow-up 2015 article:

“CUNY’s risk management and business continuity efforts are designed to be collaborative and to foster consultation. Day to day coordination, however, falls to CUNY’s Office of Environmental, Health, Safety and Risk Management. This includes leadership of the CUNY Risk Management and Business Continuity Council and coordination of its monthly meetings; chairing the monthly Emergency Preparedness Task Force meetings; conducting annual risk surveys, developing updated risk maps, and periodically revising the CUNY Risk Management Plan; preparing emergency-specific continuity of operations
plans; and maintaining the university’s risk management, business continuity, and emergency preparedness website. It also involves coordinating all of these activities with stakeholders throughout the university and with external agencies and organizations.”

Because the challenge required the protection of the health and safety of the CUNY community, as well as coordination with a wide range of outside agencies, this team was given leadership responsibility.

Sharing Success
Once the source of the outbreak was determined, several things had to happen to minimize the ongoing and future risk of any additional exposure to Legionella from cooling towers. Many agencies were involved directly, and many others played a supporting role. As noted above, the ultimate health and safety responsibility rested with the Health Department, and Commissioner Bassett issued the Commissioner’s Order. Cooling towers and other building structures are the responsibility of the Buildings Department, and Commissioner Chandler played a critical role in making sure that his department’s concerns were addressed. Finally, as is true of any city emergency, the Department of Emergency Management played a key coordinating role. This included support through regular conference calls, as well as gentle reminders from Commissioner Esposito that deadlines were approaching.

New York State also played a significant role, much of it centered at Hostos Community College. The college was happy to provide a large conference space for New York State Health Department officials, Division of Homeland Security and Emergency Services staff, representatives of the Governor’s Office, and a range of local officials. In addition, the Hostos parking lot became the staging area for the state’s mobile Emergency Operations Center trailer and other vehicles. Teams of inspectors and samplers were dispatched throughout the South Bronx from this central base.

At CUNY, we learned to be good hosts under adverse circumstances from our service as evacuation centers, hurricane shelters, and special medical needs facilities during Hurricane Irene and Superstorm Sandy. In fact, Hostos was experienced enough to understand when to be involved actively—food, sanitation, security—and when to provide background support. Of course, most of our guests were professionals, not evacuees, and we knew that our hosting obligations would be modest and short lived.

On the other hand, making sure that all of CUNY’s 24 campuses were complying with Health, Buildings, and Emergency Management requirements was a bit more complex. First, CUNY had to take inventory of its cooling towers, which is a bit more involved than one might think. As noted, we have more than 300 buildings, some with multiple cooling towers and others with none; some owned by CUNY and others leased from private landlords; some sampled and tested by CUNY staff, others by independent contractors; some with state of the art water treatment systems and others without.

Once a complete inventory was established, the compliance process began. Again, at face value, this would seem like a simple process. However, because of the many different agencies involved and the sometimes inconsistent requirements, the compliance process had some challenges as well.

Finally, procedures had to be put into place to ensure that the measures taken under emergency conditions would be revisited so that standard operating procedures (SOP) could be developed. These SOPs would help routinize the management of complex risks and reduce the need for emergency response going forward.

Conclusion
Several weeks after the crisis had abated, Governor Cuomo’s staff set up a conference at the Empire State Plaza in Albany to evaluate how the Legionella outbreak in the Bronx was handled and to share lessons learned. Many of the organizations that were enmeshed in the response were able to reflect on what went well and where there was room for improvement.

In general, the response to the crisis was extraordinary. So many agencies and organizations committed all the resources at their disposal to address the outbreak. Personnel, equipment, and financial resources were made available, and bureaucratic and jurisdictional challenges were overcome. In sum, while the deaths of 12 people—and the fear and anxiety of an entire city— muted the sense of accomplishment, everyone recognized that without this effort, the results could have been much worse.

Nonetheless, professional risk managers are always committed to continuous improvement. We acknowl-
edge a successful outcome, but we always try to uncover what we could have done better. In this case, as in many other large scale, complex emergencies, there are typically three areas that are often tested: command, control, and coordination.\textsuperscript{27}

Health crises do not respect political, jurisdictional, or organizational boundaries. That is why the first rule of incident management is to establish a clear chain of command. The fact that so many state and local agencies committed resources to address the Legionella outbreak can be vitiated if they are not all working toward the same objectives. When the lines of authority are unclear, coordination becomes much more difficult.

During a crisis, and especially in setting up recurrence prevention, control systems are critical to ensure that instructions are clear and consistent and that outcomes are measured and assessed. Inconsistencies among federal, state, and local regulations are not uncommon; most of us have a favorite example or two. But when new requirements are being established, there is a better chance of avoiding inconsistency and confusion. Similarly, when expectations are clear, outcomes are easier to evaluate.\textsuperscript{28}

Naturally, command and control require effective coordination. It is hard to say that there wasn’t enough communication during the Bronx Legionella outbreak. At the height of the crisis, there were several regular conference calls every day. But effective coordination often requires smaller scale meetings, calls, and written exchanges, where there are opportunities to ask questions and clarify any potential confusion. Emergency operations are always stressful; all the more reason to ensure that coordination is effective.

We started with a story that happened in a basement, so I will end with another underground story—this one at the New York State Emergency Operations Center in a Cold War era bunker in Albany. As you would expect, the technology was state of the art, and it was clear that New York State takes preparedness and emergency response very seriously. But when we got a tour of some of the technology at work, it was the people who operate and apply the emergency technology—the ones who run toward the crisis, not away from it—that were most inspiring. As we implement the Legionella prevention program, and all other risk management initiatives, the technology is important, but it is the human touch, from Commissioner Bassett’s patience to the fearlessness of the rooftop cooling tower inspectors, that really makes the difference.

About the Author

Howard Apsan is the university director of environmental, health, safety, and risk management for The City University of New York (CUNY), the largest urban university system in the United States. CUNY has 24 colleges, graduate schools, and professional schools; approximately 520,000 matriculated and non-matriculated students; 43,000 full- and part-time faculty and staff; and 26 million square feet of space in approximately 300 buildings located throughout New York City’s five boroughs. The university director is responsible for environmental health and safety management and compliance throughout the university. He also serves as the university’s risk manager, tasked with assessing liabilities and designing systems for minimizing CUNY’s operational and reputational risks and promoting resiliency and continuity of operations. He chairs the university’s Environmental Health and Safety Council; the Risk Management and Business Continuity Council; and the Emergency Preparedness Task Force.

Earlier in his career, he served for several years in New York City government at the Mayor’s Office, the Board of Education, and the Sanitation Department. He left municipal government to pursue a career in environmental and risk management consulting, which included eight years as a principal, and ultimately national director, of a nationwide consulting firm, and led to the founding of Apsan Consulting. He has served industrial, commercial, real estate, government, and not-for-profit clients throughout the United States and has extensive international experience.

In addition to his management and consulting activities, he has been a member of the faculty at Columbia University’s School of International and Public Affairs since 1986 and also teaches in Columbia’s Sustainability Management program. He is a LEED Accredited Professional and has served on the United States Technical Advisory Group (US TAG) for ISO 14000, the Ameri-
The author serves as the university director of environmental, health, safety, and risk management for The City University of New York, the largest urban university system in the United States. In addition, he has been an adjunct professor at Columbia University’s School of International and Public Affairs since 1986 and also teaches in Columbia’s Sustainability Management program.


Lawrence K. Altman, “In Philadelphia 30 Years Ago, an Eruption of Illness.”


Endnotes

1. The author serves as the university director of environmental, health, safety, and risk management for The City University of New York, the largest urban university system in the United States. In addition, he has been an adjunct professor at Columbia University’s School of International and Public Affairs since 1986 and also teaches in Columbia’s Sustainability Management program.


5. Ibid.


7. Ibid.


13. “Legionnaires’ Disease Kills Two, Sickens 31 in New York City.”


16. Ibid.

17. Ibid.

18. Ibid.

19. Ibid.


