Appendix Figure 2). In this case, the IgM titer increased in the convalescent-phase serum on day 58 but decreased on day 115. However, the IgG titer increased on days 58 and 115 after onset of illness. In addition, we detected antibodies against *Anaplasma phagocytophilum* by IFA and *A. phagocytophilum*–specific P44 surface antigen by Western blot. We detected only IgG antibodies against *A. phagocytophilum* in all 3 serum samples, suggesting a past infection with *A. phagocytophilum*.

The 3 patients lived on the Kii peninsula of Japan (Appendix Figure 3), which is known to be a JSF-endemic area, especially in Wakayama and Mie Prefectures (*3*,*4*). In addition, anaplasmosis exists in those areas (*5*). Previously, we revealed the presence of ticks infected with *A. phagocytophilum* and *Ehrlichia* sp. that could potentially infect humans in Mie prefecture (*6*,*7*). In particular, members of the *Ehrlichia* sp. genotype 2 group, including *Ehrlichia* sp. MieHl92 and MieHl94, were considered candidate organisms that might cause human ehrlichiosis in Japan (*6*).

In conclusion, we provide serologic evidence of autochthonous cases of human ehrlichiosis in Japan. We recommend that ehrlichiosis should be considered as a clinical cause of febrile illness in this country.

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Environmental Investigation during Legionellosis Outbreak, Montérégie, Quebec, Canada, 2021

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In August 2021, a legionellosis outbreak involving 7 persons occurred within a 500-meter radius in the Montérégie region of Québec, Canada. Near real-time modeling of wind direction along with epidemiologic and environmental investigations identified the possible source. Modeling wind direction could help identify likely *Legionella pneumophila* sources during legionellosis outbreaks.

On August 11, 2021, a third reported legionellosis case in the Montérégie region, Quebec, Canada, triggered an outbreak investigation. Using published guidelines for legionellosis investigations (*1*,*2*), the investigation team sought to find the source of infection and rapidly stop the outbreak (*3*). However, confirmation of environmental sources of *Legionella pneumophila*, the bacteria that causes legionellosis, is not always possible (*4*).

The outbreak comprised 7 identified cases, 5 in men and 2 in women. Case-patient ages were 56–85 years, and all had a positive urinary antigen test for *L. pneumophila* serogroup 1. Patient symptoms began during July 29–August 18, 2021; thus, the incubation period was during July 19–August 16. Five case-patients lived within a 500-meter radius in the same neighborhood but were not otherwise acquainted. The other 2 case-patients visited that same area, 1 during July 28–29, the other on August 1.

Within a 3-km radius of the target area, 5 water cooling towers (numbers 1–5) were in operation in 3 facilities. We collected water samples from the 5 towers during August 12–13 and analyzed samples by PCR and culture (Appendix, https://wwwnc.cdc.gov/EID/article/28/11/22-0151-App1.pdf). We also reviewed results of periodic water sampling conducted on the towers during the previous 12 months; only 1 result was above normal, but it was below Quebec's threshold of 1 million CFU/L for *L. pneumophila*, which requires owners to shut off ventilation, immediately decontaminate the system, and notify public health authorities. A sample collected on July 21 from cooling tower 1 was in the range of 10,000–100,000 CFU/L for *L. pneumophila*, triggering

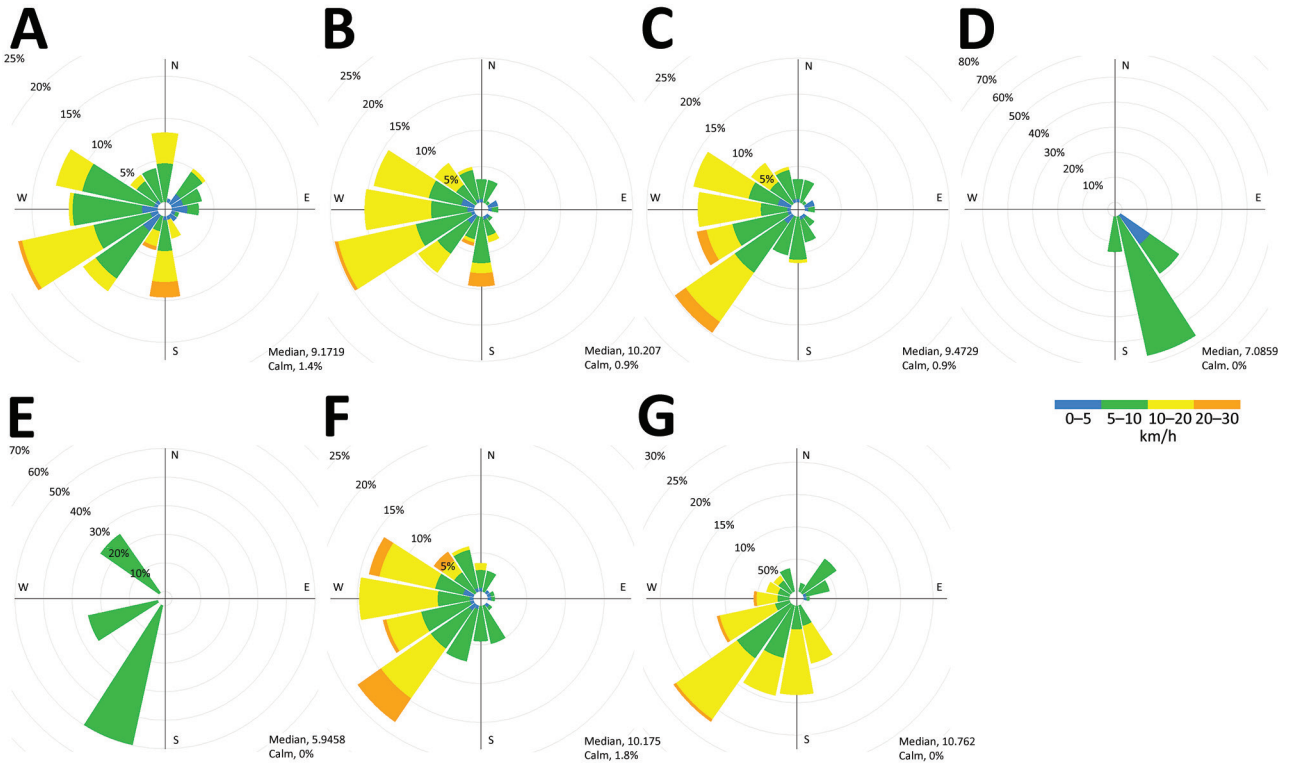

Figure 1. Wind rose profiles during each patient's exposure period used in environmental investigation for legionellosis outbreak, Montérégie, Quebec, Canada, 2021. A–G) Cases C1–C7. Center crosshairs indicate center of the target area for each case; radii indicate percentage of frequency of winds over a time period, plotted by wind direction, with color bands showing wind speed ranges. Median and calm windspeeds are indicate for exposure times for each case. We calculated wind rose profiles for each of 7 case-patients during the time they were likely exposed. Wind rose profiles were generated by using meteorological data from High Resolution Deterministic Prediction System (HRDPS) modeling. Most case-patients, C1–C3 (panels A–C), C6 (panel G), and C7 (panel F), resided in the outbreak neighborhood; cases C4 (panel D) and C5 (panel E) were only in the area for a few hours, enabling more discriminating assessment of the possible exposures. C, case.

mandatory regulatory remediation actions, which the owner implemented. Nonetheless, we requested the owner of that cooling tower stop using the ventilator until we obtained further results.

After receiving PCR results for all cooling towers, we also requested a ventilator shutdown for cooling tower 5 on August 14 because of *L. pneumophila* detection. Subsequent information showed cooling tower 5 had no biocide during July 26–August 14; the tower was flushed and decontaminated on August 15 and 16, and we collected a control sample after decontamination. We reviewed control results for cooling towers 1 and 5, then informed the buildings' managers they could restart the ventilators.

Using published protocols (*5*,*6*), the municipality and a private laboratory took water and swab samples from a rainwater retention pond located near cooling towers 1 and 2 and collected samples in 5 aeration ponds of a sewage treatment plant located near the other 3 cooling towers. All 6 ponds were equipped with aerating fountains, but swab samples were taken from the fountain only in the rainwater retention pond. Cultures identified *L. pneumophila* serogroup 2–15 in samples from 1 aerated pond at the sewage treatment plant, but no intervention was undertaken. Cultures from all other ponds were negative.

Only 2 respiratory specimens could be collected from the 7 hospitalized patients. One clinical specimen was *L. pneumophila*–positive by PCR, but cultures were negative, and sequence-based typing was inconclusive; thus, we could not match human and environmental isolates.

We collaborated with Environment and Climate Change Canada (ECCC) to identify potential *L. pneumophila* sources by examining meteorological conditions during exposure periods. ECCC created atmospheric dispersion models to illustrate wind directions during each case-patient's exposure periods (Figure). Two case-patients were not residents of the area and only visited the community for a few hours, which enabled us to use the wind data as discriminatory support for our source hypothesis. ECCC's model showed the most likely sources were cooling towers 1 and 2 and a nearby rainwater retention pond (Appendix Figures 1, 2). Using near real-time modeling, we triaged and prioritized investigation of exposure sources in the south and west because model findings illustrated little likelihood that exposure originated from the north or northeast (Figure). Modeling showed cooling tower 5 was a low probability source, but absence of biocides during the exposure period raises questions.

Another legionellosis outbreak investigation in Canada showed that few cases result from exposure within a 3- to 10-km radius of the *L. pneumophila* source (*7*). Nonetheless, we expanded our search to cooling towers within a 10-km radius of the target area (cooling towers 6–11) but found no contributing source (Appendix Figures 1, 2).

Our environmental investigation included supplementary information from many partners. Because outbreaks have been linked to misting equipment in grocery stores (*8*) and 5 of 7 case-patients shopped at the same grocery store, we took samples from the store's water system and misting nozzles, but all cultures were negative for *L. pneumophila*. In addition, no tanker trucks were used for cleaning or reducing dust on the roads nor watering flowers in the affected area.

In conclusion, although none of the sampled cooling towers had microbiologic results above the sanitary threshold and we were not able to confirm the source by sequence-type matching, evidence suggests that cooling tower 1 was involved in this legionellosis outbreak. This investigation showed the usefulness of near real-time wind direction modeling, which could help identify likely *L. pneumophila* sources in future outbreaks.

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Environmental Investigation during Legionellosis Outbreak, Montérégie, Quebec, Canada, 2021

Appendix

Results from Water Samples Collected from Cooling Towers

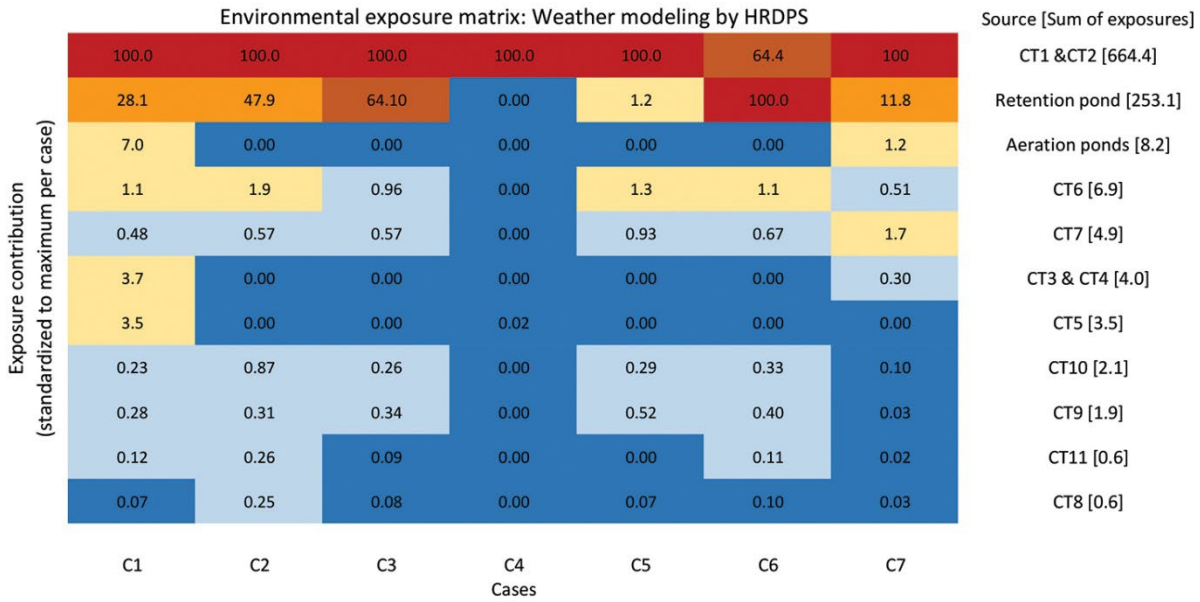
We sent samples taken on August 12 and 13 from suspect cooling towers to Centre d'expertise en analyse environnementale du Québec (the Center of Expertise in Environmental Analysis of Quebec) to conduct PCR and culture analyses. Unlike cultures, for which a result is possible after ≈14 days, PCR analyses are available within a short period, 24–48 h. We sent isolates from cultures to the Laboratoire de santé publique du Québec (Quebec public health laboratory) for identification of *Legionella pneumophila* by sequence-based typing.

PCR analyses were inconclusive for cooling towers 2, 3, and 4. The culture showed the presence of *L. pneumophila* for the cooling tower 4 with a low result of 2,500 CFU/L. No close follow-up was done with this cooling tower because the previous and subsequent monthly control samples were under the remediation action level (i.e., <5,000 CFU/L) and the owner did not report any deficiency in his logbook.

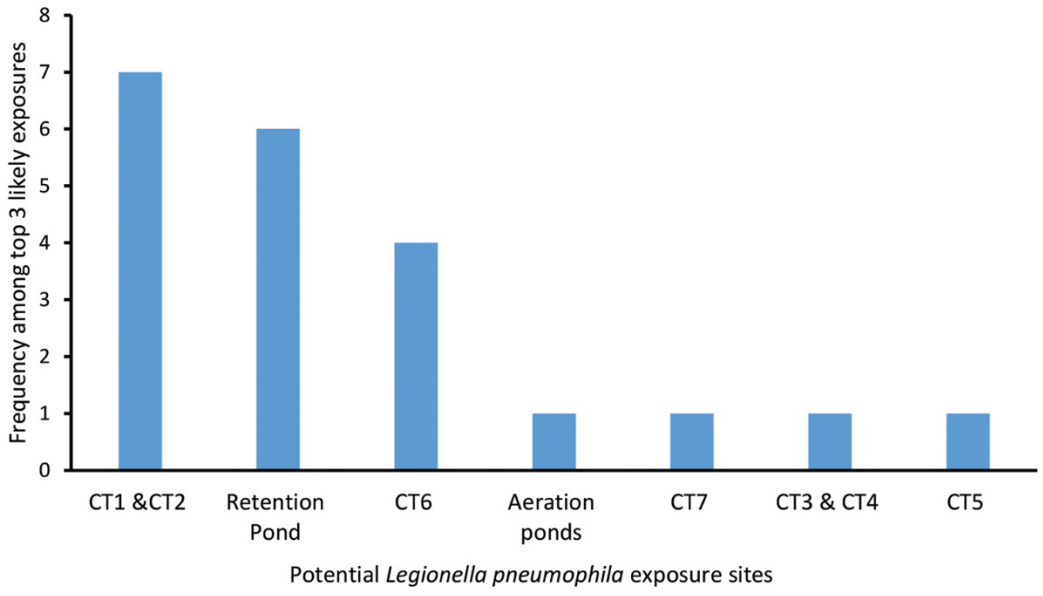
Appendix Table. Results of PCR, culture, and *Legionella pneumophila* sequence-based typing analyses from environmental investigation of legionellosis outbreak, Montérégie, Quebec, Canada, 2021*

Cooling tower no., facility	PCR, GU/L	Culture, CFU/L	Sequence-based typing
CT no. 1, facility A	4,700	5,000	ST1
CT no. 2, facility A	<760	<2,500	None
CT no. 3, facility B	Nonquantifiable	<2,500	None
CT no. 4, facility B	Nonquantifiable	2,500	ST1
CT no. 5, facility C	<190,000†	6,700	ST3023

*Samples were collected from cooling towers located on facilities in a 3-km area. CFU, colony forming units; CT, cooling tower; GU, genomic copies; ST, sequence type.
†*L. pneumophila* detected, but nonquantifiable because of presence of suspended matter and inhibitors.



Appendix Figure 1. Gaussian atmospheric dispersion modeling of *Legionella pneumophila* exposures noted during environmental investigation of legionellosis outbreak, Montérégie, Quebec, Canada, 2021. Using High Resolution Deterministic Prediction System (HRDPS), our partners at Environment and Climate Change Canada (ECCC) created a Gaussian atmospheric dispersion model for each of the suspected environmental sources of *Legionella pneumophila* in this outbreak. Using this model, ECCC produced an environmental exposure matrix for each case at the case-patient's primary exposure site and during their exposure periods. Numerals in each box indicate the relative percentage contribution or exposure each site is estimated to contribute, standardized to the highest contributing source for each case (index = 100). *L. pneumophila* sources are ordered in ascending order of the sum of the exposure estimates indicating that cooling towers at facility A (CT1 & CT2) are the most likely source, then a nearby rainwater retention pond. The Gaussian model suggests notable decreases in likelihood for the subsequent sources as determined by the sum of the exposures. CT6–CT11 are located in a 3- to 10-km radius of the target area. CT, cooling tower.



Appendix Figure 2. Compilation of most frequently contributive sources from HRDPS Gaussian atmospheric dispersion modeling during environmental investigation of legionellosis outbreak, Montérégie, Quebec, Canada, 2021. We ranked the frequency of sources for top 3 sources most likely to contribute to *Legionella pneumophila* exposure as determined by the environmental exposure matrix. The results illustrate that the facility A (CT1 and CT2) was among the top 3 contributive sources for all 7 cases, as was a nearby rainwater retention pond, which scored among the top 3 sources for 6 of the 7 cases. CT, cooling tower.