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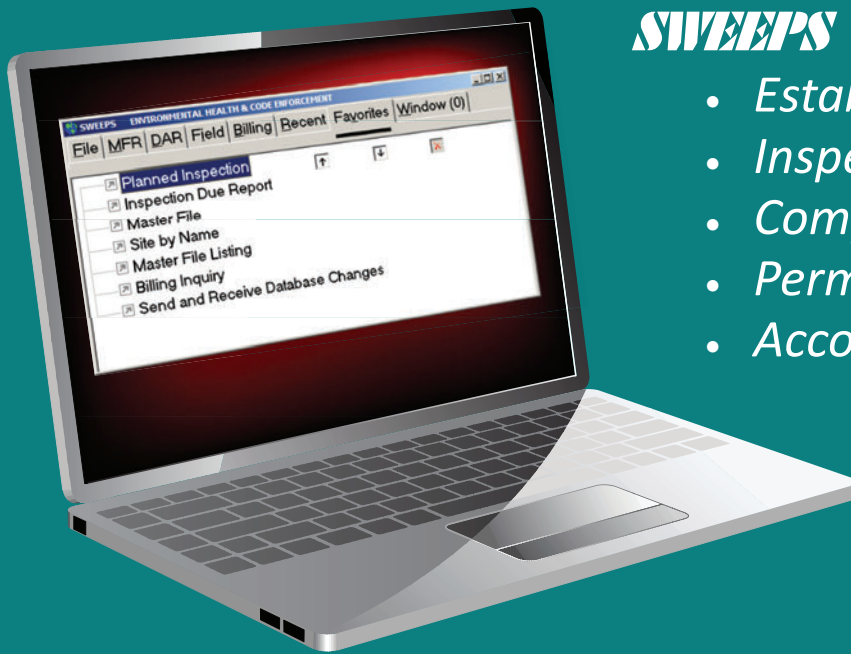
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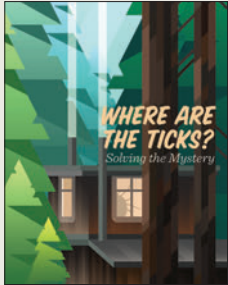
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Volume 78, No. 8 April 2016

ABOUT THE COVER



The Coconino County Public Health Services District was faced with a mystery in 2014 when an outbreak of tickborne relapsing fever occurred and the culprits,

soft ticks, could not be found in their “normal” habitat. Did Coconino call in Scooby-Doo and Mystery Incorporated to solve the mystery? Of course not ... they used sound scientific investigation skills to solve the mystery! This month’s cover feature describes the investigation into the outbreak and how they solved the mystery of where the ticks were.

See page 8.

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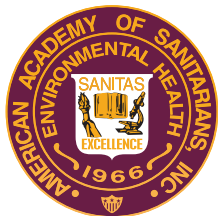
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The American Academy of Sanitarians (AAS) announces the annual Davis Calvin Wagner Sanitarian Award. The award will be presented by AAS during the National Environmental Health Association's 2016 Annual Educational Conference & Exhibition. The award consists of a plaque and a \$500 honorarium.

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- Associations Between Ultrafine Particles and Co-Pollutant Concentrations
- Swine Worker Precautions During Suspected Outbreaks of Influenza in Swine
- E-Journal Bonus Article: Human Waste as a Tool in Biogeochemical Surveys From a Barite Mining Area

Erratum

For "The Impact of Extremes in Outdoor Temperature and Sunshine Exposure on Birth Weight," published in the *Journal of Environmental Health*, 78(6), 92-100, Gouke J. Bonsel, MPH, MD, PhD, Department of Obstetrics and Gynecology, Erasmus University Medical Center, should be listed as the article's fourth author.

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▶ PRESIDENT'S MESSAGE



Bob Custard,
REHS, CP-FS

NEHA Goes to Washington

Astronaut Jim Lovell, commander of the Apollo 13 space mission, once famously said, "There are people who make things happen, there are people who watch things happen, and there are people who wonder what happened. To be successful, you need to be a person who makes things happen." I believe the same applies to organizations. To be successful, NEHA needs to be an organization that makes things happen.

For years, NEHA's members have called for us to expand our influence in Washington, DC, so that we can be more effective advocates for environmental health and the environmental health profession. Whether we like it or not, Washington, DC, is where people and organizations of influence make things happen on a national level.

New Senior NEHA Staff Members Assigned to DC

In January, we announced a major step with the appointment of two new senior staff members who will be stationed in the Washington, DC, area. This is the beginning of a new initiative by NEHA to truly make things happen for us in the national arena.

Sandra Whitehead, PhD, has been hired to lead NEHA's team that works on our grants and contracts with the Centers for Disease Control and Prevention and other federal agencies. Whitehead comes to us from the National Association of County and City Health Officials, where she served as the senior director of community health promotion, overseeing the healthy community design and chronic disease prevention portfolios. Previously she worked with the

In order for us to have an influence on federal priorities, policies, regulations, and budgets, we must consistently be at the table as a key stakeholder.

Florida Department of Health as the state-wide resource on health impact assessment, Health in All Policies, and healthy homes.

Joanne Zurcher, MPP, fills the newly created role of director of government affairs. Zurcher will coordinate our advocacy efforts and help members more effectively educate their federal legislators and officials on environmental health issues. She has more than 20 years of government affairs and legislative experience in both private and government settings. During the debate on the Affordable Care Act, Zurcher worked for the Health Resources and Services Administration as acting director of the Office of Legislation. Previously she served as the director of legislative affairs for Americans for the United Nations Populations Fund and held senior positions with several members of Congress.

Why It's Important for NEHA to Open an Office in DC

Federal priorities, policies, regulations, and budgets are framed in Washington, DC. These decisions affect the work of every environmental health professional in both the public and private sectors. In order for us to have an influence on federal priorities, policies, regulations, and budgets, we must consistently be at the table as a key stakeholder. It is difficult to do this from 1,600 miles away in Denver.

Virtually every national organization with a stake in public health or environmental issues has a presence in Washington, DC. These organizations are able to respond to fast moving issues and quickly exploit windows of opportunity that organizations located outside Washington, DC, may not even be aware of. Many collaborative meetings between key stakeholders happen with only hours of notice. In order to be a serious player in helping frame federal priorities, policies, regulations, and budgets, we have to have a presence in Washington, DC.

Environmental health often deals with crosscutting issues affecting both public health and the environment. This is especially true on issues currently in the news such as water quality (lead in drinking water) and vector control (Zika virus, dengue, and chikungunya). NEHA is in a position to assume a leadership role in pulling together stakeholders to work collaboratively across disciplines on these types of issues if, through a Washington, DC, office, we can build a strong network of partners.

Why a DC Presence Is Especially Important Now

2016 is a federal election year. In less than a year there will be a change in administrations. Even if there is not a change in the political party in the White House, priorities and policies are likely to change for the first time in eight years. It is especially important for us to be at the table as these new priorities and policies are framed as they will likely set the agenda for the next four to eight years.

Further, in the heat of a presidential election, it is unlikely that Congress will agree on a budget this year. It is more likely that Congress will pass a continuing resolution and then present a fresh budget for adoption in the early spring of next year under a new administration. Under this scenario, this year's budget proposals will likely be considered for implementation in a 2017 budget bill as there will not be time between the inau-

guration on January 20 and early spring to craft many new proposals. 2016 is a year that being at the table in Washington, DC, will be especially important.

How Will NEHA's Operation in DC Evolve Over Time?

We hope to secure office space in Washington, DC, perhaps initially co-locating with another public health or environmental organization. As NEHA expands, more staff will likely be stationed in Washington, DC. (NEHA's current Denver office is at capacity.) Eventually we will likely have an office space of our own in the Washington, DC, area.

As NEHA's operations in Washington, DC, ramp up, expect that we will

- increase our collaboration with other public health and environmental organizations on national policy issues affecting environmental health,

- increase our contact with top policy makers in key federal agencies,
- begin playing coordinating and leading roles in bringing together diverse stakeholders on environmental health issues, and
- coordinate "Hill Days" for NEHA members to visit their federal representatives and educate them on environmental health issues.

These are exciting times for us as NEHA members. As an organization we are aggressively moving to become an organization that makes things happen on the national level. The establishment of a permanent NEHA presence in Washington, DC, is a huge step in that direction. 🐘

Bob Custard

NEHA.Prez@comcast.net

Did You Know?

The NEHA 2016 AEC and HUD Healthy Homes Conference, with presenting sponsor Green & Healthy Homes Initiative, is an excellent opportunity for attendees to advance their careers, network with other professionals, and enjoy social events that turn this conference into a memorable experience! Register before April 15 for early pricing at www.neha.org/aec. Be sure to check out the educational tracks offered at the conference online and start building your schedule at www.neha.org/aec/sessions.

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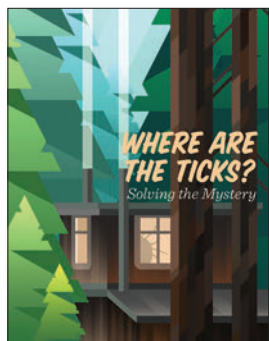
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► SPECIAL REPORT



Where Are the Ticks? Solving the Mystery of a Tickborne Relapsing Fever Outbreak at a Youth Camp

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Services District

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Northern Arizona University

Jennifer Corrigan
Hugh Murray
Matt Maurer
Coconino County Public Health
Services District

Abstract During the summer of 2014 an outbreak of tickborne relapsing fever (TBRF) occurred in a group of high school students and staff at a youth camp, which was reported to Coconino County Public Health Services District. Six confirmed and five probable cases of TBRF occurred. During the environmental investigation two rodents tested positive for TBRF, but the vector, soft ticks, could not be found in their “normal” habitat. Ticks were finally located in areas not typical for soft ticks.

Introduction

The Flagstaff Unified School District (FUSD) has operated Camp Colton as a youth camp since 1971. Each year FUSD provides week-long residential outdoor learning experiences at the camp to about 1,000 local sixth graders on a rotational basis, beginning shortly after the start of school. The camp is located about eight miles north of Flagstaff, Arizona, at 7,000 feet above sea level, and is surrounded by one of the largest Ponderosa Pine forests in the world (Friends of Camp Colton, 2014).

On a Sunday evening in August 2014, the Coconino County Public Health Services District in Flagstaff, Arizona, was notified by a local hospital that four high school students had been admitted exhibiting symptoms of high fever, chills, and body aches. One of the students was considered to be in serious condition.

Prior to the onset of their symptoms, the students had been staying in an old log cabin

at Camp Colton, which is located at the base of the San Francisco Peaks (see photo on page 9). The students were performing public service by cleaning and refurbishing the cabin in preparation for the seasonal opening of the youth camp.

The symptoms displayed by the students mimicked a number of enzootic diseases encountered in the northern region, including hantavirus and plague. Initially, the suspect disease was thought to be hantavirus, since two such cases had recently occurred in and around Flagstaff, one of which was fatal. Moreover, prior to becoming ill the students participated in cleaning activities that exposed them to rodent feces and dust. The initial blood results ruled out hantavirus and identified spirochetes, tickborne relapsing fever (TBRF), which is treatable with antibiotics, as the cause of illness. The camp was closed immediately and an environmental investigation was scheduled for the following day.

Tickborne Relapsing Fever (TBRF)

TBRF is endemic in many parts of Coconino County. The disease-causing agent is a bacterial genus called *Borrelia*. The most common species that may cause human disease is *B. hermsii* (Heymann, 2008). TBRF is transmitted from the bite of an infected soft body tick (family Argasidae) of the genus *Ornithodoros*. Soft ticks, unlike hard ticks, do not stay attached to their host. A soft tick feeds on the host at night and returns to the host nest after feeding. Soft ticks will feed on humans when their rodent host dies (Centers for Disease Control and Prevention [CDC], 2012). The incubation period for TBRF in humans is usually 2–18 days with an average of seven days (Heymann, 2008). TBRF is characterized by relapsing episodes of fever accompanied by a variety of other symptoms, with each fever episode ending with a “crisis” that includes a chill phase and a flush phase (CDC, 2012).

History of TBRF Outbreaks in Coconino County

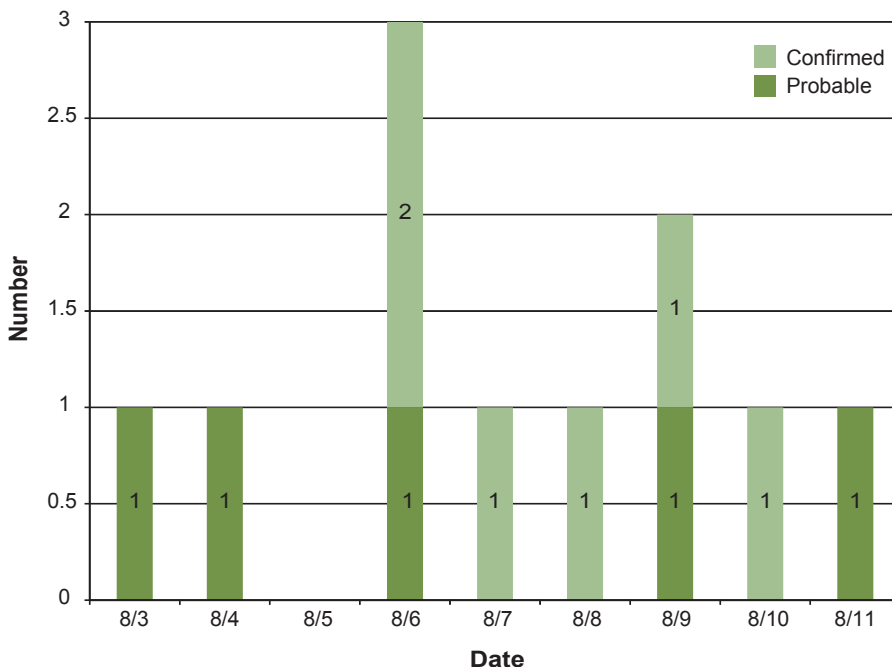
Prior to this outbreak, the last outbreak of TBRF in Coconino County occurred in August 2009 in a cabin located about 19 miles north of Flagstaff in the national forest. One confirmed case and three probable cases occurred. All cases stayed in the cabin. In response to the outbreak, the cabin, which the Forest Service rents to the public, was closed and treated for ticks and fleas, with



Camp Colton.

FIGURE 1

Epidemiologic Curve: Tickborne Relapsing Fever Outbreak, August 2014



all cracks and crevices permanently sealed. Although it is known that soft ticks are the only vector for TBRF, no soft ticks were found or trapped.

Earlier outbreaks were recorded at the North Rim of the Grand Canyon: one in 1990 with 17 confirmed cases and the other in 1973 involving 62 cases. No data exist,

however, about whether ticks were recovered. Typically, soft ticks are found in rodent nesting material (Wheeler, 1942). The failure to find ticks in this outbreak as well as in the cases cited previously has hindered efforts at developing appropriate mitigation strategies. In order to prevent TBRF, the habits of soft ticks must be established. The central issue confronting environmental health professionals is, “Where are the ticks?”

Investigation Protocols

The health district interviewed 26 of the 45 students and staff who stayed at the Camp Colton cabin August 1 through August 3, 2014. Spirochetes were confirmed in initial blood samples screened by the acting hospital and *B. hermsii* was confirmed in blood samples by the Centers for Disease Control and Prevention. Approximately 41 students and staff slept inside the cabin. Of the 41 who slept inside the cabin, six were confirmed and five were probable cases of TBRF (Figure 1). All confirmed and probable cases fully recovered from TBRF.

Concurrent with the epidemiological investigation, the health district coordinated an investigation of the camp and surrounding area. Dr. Nathan Nieto with Northern Arizona University, who is a TBRF expert, was invited on the investigation to collect samples for analysis.

During the environmental investigation, all aspects of the camp were inspected. Evidence of rodents and nesting materials was found in the two open lofts of the main cabin where the students slept as well as throughout the first floor around the kitchen where the staff slept and in the basement area (see photos on page 10, top). During the investigation the camp director indicated that a pest control company was hired to remove rodents from the cabin about a month before students arrived, but the cabin had not been treated for ectoparasites such as fleas and ticks.

Live rodent traps (Sherman traps) were set inside and outside the main cabin by Dr. Nieto (see photo on page 10, bottom). Two chipmunks, two mice, and two voles were caught. One chipmunk (*Eutamias dorsalis*) and one deer mouse (*Peromyscus maniculatus*) tested positive for TBRF. Dr. Nieto also collected rodent nesting material that was sieved for ticks, but no ticks were found. As in previous investigations, this was a concern



Loft inside cabin.



First floor inside cabin.



Dr. Nieto processing a chipmunk.

because without finding the ticks the vector of this disease could not be verified. Once again the investigators were left wondering, "Where are the ticks?"

After the investigation was completed the health district environmental assessment was written and provided to the camp director.

The environmental assessment included a list of items that needed to be corrected prior to reopening. Items on the list included treatment for ectoparasites by a state licensed pest control company and sealing penetrations, holes, cracks, and crevices throughout the inside of the old log cabin. The basement located under the old cabin was cluttered, which provided harborage for rodents and was therefore added to the remediation list of areas to be cleaned out. The dry food store room for the kitchen also needed to be cleaned and organized, with all boxed and plastic wrapped food items to be stored in rodent-resistant containers.

Solving the Mystery

To this point investigators had searched for ticks based on the conventional assumption that they would be found in rodent's nesting material. As in previous outbreaks no ticks were found. Then the search was extended to

areas of the cabin where ticks would not typically be found. Expanding the search protocols yielded unexpected results. Black tarry spots were found along the window frames in both the upstairs and downstairs windows (see photo on page 11, left). Closer examination revealed these spots to be digested blood deposited by ticks. Further examination revealed a few remaining ticks that were hiding in cracks along the windows, and both live and dead specimens were found behind pictures near the windows, which are located in close proximity to the sleeping areas (see photo on page 11, right).

Finding soft body ticks harboring in window frames and in cracks and crevices of walls is unusual. Typically soft body ticks are found in rodent nesting material where they have easy access to their hosts for blood meals. In this case, however, it appears that the ticks changed their habits in order to gain access to both rodent and human hosts, enabling



Black tarry spots.

the ticks to make seasonal transitions. During off-season months, hosts consisted of rodents and during the months the camp operated, the primary hosts were humans. To accommodate this dramatic change of hosts over the course of a year, it appears the ticks adopted behaviors typically encountered in bed bugs.



Soft tick found in cabin.

Conclusion

The camp was reopened after the cabin was retreated in the areas where the ticks were found and after both the cabin and basement had been completely cleaned, removing all unnecessary articles and sealing cracks and crevices. As an added precaution, staff and students slept in newly constructed structures located away from the log cabin.

Following the tick hiding place discoveries made at Camp Colton, health district investigators revisited the Forest Service cabin, which was the site at the 2009 TBRF outbreak. Back at the Forest Service cabin, black tarry spots were found on the surfaces of the windowsills adjacent to the sleeping areas. The Forest Service closed the cabin

and treated the identified areas for soft ticks. This investigation provided new information into the feeding habits of ticks, helping solve the mystery. Now that it is known where the ticks are, this information will be applied for future TBRF outbreaks. 🐜

Acknowledgements: Marie Peoples, PhD, chief health officer, Coconino County Public Health Services District; Randy Phillips, division manager, Coconino County Public Health Services District; Trish Lees, public information officer, Coconino County Public Health Services District; Eric Bohn, environmental specialist 1, Coconino County Public Health Services District; David Engelthaler, PhD, general manager, TGen Translational Genomics Research Institute; LCDR Jefferson Jones, MPH, MD, U.S. Public Health Service, Epidemic Intelligence Service officer, Centers for Disease Control and Prevention, Arizona Department of Health Services, Maricopa County Department of Public Health.

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Assessment of *Enterococcus* Levels in Recreational Beach Sand Along the Rhode Island Coast

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Rhode Island Department of Health

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Abstract Recent studies have shown that coastal beach sand as well as coastal ocean water can be contaminated with fecal indicator *Enterococcus* bacteria (ENT). A study of sand ENT concentrations over a four-week period at 12 Rhode Island beaches was conducted during the summer of 2009. While average contamination was low relative to water quality standards, every beach had at least one day with very high sand ENT readings. On 10 of the 12 beaches, a statistically significant gradient occurred in geometric mean ENT concentrations among tidal zones, with dry (supratidal, or above high tide mark) sand having the highest level, followed by wet (intra-tidal, or below high tide mark) and underwater sand. Beaches with higher wave action had significantly lower ENT levels in wet and underwater sand compared to beaches with lower wave action.

Introduction

The Beaches Environmental Assessment and Coastal Health Act of 2000, 2012 (BEACH Act) requires all coastal states and territories to monitor the water quality of its recreational coastal beaches for pathogens that are harmful to human health. Following guidelines established by the U.S. Environmental Protection Agency (U.S. EPA), Rhode Island monitors all licensed saltwater beaches for *Enterococcus* bacteria (ENT) including the species *faecalis* and *faecium*. Although harmless strains of the bacteria are present in the human digestive system, more virulent and antibiotic-resistant strains also exist that when ingested in high enough concentrations can cause significant gastrointestinal distress and potentially other illnesses including skin-related symptoms such as rash and itching (Heaney et

al., 2012; Yau, Wade, de Wilde, & Colford, 2009). Such illnesses can be especially serious in children, older adults, and those with compromised immune systems. Further, the presence of ENT is also indicative of the presence of other fecal bacterial pollution. As such, ENT results are referenced as fecal indicator bacteria (FIB) used to assess the possible presence of other such bacteria.

Rhode Island's combined sewer overflows and urban and agricultural runoff are sources of fecal pathogens that are released into the ocean and carried toward beach environments. During the summer season sources of contamination in ocean water and beach sand include beachgoers, waterfowl, wildlife, and pet waste. Although dogs are not allowed on most Rhode Island beaches during the summer season many owners bring their pets to the beach and do not properly dispose of

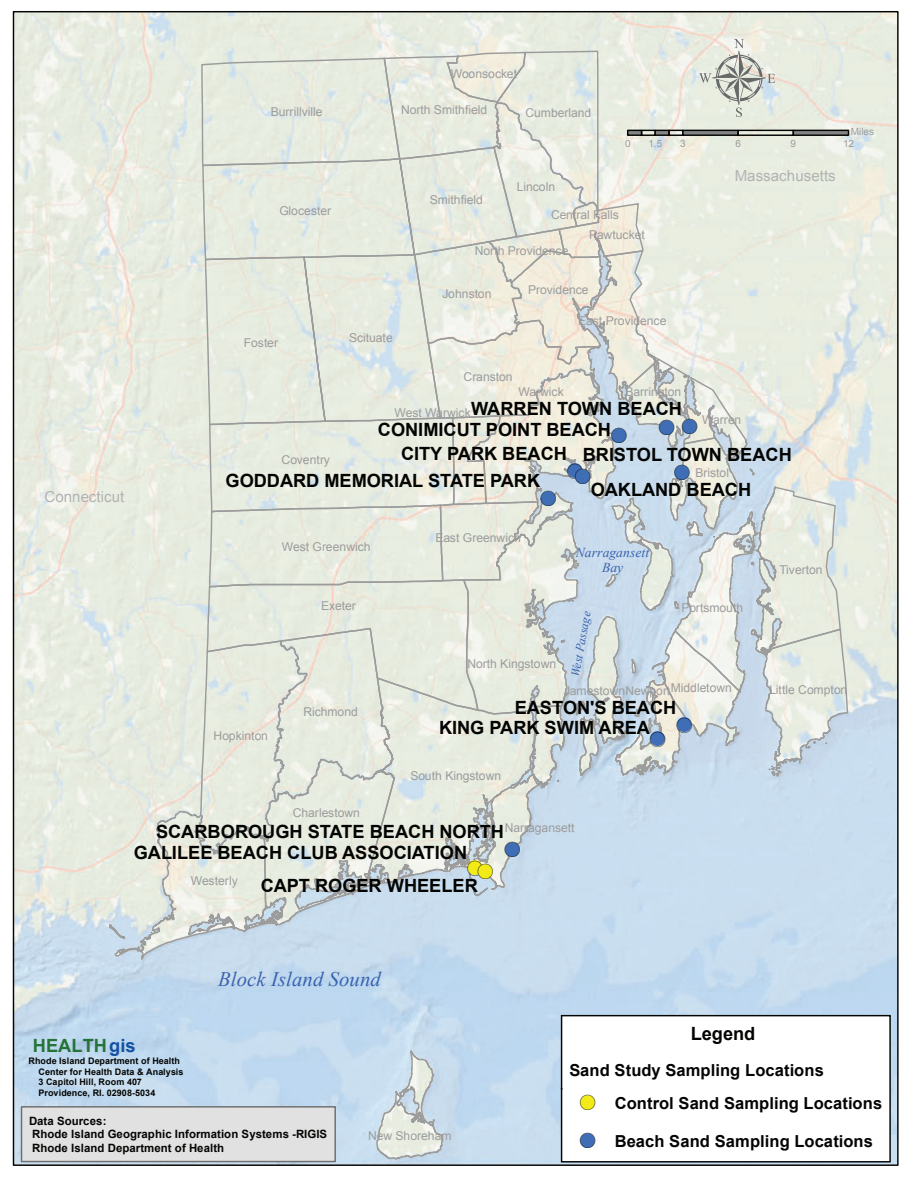
the waste. Pet waste may then be washed into the ocean, increasing levels of ENT. In some water bodies, sewage discharges from boaters also pose problems for water quality; however, Rhode Island has "no discharge" regulations for all marine waters, including Narragansett Bay.

Recent studies have shown that ENT is widespread in beach sands along the coast of California (Yamahara, Layton, Santoro, & Boehm, 2007), Hawaii (Cui, Yang, Pagaling, & Yan, 2013), North Carolina (Gast, Gorrell, Raubenheimer, & Elgar, 2011), and Florida (Phillips, Solo-Gabriele, Piggot, Klaus, & Zhang, 2011). Generally, these studies note higher concentrations of ENT in dry sand (above the high tide mark, or supratidal zone) and lesser concentrations in wet sand (below high tide mark, or intertidal zone) and underwater sand (subtidal zone). Further, high tide, rain events, groundwater discharge, and even pedestrian traffic may facilitate transport of ENT from sand into the water (Halliday & Gast, 2011; Yamahara et al., 2007). This statement may also be true for Rhode Island as historical data show rainfall and beach closures are highly correlated.

Many of Rhode Island's marine beaches (i.e., ocean or salt water) are located in the highly urbanized Narragansett Bay Watershed, where many of the known ENT sources exist. The BEACH Act allows the Rhode Island Department of Health to apply a risk-based monitoring and notification program to marine bathing beaches across the state. From Memorial Day through Labor Day, beaches that are historically at highest risk for illness are sampled three times per week,

FIGURE 1

2009 Rhode Island Beach Sand Sampling Locations



while historically lower risk beaches are monitored twice per month. This risk-based approach ensures that higher risk beaches are sampled more often and thus more protective of public health. The potential risk of a beach is determined by historical water quality and its relation to sources of contamination. During this time, water quality samples exceeding the single sample maximum of 104 CFU/100 mL of water were closed to swimming by state health officials.

A study of sand ENT concentrations over a four-week study period at 12 Rhode Island beaches was conducted from August to September 2009. The purpose of our study was to determine the levels of ENT in Rhode Island beach sand and to examine what features, if any, could help explain the ENT levels found. Ultimately, results from our study will help determine whether beach sand may expose beachgoers to ENT and what influences may contribute to this risk.

Methods

Study Sites

Our study was performed from August 11, 2009, through September 3, 2009, at 12 of Rhode Island's 74 licensed coastal beaches (Figure 1) for a total of 15 sampling days over a four-week period. This study period reflects the end of the summer season in Rhode Island and a time of high bather load. Sand samples were collected at 10 of Rhode Island's highest risk beaches as determined by location-specific characteristics such as potential sources of contamination, historical water quality, and bather load. Two additional beaches were sampled as control sites determined by lack of contamination sources and historically clean water quality (Table 1). The 12 collection sites were also selected to incorporate high, medium, and low wave intensities. Three of the 10 beaches contain a potential direct source of contamination, being either storm water outfalls or a stream.

Sand Data Collection

Three samples were collected in a line perpendicular to the water, at three locations directly up the center of each beach. The first (subtidal) sample was collected underwater in approximately 45–60 cm of water. The underwater sand sample was collected at a depth of 7–15 cm using a 500-mL bottle capped underwater to ensure no loss of sediment. If the field staff was unable to collect a minimum of 250 mL of sand due to the underwater terrain (rocks, shells), sand was collected underwater within the closest vicinity of the correct location.

The second sample was collected in the intertidal zone between the high and low tide lines to capture consistently wet sand, despite the current tide. The third sample was collected above the highest high tide line in dry sand. Field staff wore vinyl, latex-free gloves while collecting these samples, and all samples were taken at depths of 7–15 cm.

Three additional samples were collected at both Scarborough State Beach in Narragansett and Bristol Town Beach in Bristol. Both of these beaches have storm water outfalls located on the beach, but not close to the center sampling stations. One sample was collected in the dry sand directly at the mouth of the pipe, one sample in the wet sand directly in line with the mouth of the

TABLE 1

Characteristics of 12 Rhode Island Study Beaches

Location*	Beach Name	Shore Line Length Category	Amount of Wave Action	Storm Drain Pipe or Stream on Beach	# Days Closed in 2009	Median (Range) <i>Enterococcus</i> CFU/dL in Ocean Water During 2009 Season
Upper Narragansett Bay	Barrington Town	300'–700' (91 m–213 m)	Low	No	15	15.0 (10–566)
	Bristol Town	300'–700' (91 m–213 m)	Low	Yes (pipe)	12	25.5 (10–453)
	City Park	<300' (<91 m)	Low	No	12	10.0 (10–1296)
	Conimicut Point	300'–700' (91 m–213 m)	Low	No	19	24.4 (10–894)
	Goddard Memorial State	>700' (>213 m)	Low	No	10	30.7 (10–7032)
	Oakland	>700' (>213 m)	Low	No	17	20.3 (10–486.7)
	Warren Town	<300' (<91 m)	Low	No	9	20.0 (10.0–341)
Easton Bay/ Newport	Easton's	>700' (>213 m)	High	Yes (stream)	3	20.0 (10–790)
	King Park	>700' (>213 m)	Low	No	0	10.0 (10–4016)
Open Ocean	Capt. Roger Wheeler State	300'–700' (91 m–213 m)	Moderate	No	0	10.0 (10–29)
	Galilee Beach Club	<300' (<91 m)	Moderate	No	0	10.0 (10–52)
	Scarborough State	>700' (>213 m)	High	Yes (pipe)	5	12.0 (10.0–784)

*Locations are listed from north to south; beaches within locations are listed alphabetically.

pipe, and a third sample underwater in line with the second sample and the pipe. At Easton's Beach in Newport, a stream runs perpendicular to the beach and directly into the water. For this location, only one sample was collected underwater in the center of the stream. All samples were placed on ice in a sanitized thermal cooler and transported to the State Health Laboratory within six hours of the first beach sample collected each day.

Field staff also completed a visual environmental survey of each beach during each sampling day. They documented water temperature, date and time of day, latitude, and longitude. They qualitatively observed weather conditions (rain, sun, clouds), incoming and outgoing tides, shoreline vegetation, water clarity, and potential sources of contamination (waterfowl, pets, wildlife), and bather load.

Laboratory Analysis

The Enterolert test kit by IDEXX was used and calculations were performed to convert results to CFU/g of sand. From each sand sample, two aliquots of sand were weighed, a 35 g por-

tion for bacteria testing, and a 10 g portion for dry weight analysis. The 35 g sand was rinsed with 10 mL of sterile water. The 10 mL of rinse water, diluted with 90 mL sterile water, per instructions, was then used as the sample aliquot for the salt water Enterolert procedure. The 10 g portion of sand was dried and reweighed. Results were computed by dividing the number of bacteria colonies incubated from the water by the dried weight of sand to produce CFU/g of sand.

Ocean Water Data Collection

In addition to ENT levels in beach sand, ENT levels in the adjacent beach water was also provided. Water samples were collected between knee and waist deep using a 250-mL bottle. The sand study was independent of the water testing. The Rhode Island Department of Health provided an Excel file with the 2009 beach water results. From this data set, information on ocean samples from the same days and on the same beaches as the sand samples were selected for comparative analysis. Only ENT readings that were part of routine water monitoring were included;

supplementary samples collected after single sample exceedances were excluded.

Data Analysis

Data analyses were performed in SAS version 9.3. The distributions of ENT values for both the ocean and sand data were examined. The daily amount of ENT at each beach varied greatly in both environments, ranging from nearly zero to 900 CFU/g or more. To reduce this variability in order to more clearly see patterns in the data, such as when comparing mean values, ENT values were natural log-transformed prior to statistical analysis. Analysis of variance (ANOVA) was used to determine whether the average amount of ENT in beach sand varied significantly by tidal zones. Traditional ANOVA was used in the overall analysis that combined the data for all beaches because of the large sample size (225 measures = 15 measures times 12 beaches). Nonparametric ANOVA, also called the Kruskal-Wallis test, was used when examining the distribution of ENT by tidal zones for each individual beach because of the much smaller sample size (15 measures/beach).

TABLE 2

Comparison of Mean Beach Sand *Enterococcus* (ENT) Levels, by Tidal Zone Over 15 Sampling Days (August–September 2009)

Beach Location and Name	Geometric Mean* ENT/g Levels (Actual Range)			Analysis of Variance (ANOVA) Test**
	Underwater (Subtidal) Sand	Wet (Intertidal) Sand	Dry (Supratidal) Sand	
Upper Narragansett Bay				
Barrington Town	1.49 (0.3–714)	2.40 (0.3–912)	0.25 (0.3–220)	3.46/.0289
Bristol Town	-2.83 (2–108)	4.20 (13–709)	4.36 (12–722)	5.35/.0087
City Park	1.28 (0.4–899)	1.37 (8.2–313)	5.25 (10.3–695)	33.78/.0001
Conimicut Point	3.49 (2.1–876)	3.65 (1.9–804)	4.22 (2.7–694)	0.79/.4594
Goddard Memorial State	0.48 (0.8–252)	1.07 (7.3–857)	3.91 (6.9–820)	10.52/.0002
Oakland	3.79 (2.1–910)	5.38 (1.6–760)	6.01 (0.3–716)	4.80/.0133
Warren Town	2.41 (2.3–75)	3.81 (4.3–809)	4.41 (4.7–340)	6.69/.0031
Easton Bay/Newport				
Easton's	3.13 (0.4–932)	3.37 (1.5–927)	3.74 (3.9–737)	0.33/.7184
King Park	3.17 (0.7–939)	4.60 (9.5–805)	4.00 (9.7–743)	3.00/.0605
Open Ocean				
Capt. Roger Wheeler (control)	2.97 (0.4–49)	2.76 (0.4–953)	5.11 (68.3–713)	5.72/.0064
Galilee Beach Club (control)	2.17 (0.3–318)	3.00 (0.3–968)	4.73 (1.6–695)	6.42/.0038
Scarborough State	0.22 (0.3–867)	-0.10 (0.3–7.0)	3.84 (4.7–340)	29.61/.0001
Overall beaches	2.29 (0.3–939)	2.95 (0.3–968)	4.15 (0.3–820)	32.20/.0001
*The geometric mean is computed by taking the natural log transformation of values and then averaging them. This method is used to make the average more representative when data are skewed. Note: a negative geometric mean implies the actual mean is <1 ENT/g.				
**The ANOVA tests for a significant difference in mean levels across tidal zones. To account for small sample size (15 sampling days per beach), nonparametric ANOVA is used on the beach-level analyses. For the combined beach analysis, parametric ANOVA is used.				

ANOVA was also used to test for significant differences in geometric mean ENT levels by tidal zone, when beaches were grouped by the amount of wave action and by existence of a point source of pollution on or near the beach. All 12 beaches were classified based on these two features; the two control beaches were classified in the high wave action and no point source categories. In these analyses, random-effects ANOVA was used to account for correlated data due to having multiple (15) readings per beach when grouping data by wave action or point source. For all statistical analyses, *p*-values < .05 are indicative of a statistically significant difference across groups; *p*-values ranging from .05 to .10 are indicative of a weaker tendency.

Results

During the four-week study period, the concentration of ENT in beach sand varied substantially. Every beach had at least one dry sand reading well over 104 CFU/g (U.S. EPA threshold for safe swimming), and most beaches had at least one wet or underwater sand reading also exceeding the U.S. EPA threshold for safe swimming (Table 2). ENT levels were highest in the supratidal zone, lower in the intratidal zone, and lower still in the subtidal zone. For 10 of the 12 beaches, this gradient across zones was statistically significant (Table 2).

Combining results across all beaches, the geometric mean concentrations were 2.29 CFU/g (subtidal zone), 2.95 CFU/g (inter-

tidal zone), and 4.15 CFU/g (supratidal zone). This gradient was also observed on the two control beaches; supratidal ENT levels were in the same range as on the noncontrol beaches. On the two beaches without a statistically significant gradient (Easton's Beach and Conimicut Point), mean levels were high in all three zones.

The typical degree of wave action was also statistically significantly associated with the ENT concentration in the subtidal and intertidal zones, but not in the supratidal zone (Table 3). Beaches with lower wave action (*n* = 8) had higher concentrations of ENT in the subtidal and intertidal zones than beaches with moderate (*n* = 2) or high (*n* = 2) wave action.

Three of the beaches had potential point sources of storm water runoff (two had storm water outfalls and one had a stream). Geometric mean ENT readings in front of the outfalls were typically greater than along the central sampling locations. Underwater readings in the stream were greater than the central underwater sampling location. The data indicate, however, that these point sources did not result in higher ENT concentrations in any of the three central measurement zones (Table 3).

To determine whether the days with high ocean ENT readings were also the days with consistently high (or low) sand readings, we identified 105 pairs of ocean and sand readings collected on the same day. The number of days of readings was 10–12 for most beaches, except for Galilee Beach Club, which only had one day with coincident readings. Because of the limited number of sampling days, this analysis could not take into account that it might take more than a day for ENT to migrate through the sand toward the ocean.

The linear correlations between ocean and sand ENT results were computed and no significant associations were found for any beach, nor all beaches combined. A less stringent analysis was performed by categorizing the ocean water ENT as simply exceeding ≥104 CFU/mL or not. Sand ENT was similarly categorized. Of the 22 days with high ocean water ENT readings, 12 (or 55%) also had high sand readings (nine in dry sand, two in wet sand, one in both wet and dry sand). Conversely, of the 66 days with high levels of ENT in sand, only 12 (or 18%) had high

TABLE 3

Association of Beach Characteristics With *Enterococcus* (ENT)/g levels in Beach Sands Over 15 Sampling Days (August–September 2009)

Characteristic	Underwater (Subtidal) Sand		Wet (Intertidal) Sand		Dry (Supratidal) Sand	
	Geometric Mean (SD)	F-Statistic/p-Value	Geometric Mean (SD)	F-Statistic/p-Value	Geometric Mean (SD)	F-Statistic/p-Value
Wave action		7.51/.01		6.30/.02		0.12/.89
Low	2.91 (2.10)		3.77 (1.93)		4.01 (2.29)	
Moderate	0.88 (1.71)		1.22 (2.28)		4.58 (1.66)	
High	1.16 (2.21)		1.44 (2.26)		4.29 (1.68)	
Point source		0.85/.39		0.56/.47		0.05/.84
Yes	1.73 (2.08)		2.32 (2.38)		4.31 (1.62)	
No	2.47 (2.26)		3.15 (2.31)		4.10 (2.25)	

Note. Random-effects analysis of variance was used to test for significant differences in mean ENT levels: (1) across wave action categories, in each tidal zone, and (2) across point source category, in each tidal zone.

TABLE 4

Association Between Sand and Ocean Readings on the Same Day, During the Study Period (n = 105 Pairs of Readings)

Measurement	All Three Sand Zone Readings <104 CFU/g	At Least One Sand Zone Reading ≥104 CFU/g	Total
Ocean reading <104 CFU/dL	29	10	39
Ocean reading ≥104 CFU/dL	54	12	66
Total	83	22	105

ocean water ENT results. So, knowing the ocean reading conferred some information about the sand reading on the same day, but not the other way around.

Analyses also examined ENT by other features of the beach. Sampling days were categorized as beginning of the week (Monday) versus later in the week (Tuesday–Thursday) to reflect heavier bather loads on the weekends. Sampling days were also categorized by bird count. Neither analysis was statistically significant. An analysis of rainfall, a known risk factor for high ocean ENT levels, was not significant; however, no heavy rainfall occurred during the study period (only one rainy day with 0.2” accumulation).

Conclusion

Using methods consistent with other published studies, we found a similar result—a gradient in geometric mean ENT levels across

tidal zones in beach sand. This pattern was found on 10 of 12 Rhode Island beaches, including two control beaches, chosen for their historically clean water quality. In fact, the geometric mean levels in dry, or supratidal sand, was as high on these two beaches as on the other 10 beaches. Over four weeks (15 sampling days) all the beaches had one or more days of high ENT levels in sand, indicating that short-term spikes were a relatively common occurrence.

Many factors contribute to the fluctuation in ENT levels in sand and ocean water absent an outbreak. Bacteria may naturally reside in sand as well as have been added to sand through pollution. ENT may take refuge in biofilm within the dry sands, allowing conditions in the substrate necessary to feed ENT reproduction. This occurs at the highest rate within temperatures between 35°C and 37.5°C and has been shown to culture in

marine sediments up to 68 days after deposition (Ferguson, Moore, Getrich, & Zhou-dai, 2005). These sands may provide a constant ENT supply into the saline groundwater beneath the dry sands or wet intertidal sands and thus directly into ocean water via wave action. It is noted, however, that studies indicate ENT released from intertidal sand during high tide, which can cause mild elevations of ENT in water, may only last for periods up to four hours in sunny weather (Zhu, Wang, Solo-Gabriele, & Fleming, 2011), and can reach a 90% mortality rate within 60 hours (Ferguson et al., 2005). Our results support these possibilities; we found lower ENT levels in subtidal sands in the presence of higher wave action.

Throughout the macroscale cycle of ENT movement through beach sands, smaller event-driven cycles (microscale) appear to be causing fluctuation in the ENT levels between tidal zones, with significant variation between beaches. Many factors may be driving these cycles (Zhu et al., 2011). In part these include dog and bird fouling, seaweed and debris, anthropogenic effects such as beach use or combing, interaction with other bacteria or viruses sharing the biosphere, temperature, and ultraviolet exposure. These variables, some unmeasurable and with complex interactions, explain the difficulty assessing associations between measured microlevel factors and sand ENT levels given the short duration of this study period.

Unlike ocean ENT exposure, very few studies have been published on the health effects of sand ENT exposure. Heaney and co-authors (2009, 2012) did find an association between human interaction with beach sand (ingestion of, or being buried, in sand) and increased risk of gastrointestinal illness in children. Researchers examining illnesses in bathers at three beaches in Puerto Rico (Sanchez-Nazario, Santiago-Rodriguez, & Toranzos, 2014), used a novel, more integrated approach. In their pilot study, they measured microbial levels in dry sand and ocean water, and followed a group of beachgoers (swimmers and nonswimmers alike) to ascertain symptoms over 8–10 days. They reported illness incidence rates *per beach*, indicative of combined exposure to ENT and other FIB in the beach environment. Illness rates (gastrointestinal, respiratory, and skin) were typically higher for swimmers than nonswimmers, but illness rates varied by beach.

More research is needed on the health impacts of FIB in the beach environment, particularly from beach sand. Given the known risks of FIB in water, however, and

the strong evidence of FIB occurring in sand, our findings support advising the public to take simple sanitary precautions to reduce the likelihood of ingesting sand. These measures include disinfecting hands after digging in the sand and before eating, showering, and rinsing off toys and other beach equipment.

Future experiments might incorporate sand measurements from three tidal zones at one or more beaches throughout a full swimming season (Spring–Fall). This would provide new insights into sand ENT levels in correlation with ocean water exceedances. These measurements could help inform the decision to close beaches; how long they should be closed; provide information leading to minimizing public exposure; and provide insight into solutions other than closure. Other useful experiments could be designed to assess variation in ENT levels in sand and ocean over longer time periods and larger areas of the beaches. For example, a study that samples specific locations where dogs or birds foul sand could help identify the type and amount of bacterial contamination and duration the contamination remains in that

location. Such information would prove critical in forming more accurate decision making and thus minimizing the impact beach closures have on the general public and local economies.

Additional knowledge about sand FIB could lead to better management practices such as the use of daily sand raking, rotating use of beach sections, and so on. Pilot studies of such techniques can be conducted to compare ENT levels between treated and untreated sands and drive policy decisions resulting in fewer beach closures and decreased fecal bacterial exposures from interaction with beach sand. 🐾

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Health and Environmental Hazards of Electronic Waste in India

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Abstract Technological waste in the form of electronic waste (e-waste) is a threat to all countries. E-waste impacts health and the environment by entering the food chain in the form of chemical toxicants and exposing the population to deleterious chemicals, mainly in the form of polycyclic aromatic hydrocarbons and persistent organic pollutants. This special report tries to trace the environmental and health implications of e-waste in India. The author concludes that detrimental health and environmental consequences are associated with e-waste and the challenge lies in producing affordable electronics with minimum chemical toxicants.

Introduction

Hazardous Substances in E-Waste

The composition of e-waste is incredibly miscellaneous. E-waste contains complex mixtures of potential environmental contaminants that are distinct from other forms of waste (Robinson, 2009). It contains more than 1,000 different substances that fall under “hazardous” and “nonhazardous” categories (Ministry of Environment and Forests, 2008). Due to the presence of a large number of hazardous substances including heavy metals (e.g., mercury, cadmium, lead, etc.), flame retardants (e.g., pentabromophenol, polybrominated diphenyl ethers [PBDEs], tetrabromobisphenol-A, etc.), and other substances, e-waste is generally considered hazardous, and if improperly managed, may pose significant environmental and health risks (Tsydenova & Bengtsson, 2011). Some potential contaminants in e-waste are so uncommon that little research has been conducted on their disposal conse-

quences. Further, chemical composition of e-waste varies depending on the age and type of the discarded item as some new chemicals are introduced into electrical and electronic equipment (EEE) from time to time while other chemicals are restricted. For instance, e-waste composition is changing with technological development and pressure on manufacturers from regulators and nongovernmental organizations (NGOs) (Robinson, 2009). The replacement of cathode ray tube (CRT) monitors with liquid crystal displays (LCD) is a constructive advancement in this context as it reduces the concentration of lead in e-waste. LCD displays, however, contain the heavy metal mercury.

Furthermore, e-waste contains certain precious metals such as gold, silver, and copper. This provides incentives for recycling and makes e-waste economically significant. For instance, precious metal concentrations in printed circuit boards are more than tenfold higher than commercially mined minerals (Robinson, 2009). Platinum group metals are

included in EEEs due to their high chemical stability and conductance of electricity (Robinson, 2009). Thus, a hidden treasure lies beneath the ever-growing mountain of e-waste. Some 820,000 tons of copper are included in the annual flow of e-waste (Robinson, 2009).

Health Hazards Related to E-Waste Treatment

E-waste treatment including simple recycling, burning, chemical digestion, and disposal practices exposes the workers and area residents to high levels of toxicity through mechanisms such as inhalation, contact with soil and dust, dermal exposure, and oral intake of contaminated locally produced food and drinking water. Unregulated recycling activities generate workplace and environmental contamination by a wide range of chemicals. Methods used for recycling of e-waste release toxic metals (such as lead) as well as persistent organic pollutants (POPs) into the environment (Wong et al., 2007). Inhalation and dust ingestion are suggested as particularly important routes of human exposure. An assessment of risk from dust ingestion conducted by Leung and co-authors (2008) revealed that ingestion of lead- and copper-contaminated dust may pose serious health risks to workers and local residents. For instance, for a printed circuit board recycling worker, the estimated oral average daily dose of lead exceeded the “safe” oral reference dose for lead by 50 times. Available evidence demonstrates that e-waste-related mixtures (EWMs) contain both chemicals present in EEE components and chemicals released during e-waste combustion (Frazzoli, Orisakwe, Dragone, & Mantovani, 2010). EWMs can enter living organisms, from food-producing

TABLE 1

Effects of E-Waste Components on Health

Source of E-Wastes	Constituent	Health Effects
Solder in printed circuit boards, glass panels, and gaskets in computer monitors	Lead	<ul style="list-style-type: none"> • Damage to central and peripheral nervous systems, blood systems, and kidney damage. • Affects brain development of children.
Chip resistors and semiconductors	Cadmium	<ul style="list-style-type: none"> • Toxic irreversible effects on human health. • Accumulates in kidney and liver. • Causes neural damage. • Teratogenic.
Relays and switches, printed circuit boards	Mercury	<ul style="list-style-type: none"> • Chronic damage to the brain. • Respiratory and skin disorders due to bioaccumulation in fish.
Corrosion protection of untreated and galvanized steel plates, decorator or hardner for steel housings	Hexavalent chromium	<ul style="list-style-type: none"> • Asthmatic bronchitis. • DNA damage.
Cabling and computer housing	Plastics including polyvinyl chloride	Burning produces dioxin. It causes <ul style="list-style-type: none"> • reproductive and developmental problems, • immune system damage, and • interference with regulatory hormones.
Plastic housing of electronic equipments and circuit boards.	Brominated flame retardants	<ul style="list-style-type: none"> • Disrupts endocrine system functions.
Front panel of cathode ray tubes	Barium	Short-term exposure causes <ul style="list-style-type: none"> • muscle weakness, and • damage to heart, liver, and spleen.
Motherboard	Beryllium	<ul style="list-style-type: none"> • Carcinogenic (lung cancer). • Inhalation of fumes and dust causes chronic beryllium disease or berylliosis. • Skin diseases such as warts.

Source: Ramachandra & Varghese, 2004.

animals to humans, through the gastrointestinal tract as well as lungs and skin (Frazzoli et al., 2010). Toxicants in EWMs are generally POPs. POPs are the substances that are resistant to biodegradation, have a strong tendency to bioaccumulate in the food chain, and are prone to long-range transport. It has been reported that POPs have the potential to transfer from one generation to another through breastfeeding (Frazzoli et al., 2010). Hence, it is a pollutant not only of significant concern for the current generation but also for their offspring.

Effects on Food Crops

Fu and co-authors (2008) carried out a study in Taizhou in southeast China, which is the biggest e-waste recycling area in Zhejiang Province. Taizhou is also an important

agricultural area in Zhejiang Province, and rice serves as the major crop for the local people. The authors investigated the heavy metal contents in rice samples from a typical e-waste recycling area. Ten heavy metals including copper, cadmium, and lead were found in 13 polished rice and relevant hull samples. Six paddy soil samples were also investigated. The results showed that the agricultural soil in Taizhou was most severely contaminated by cadmium, followed by copper and mercury. Moreover, the concentration of heavy metals such as lead and cadmium in rice near e-waste recycling sites was higher than those from other areas. The authors hypothesized the probability of lead intake by the local inhabitants being higher than the limit prescribed by the World Health Organization.

Effects on Child Health

Liu and co-authors (2011) carried out a study aimed at evaluating the dose-dependent effects of lead exposure on temperament alterations in children from a primitive e-waste recycling area in Guiyu, China, and a control area Chendian, China. It is widely known that environmental exposure to pollutants results in accumulation of lead and other toxic substances in children. The results showed higher blood lead levels (BLLs) in Guiyu children. Primitive e-waste recycling may threaten the health of children by increasing BLLs and altering children's temperaments. This is because lead exposure produces a wide spectrum of health outcomes, most notably neurocognitive and behavioral deficits in response to pre- or postnatal exposures (Liu et al., 2011). Child exposure to lead has been related to irreversible decreases in intelligence. The authors suggested that it is necessary to make policy changes to restrict e-waste recycling to certain areas so that children's exposure to chemical toxicants can be limited.

Contamination of Food Chains by the Toxicants From E-Waste

EWMs may accumulate in agricultural lands and be available for uptake by grazing livestock. Persistent bioaccumulating pollutants are of top concern from the standpoint of food chain contamination (Frazzoli et al., 2010). In general, chemicals from EWMs have slow metabolic rates in animals and may bioaccumulate in tissues and be available in edible products, such as eggs and milk (Frazzoli et al., 2010). For instance, PBDEs are lipophilic, resulting in bioaccumulation in organisms and biomagnification in food chains (Robinson, 2009). Studies reported e-waste contaminants in breast milk. The reporting of e-waste toxicants in milk is a major concern as dairy animals have productive lives much longer than meat-producing animals. Hence, a greater chance exists for bioaccumulation. It is noteworthy, however, that bioaccumulation occurs also in the adipose tissue, liver, and fatty portion of meat (Robinson, 2009). Bioavailability and bioaccumulation factors in aquatic species for polychlorinated biphenyls (PCBs) and PBDEs from e-waste sites were shown by Wu and co-authors (2008). Frazzoli and co-authors (2010) highlight the impacts of

TABLE 2

Laws and Regulations in India Relating to E-Waste

Law or Regulation	Major Content	Status/Date
Environment (Protection) Act, 1986 (amendment 1991)	An umbrella legislation that empowers the central government to take measures to protect and improve environmental quality and control and reduce pollution from all sources.	Effective from November 19, 1986
Hazardous Wastes (Management and Handling and Transboundary Movement) Rules, 2008 (amendments July 2009, September 2009)	Provides stipulations on the management, disposal, and transboundary movement of solid waste of a hazardous nature (encompassing provisions of the Basel Convention) as mentioned in schedules I, II, III, and IV of the rule.	Effective from September 24, 2008
Municipal Solid Wastes (Management and Handling) Rules, 2000	Provides compliance criteria to municipalities for the collection, segregation, storage, transportation, processing, and disposal of municipal solid wastes.	Effective from September 25, 2000
Batteries (Management and Handling) Rules, 2001	Confers responsibility for the safe disposal and recycling of used lead acid batteries on the manufactures/assemblers/importers.	Effective from May 16, 2001
The Hazardous Wastes (Management and Handling) Amendment Rules, 2003	Under schedule 3 of this rule, e-waste is defined as “waste electrical and electronic equipment [EEE] including all components, subassemblies, and their fractions except batteries falling under these rules.” The definition provided here is similar to that of Basel Convention. E-waste is only briefly included in the rules with no detailed description.	Notified on May 20, 2003
The E-Waste (Management and Handling) Rules, 2011	A recent initiative meant exclusively to address e-waste. Here, “EEE” means equipment that is dependent on electric currents or electromagnetic fields to be fully functional and “e-waste” means waste EEE, whole or in part or rejects from their manufacturing and repair process, which are intended to be discarded. These rules are meant to be applied to every producer, consumer, or bulk consumer involved in manufacturing, sale purchase, and processing of EEE, collection centers, dismantlers, and recyclers of e-waste. Emphasises on extended producer responsibility.	Effective from May 1, 2012
The Public Liability Insurance Act, 1991 (amendment 1992)	Covers accidents involving hazardous substances and insurance coverage for these.	Effective from January 23, 1991
National Environmental Tribunal Act, 1995	Provide for strict liability for damage arising out of accidents caused from the handling of hazardous substances. (The tribunal shall become defunct and the act shall stand repealed upon the enactment of the National Green Tribunal Bill 2009 currently pending in parliament.)	Effective from June 17, 1995
The Water (Prevention and Control of Pollution) Act (amendment 1988)	Provide for the prevention and control of water pollution and for maintaining or restoring of wholesomeness of water in the country.	Effective from March 23, 1974
The Water (Prevention and Control of Pollution) Cess Act, 1977 (amendment 2003)	Provide for the levy and collection of a cess on water consumed by persons operating and carrying on certain types of industrial activities. This cess is collected with a view to augment the resources of the central board and the state boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974.	Effective from December 7, 1977
The Air (Prevention and Control of Pollution) Act, 1981 (amendment 1987)	Provide for the prevention, control, and abatement of air pollution in India.	Effective from March 29, 1981

Source: Adopted from Wath, Vaidya, Dutt, & Chakrabarti, 2010.

improper disposal of e-waste on the overall environment. It not only creates pollution, but also adversely affects the food chain, and thus health. Effects of e-waste components on health are listed in Table 1.

Hazards and Risks Associated With E-Waste Treatment in India

Recycling of e-waste is a very lucrative business in India and dominated by informal actors (Manomaivibool, 2009). E-waste in

India is often processed to recover valuable materials in small workshops using rudimentary recycling methods (Tsydenova & Bengtsson, 2011). For instance, during the manual dismantling process in informal

dismantling and recycling sites, e-waste recyclers use chisels, hammers, and cutting torches to open solder connections and separate various types of metals and components (Duan et al., 2011). Wong and co-authors (2007) listed some of the common crude recycling techniques related to e-waste in developing countries such as India. These are 1) stripping of metals in open-pit acid baths to recover valuable metals as silver, gold, copper, and platinum; 2) removing electronic components from printed circuit boards by heating over a grill using honeycombed coal blocks (coal mixed with river sediment that is contaminated) as fuel; 3) chipping and melting plastics without proper ventilation; 4) burning cables for recovering metals, and also burning unwanted materials in open air; 5) disposing unsalvageable materials in the fields and riverbanks; 6) toner sweeping; and 7) dismantling electronic equipment. Ha and co-authors (2009) attempted to evaluate the contamination by trace elements at e-waste recycling sites in Bangalore and Chennai, India, and accordingly measured trace elements (TEs) in soil, air dust, and human hair collected from e-waste recycling sites and the reference sites in both places. The results suggest that e-waste recycling and its disposal may lead to environmental and human health contamination by some TEs. As observed by Brigden and co-authors (2005), high levels of cadmium, copper, lead, and zinc were characteristic of ash collected from two waste burning operations in New Delhi, India, at Ibrahimpur and Shashtri Park.

Hazards and Risks Associated With Manual Disassembling of CRTs

Discarded computer monitors and television sets are identified as hazardous materials due to the high content of lead in their CRTs. CRTs are broken to remove copper yokes that are further used for copper recovery through the manual disassembly process. Environmental pollution is a likely outcome of the breaking and further handling of CRTs. In India, CRTs were reportedly smelted for recovery of glass, but prior to the treatment they were stored in an open area (Brigden et al., 2005). The open air storage and dumping of CRTs raise concerns about the possibility of lead contained in the CRT glass leaching out into the environment (Tsydenova & Bengtsson, 2011).

Hazards and Risks Associated With Manual Disassembling of Printed Circuit Board Assemblies (PCBAs)

PCBAs are one of the fastest growing sources of waste in many developing countries and spotlight the need to recycle, recover, and reuse materials that have been consigned to informal dismantling sites (Duan et al., 2011). The techniques used for PCBA dismantling in India mainly involves primitive open-soldering methods. In countries like China and India, immature technologies are the main obstacle to the recycling of waste PCBAs. Duan and co-authors (2011) noted that PCBAs, which are more complicated and difficult to process, are simply cooked on a coal-heated plate and melted (on the iron plate or flat wok) in order to resell the chips and other recovered components to acid strippers for further processing. The study shows that the dismantled PCBAs have a significant environmental impact because they contain heavy metals and halogen-containing flame retardants, such as lead (soldering tin), mercury (switches, round cell batteries), cadmium (pins), brominates, and mixed plastics that can seep into the environment if not properly managed. Further, cell batteries may ignite or leak potentially hazardous organic vapors if exposed to excessive heat or fire and explosion may result if a capacitor is subjected to high currents and heating.

Hazards and Risks Associated With Recovery of Metals

The most common practice used for the recovery of metals from e-waste in India includes dissolving of the metals in strong acid solutions. Mixtures of concentrated nitric acid and hydrochloric acids were reportedly used in Delhi for the extraction of gold and copper, respectively (Tsydenova & Bengtsson, 2011). Aside from the obvious health and safety concerns that arise from the handling of concentrated acid solutions in these workshops, indications from workers that the contaminated spent acid wastes are simply disposed of in land also raises substantial environmental concerns (Brigden et al., 2005). Further, various volatile compounds of nitrogen and chlorine are known to be emitted during such processes.

Hazards and Risks Associated With Processing of Plastics

Plastics are manually removed from e-waste and mechanically shredded (Tsydenova

& Bengtsson, 2011). The next treatment step may be some kind of separation (e.g., by color or density) or further grinding. E-waste parts are burned on open fires to recover metals from plastics in which they are encased; this includes plastic coated wires as well as other complex components (Tsydenova & Bengtsson, 2011).

Major Environmental Pollutions From E-Waste

Disposal of e-waste in an environmentally acceptable manner is a major challenge. Most e-waste today is landfilled, which is not a sustainable practice. Although recycling may remove some contaminants, large amounts may still end up concentrated in landfills, adversely affecting human health or the environment. An article by Sepúlveda and co-authors (2010) assessed the magnitude of environmental contamination at e-waste recycling sites in China and India by comparing the data with known concentration thresholds and other pollution level standards. The review highlighted very high levels of lead, PBDEs, etc., in air, bottom ash, dust, soil, water, and sediments in e-waste recycling areas of the two countries suggesting a serious threat to the environment and human health.

Air Pollution

Dust is a major air pollutant produced in e-waste treatment sites during dismantling. Many e-waste contaminants are spread into the air via dust (Robinson, 2009). This is a major exposure pathway for humans through ingestion, inhalation, and skin absorption. Brigden and co-authors (2005) screened dust samples from the e-waste recycling workshops involved in desoldering and PCBA disassembly in China and India, which showed exceptionally high concentrations of lead and tin. Incineration, carried out as a disposal measure of e-waste (especially the open-air burning of plastics in order to recover copper and other metals), has the potential to emit toxic fumes and gases into the environment, thereby polluting the surrounding air. Moreover, obsolete refrigerators, freezers, and air conditioning units contain ozone-depleting chlorofluorocarbons, a potential air pollutant. Thus, both e-waste recycling and disposal areas are potential air pollution sites.

Water Pollution

Both ground and surface water pollution are major concerns near to the e-waste recycling sites. E-waste contaminants can enter aquatic systems via leaching from dumpsites where processed or unprocessed e-waste may have been deposited. Similarly, the disposal of acid following hydrometallurgical processes into waters or onto soils, as well as the dissolution or settling of airborne contaminants, can also result in the contamination of aquatic systems (Robinson, 2009). Several studies indicated that Guiyu, China, a thriving area of illegal e-waste recycling, is facing acute water shortages due to the contamination of water resources. The whole ecosystem in Guiyu has been affected by the intensive recycling activities, especially acid leaching operations taking place along the rivers (Tsydenova & Bengtsson, 2011). Now water is being transported from far away towns to cater to the demands of the local population (Ramachandra & Varghese, 2004).

Soil Pollution

Soil pollution is a major apprehension in e-waste landfill sites. Soil acidification is a common occurrence. Mercury leaches when certain electronic devices are destroyed. The same is true for PCBs from condensers (Ramachandra & Varghese, 2004). Ha and co-authors (2009) reported that soils at an e-waste recycling slum in Bangalore had concentrations of chemical toxicants some one hundredfold higher than those found at a nearby control site in the same city.

Legislation in India Related to E-Waste

In India, policy level initiatives, both in the form of regulatory regimes and market-based policy initiatives related to e-waste, are still inadequate. For instance, the IT revolution started in India back in the early 1990s, whereas a proper policy related to e-waste was introduced almost 20 years later, in 2011, in the form of the "E-Waste (Management and Handling) Rules, 2011." Although market-based policies have great potential to initiate proper disposal behavior of e-waste, such policies are not accurately implemented in India. For instance, some manufacturing giants claim that they practice extended producer responsibilities and carry out take-back services (a form of market-based policy initiative) in India. A study carried out by Greenpeace

(2008), however, reveals that global giants such as Apple, Microsoft, Panasonic, Philips, Sharp, Sony, Sony Ericsson, and Toshiba have no take-back services in India. It is noteworthy that these are the companies with particularly high market share of EEEs in the country. Some of them have take-back programs in countries like the U.S., but they don't offer such services in India. These companies indirectly foster the growth of the informal recycling by failing to provide easy and free take-back services to ensure responsible recycling (Greenpeace, 2008). Table 2 lists the laws and regulations in India relating to e-waste.

The Challenge of Producing EEEs With Minimum Toxicants

When the e-waste problem started gaining attention, several studies were carried out to evaluate the hazards from improper treatment and disposal facilities. A number of studies have been conducted in the informal recycling sites of the developing countries, such as in Guiyu and Taizhou, China, and Delhi and Bangalore, India. All these studies mark the presence of some potentially harmful chemicals in the e-waste stream. Several NGOs have been active in putting pressure on the producers of EEEs to reduce or eliminate the toxic environmental contaminants in their products. Many producers of EEEs have responded well and are investigating innovative ways to enhance safe disposal and recycling. The European Union's "Restriction on Hazardous Substances Directive (RoHS)" enacted in 2003 is a momentous policy level initiative to restrict the use of six hazardous components (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, and PBDEs) in EEEs. The RoHS directive created a new global standard on hazardous substances in electronics. Further, radio frequency identification tags could provide information about the condition and composition of electronic products, which can alert waste recyclers about valuable components and potential environmental contaminants contained within the end-of-life product (Robinson, 2009).

Conclusion

This special report discussed the detrimental environmental and human health consequences of e-waste. The workers in the e-waste recycling units and local residents

are exposed to the perilous chemicals present in e-waste mostly through inhalation, dust ingestion, dermal exposure, and dietary intake. The substances present in e-waste have the capacity to bioaccumulate and biomagnify along the food chain. The chemicals present in e-waste are POPs having long-term effects both on human health and the environment. Heavy metal concentration in e-waste is of great concern. Health effects of heavy metals such as mercury and lead were observed among workers working in rudimentary recycling workshops. Air, water, and soil pollution caused by e-waste recycling/disposal are of major concern. Efforts should be made to educate e-waste recycling personnel to adopt health and safety measures, for instance, to wear personal protective equipment, to clean up the environment/surroundings after recycling is performed, and so on. The government should conduct health screenings from time to time to see if the people performing recycling activities have any of the health effects described and educate them on how to avoid such health effects. Further, it is essential to put regulations in place and enforce them to curtail open burning, illicit dumping of e-waste, and to restrict the areas where recycling can take place in order to control its environmental and health consequences.

At present the challenges in front of the global community lie in producing affordable EEEs with minimum chemical toxicants. A number of EEE manufacturers have taken initiatives to invent "green" EEEs. A major concern related to green electronics is their high cost. For instance, although "Energy Star" products are green and eco-friendly, they are not affordable to most of the consumers in countries like India. Further, India needs a grassroots level education and awareness agenda in order to sensitize people towards issues involving e-waste. It is essential to educate various stakeholders involved in the e-waste flow about how to handle e-waste, the ramifications of not handling it correctly, and the impact of those living close to disposal and recycling sites or even downwind of it. 🌱

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► BUILDING CAPACITY



Darryl Booth, MBA

Regional Data Standards Build Capacity for Health Departments

Editor's Note: A need exists within environmental health agencies to increase their capacity to perform in an environment of diminishing resources. With limited resources and increasing demands, we need to seek new approaches to the business of environmental health.

Acutely aware of these challenges, NEHA has initiated a partnership with Accela (formerly Decade Software Company) called *Building Capacity*. *Building Capacity* is a joint effort to educate, reinforce, and build upon successes within the profession, using technology to improve efficiency and extend the impact of environmental health agencies.

The *Journal* is pleased to publish this bimonthly column from Accela that will provide readers with insight into the *Building Capacity* initiative, as well as be a conduit for fostering the capacity building of environmental health agencies across the country.

The conclusions of this column are those of the author(s) and do not necessarily represent the views of NEHA.

Darryl Booth is senior vice president and general manager of environmental health at Accela and has been monitoring regulatory and data tracking needs of agencies across the U.S. for almost 20 years. He serves as technical advisor to NEHA's informatics and technology section.

The origins of our state and local health departments, like most other modern administrative institutions, reflect the wisdom and need of the times. Most state and local health departments created in the late 19th century rapidly broadened their authority to protect and promote the health of people in the U.S. in response to the public health needs of the moment.

Tobey (1947) characterized those early moments in his authoritative book as follows:

It can be assumed now from the unanimity of professional opinion and the

practical attitude of local government that the delivery of the half-dozen essential, basic, or primary services of public health should continue to be, as has been the case in the past in this country, an important function of units of local government responsive intimately, and it may be said personally, to the needs of the families of each community, and provided for chiefly if not wholly through tax resources appropriated by the elected officers of local government, except in instances where the lack of

financial resources of local jurisdiction makes aid from state and federal sources imperative.

Zoom in on one state and advance to the current century. The state of Colorado, the Centennial State, boasts over 50 local public health agencies. This is a familiar model capitulating to local authority in light of local needs. One would expect that each agency prioritized and implemented health programs according to need and priority in their communities. With certainty, each introduced and advanced technical tool sets some time later and without a shared vision.

Leap ahead to 2011 and we observe five different inspection data collection systems throughout the state. Even among health departments using the same software system, i.e., the same named software product, the implementations differed. These differences occurred because each project was born and raised in its own local silo. Inspection checklists—some captured electronically while some still recorded on paper—were not the same. And the regulated community and the food facility operators knew consistency was lacking. This was, as they say, the problem statement which defined the leadership opportunity to move forward.

In this time frame, the Centers for Disease Control and Prevention (CDC) published its Winnable Battles (www.cdc.gov/winnable-battles), seeking quick wins by defining clear targets. Food safety is listed as a winnable battle with foodborne illness affecting one in six citizens each year.

In concert, the state of Colorado launched its 10 Winnable Battles, also intended to address public health and environmental

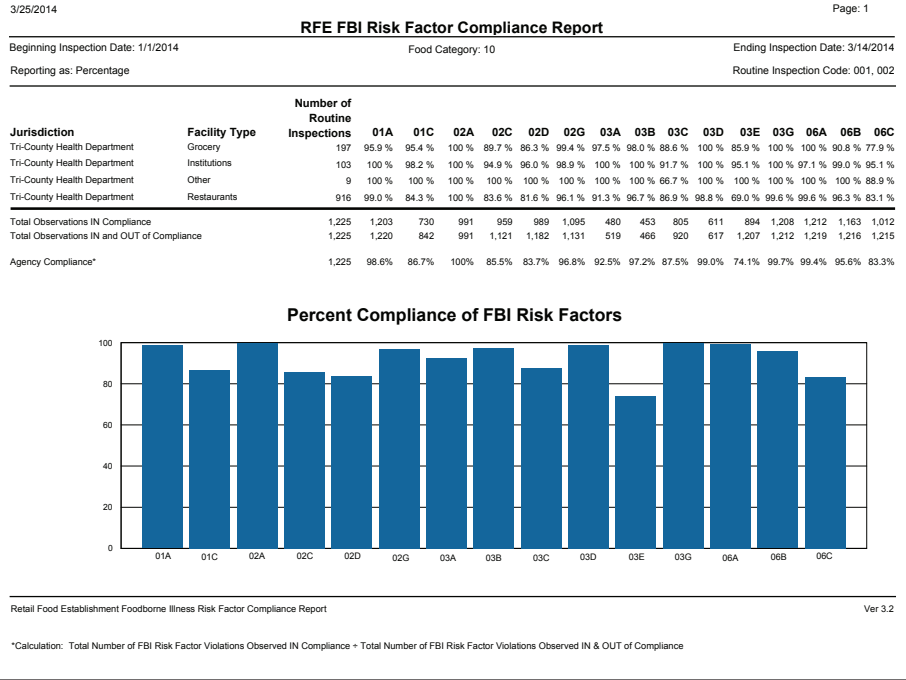
TABLE 1

Foodborne Illness Risk Factor Violation Codes for Colorado

01a. Approved source
01c. Cross-contamination
02a. Personnel with infections restricted
02c. Hands washed as needed
02d. Hygienic practices
02g. Preventing food contamination from bare hands
03a. Rapidly cool foods to 41°F or less
03b. Rapidly reheat to 165°F or greater
03c. Hot holding at 135°F or greater
03d. Required cooking temperature
03e. Cold hold at 41°F or less
03g. Adequate equipment to maintain food temperatures
06a. Adequate number, location of hand sinks
06b. Hand sink accessible
06c. Hand sink soap, towels, and drying devices
<i>Source:</i> Colorado Department of Public Health and Environment (2014).

FIGURE 1

Foodborne Illness Risk Factor Compliance Report



priorities—many in common with CDC, Food and Drug Administration (FDA), and U.S. Environmental Protection Agency priorities, and others unique to Colorado—with known and effective solutions that could be implemented in five years (Colorado Department of Public Health and Environment [CDPHE], n.d.). Like CDC, Colorado listed safe food was one of its key winnable battles.

Separately, but destined to coalesce, Colorado's Lean statewide initiative was demonstrating that a "customer-focused culture is possible in the public sector" (Colorado Office of State Budget and Planning, n.d.). Lean is a formalized method of problem solving and project management that prioritizes customer value and systematically eschews waste.

Citing 10 Winnable Battles as the tip of the spear, the safe food battle prompted a unique multiagency, multisoftware vendor, cross-departmental task force charged with using data to further support food safety managers and staff. The charge was to make policy and inspections more consistent and precise across Colorado through measurement and improvement. The ultimate goal was, of

course, safer food as expressed by CDPHE (n.d.) in the following:

Standardize statewide retail food inspection data by: continuing to work towards statewide data sharing, expanding data standardization to include additional compliance factors for comparison, and determining new and innovative ways to collect and use data for continual improvement of the statewide food safety program.

Using Lean and a trained facilitator, the workgroup ultimately standardized the way each agency's data system collects, codes, describes, and reports foodborne illness risk factor violations. The makeup was purposeful, representing and being considerate of each of the five data systems. Most were commercial systems with one being "home-grown." Where possible, one vendor's change could benefit many health agencies. Regardless, the local health departments had to direct their vendors to respond, which took some planning and cost forecasting.

One might assume that the strategy was largely operational. The effort actually involved great leadership, communication, and financial support, all with an eye on maintaining the

integrity of one of the most important health programs in the state.

Defining a routine inspection presented the first challenge. General agreement took 15 minutes. The next two hours covered all the special circumstances. Facility type (e.g., restaurants with food preparation, restaurants without food preparation, fast-food, mobile, grocery, institutions, etc.) also prompted lots of discourse. Sidebars referencing the FDA *Food Code* kept them grounded and served as a tiebreaker in some cases.

The team was coached to not get slowed down by "terminal uniqueness," the belief that a particular technique, method, or need is too unique to be replaced or discarded, which shuts down the process altogether. *Everyone* had to be willing to change. Once these basics were ironed out, data collection and transfer required the cooperation of several different software vendors and local IT.

After aggregating all health departments' violation codes and comments in one place, the team split into two dynamic working groups to separately study all the variants, compare their findings, and select the style best suited for statewide consolidation. Over

five days they winnowed down hundreds of violation numbers and descriptions. For example, for “cross-contamination” they narrowed 17 violation descriptions down to two predefined violation code descriptions. “Hygiene” went from 97 descriptions down to just eight! The end result across all 15 violations was a clean list of 74 predefined violation code descriptions. See Table 1 for a select list of these violation codes. The team also defined routine inspection and facility type codes and definitions.

Once common coding was accomplished, the group moved its attention to cross-department reporting. While it was tempting to ask for a new system with sweeping requirements, leadership wisely opted for something very approachable: monthly Excel files e-mailed to a state health department coordinator for consolidation and re-reporting to local departments. Said more plainly, every health department e-mails (most systems allowed for this to be automated) their year-to-date inspection data in an agreed upon format. The coordinator recipient tracks missing reports and combines with very little effort the files into a statewide data set. The consolidated data set is like gold! Everybody wants to tease out their own data as it compares to neighboring health departments. It’s fascinating to observe how a new resource gains attention and is put to use in different ways.

Today, the local health agencies’ food program managers now have data driven reports assessing violations and compliance. The team approached the traditional data assessment in a very prescriptive way. While most reports look at the number of violations per inspection, Colorado’s reports calculate what percentage and total number of times a foodborne illness risk factor checklist item was marked IN and OUT of compliance (Figure 1).

Incremental customer value is a Lean project measure of success. To the state and the locals, food safety managers and policy makers reference these reports as a standing agenda item. In legislative negotiations and for operators, the data and the project awareness raise credibility for the program’s good work and its mission to be consistent across inspectors and jurisdictions. Local health agencies now have measurable improvements in their inspection data quality, not just in the violations checked but in the numbers, types, and time spent.

Additional iterations should be expected ... that’s the nature of Lean programs. Partners meet monthly to allow the team to deliver calculated tweaks and revisions to improve efficiency. The team has already committed to adding nonfoodborne illness risk factor critical violations and is observing similar moves in the state to standard-

ize child care inspections. The effectiveness of this project is prompting other regions to launch their own state/local partnerships for pragmatic data consolidation. 🐷

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▶ DIRECT FROM ATSDR



Patrick Breyse, PhD, CIH

A, T, S, D, What?

Editor's Note: As part of our continuing effort to highlight innovative approaches to improving the health and environment of communities, the *Journal* is pleased to publish a bimonthly column from the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is a federal public health agency of the U.S. Department of Health and Human Services (HHS) and shares a common office of the Director with the National Center for Environmental Health (NCEH) at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.

The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment and their impact on human health and how to protect public health. We believe that the column will provide a valuable resource to our readership by helping to make known the considerable resources and expertise that ATSDR has available to assist communities, states, and others to assure good environmental health practice for all is served.

The conclusions of this article are those of the author(s) and do not necessarily represent the views of ATSDR, CDC, or HHS.

Patrick Breyse joined CDC in December 2014 as the director of NCEH/ATSDR. He leads CDC's efforts to investigate the relationship between environmental factors and health.

After I became the director of the Centers for Disease Control and Prevention's (CDC's) National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry (NCEH/ATSDR), my first task was to master the use of an awkward acronym. "ATSDR" doesn't, admittedly, roll lightly off the tongue. I also quickly realized that many people have either never heard of us or don't really understand what we do.

Meanwhile, I learned rather quickly what we do. Within my first few months, we faced

an oil spill in Wyoming's Yellowstone River, a train derailment in West Virginia, and pesticide exposure in the U.S. Virgin Islands. I witnessed firsthand just how important it is to have a federal agency focused on environmental health. And every day that I've worked here since reinforces this belief.

Environmental health is complex and often nuanced. Successfully addressing the environmental health challenges we face today requires a wide variety of expertise, and NCEH/ATSDR's extensive work has an enormous impact on people's lives. In this col-

umn, I'm going to focus on ATSDR; I'll share more about NCEH in a later publication.

A Few Founding Facts

Congress created ATSDR in 1980 as part of the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA or "Superfund" law). We just celebrated our 35th birthday. Superfund gave the U.S. Environmental Protection Agency (U.S. EPA) the responsibility for identifying, investigating, and cleaning up sites on the National Priorities List and created ATSDR as a nonregulatory public health agency with very specific functions to

- conduct health assessments,
- produce toxicological profiles,
- conduct epidemiological studies, and
- establish registries and medical surveillance.

Initially, ATSDR focused on evaluating toxic exposure specifically for communities located near Superfund sites. As time went on, the agency began responding to requests from U.S. EPA; state, tribal, or local agencies; residents; and communities. In total, we've worked in more than 6,000 communities to address health concerns posed by chemical contamination. In 2014 alone, we worked in about 600 communities across the country, evaluating toxic exposure for close to one million people.

A Different Kind of Fed: Up Close and Local

Most of our work in communities focuses on understanding whether people are or have been exposed to harmful chemicals. Once we receive a request, we assess existing environmental and health data to determine whether people are at risk because of their exposures. We then make recommendations to U.S. EPA; state, regulatory, and health agencies; and

other stakeholders for stopping and preventing the harmful exposures. Sometimes our assessments identify important data or science gaps that keep us from answering questions about health risks, so we undertake or recommend further investigation.

We evaluate environmental health issues that differ widely in scope, size, and exposure type. Some of our activities are large projects with multiple assessments and even long-term epidemiologic studies, such as our investigations of asbestos exposure in Libby, Montana, or our ongoing investigations of exposure to contaminated drinking water at Camp Lejeune, North Carolina. We conduct health studies to understand the associations between exposures and health outcomes, such as our study of the reproductive outcomes and environmental contaminants (uranium and other heavy metals) in the Navajo Nation. Some projects are much smaller, such as helping to determine whether one or two families with private wells can safely drink their well water.

ATSDR works closely with local residents, which sets us apart from many other federal agencies. We:

- talk to individual community members to find out how environmental exposures affect them.
- establish community assistance panels to help guide our work when we conduct more detailed investigations. We then hold public meetings and availability sessions to explain our findings and recommendations.
- work with health providers near exposure sites so they can answer patients' questions and provide effective treatment.

Our 400+ environmental health experts are spread across the country so they can quickly travel to emergencies and connect to local issues and agencies. We have staff at ATSDR's headquarters in Atlanta, at U.S. EPA headquarters in Washington, DC, and in 10 regional offices from Boston to Seattle. We also fund 25 state health departments to do the same types of work our in-house staff do: evaluate hazards, make recommendations, and educate residents.

We Even Help With Emergency Response

Although much of ATSDR's work focuses on assessing community exposures, our toxicologists, physicians, and other scientists also

respond to environmental emergencies, like the oil pipeline breach near the Yellowstone River in Montana. Our Assessment of Chemical Exposures (ACE) program provides resources and technical assistance to perform rapid epidemiologic assessments. ACE can quickly assemble a multidisciplinary, multiagency team to assist state and local health departments either from Atlanta or at the scene.

Don't Forget Our World-Class Toxicology Resources

ATSDR is world-renowned for its research and contributions to scientific and technical knowledge. We provide scientists and consumers with the latest information about toxicology, environmental science, and environmental medicine.

Our toxicological profiles (ToxProfiles™) are comprehensive reference documents used by scientists, health providers, and regulators around the world. In 2014, we released six new ToxProfiles and updated six—bringing our library to a total of 173 documents about more than 350 substances. In 2014, more than 1,700 peer-reviewed journal articles cited the ToxProfiles. Furthermore, we have developed short summaries for the profiles (ToxFAQs™) that answer the major questions about the health risks of hazardous substances.

We're also building the capacity of health care providers nationwide to diagnose and treat environmentally linked health concerns. We provide

- 11 Pediatric Environmental Health Specialty Units for clinical consultations to physicians nationwide;
- case studies in environmental medicine online, plus continuing education courses for diagnosing and treating environmental exposures; and
- medical management guidelines to help emergency departments and health providers manage acute exposures from chemical incidents, plus comprehensive evaluation and treatment guidelines.

We conduct geospatial analyses to identify contamination and estimate how many people are exposed. And we have computational toxicology, exposure modeling, and biomonitoring services and resources.

ATSDR's partnership with NCEH allows the agency to leverage CDC resources to protect communities. We often rely on NCEH's state-of-the-art environmental laboratory to

evaluate biological samples, such as the testing of children's blood for lead and other metals, like we did at the Colorado Smelter site.

It's in Our Name: Health Registries

As the last two letters in our tongue-twisting acronym suggest, ATSDR is involved with disease registries, too. We design and conduct surveillance and registry programs and manage the nation's only population-based registry, collecting information to help scientists learn more about who gets amyotrophic lateral sclerosis (ALS) and what causes it. The National ALS Registry provides information on clinical studies and other resources for persons with ALS and their families and is currently considering adding a bioregistry. ATSDR has also created registries for specific populations and for specific timepoints, like the World Trade Center Registry for people who were exposed to toxic substances on 9/11 or during cleanup.

A Couple More Accolades

We also create tools and resources for local communities. In response to hundreds and hundreds of mercury spills, we developed a campaign, "Don't Mess with Mercury," to educate middle school children. It includes tools for teachers, administrators, and school custodians for safely removing mercury and cleaning up (or contacting the right people) when a spill happens. We also developed a toolkit for bringing health into discussions about reusing potentially contaminated properties known as brownfields.

A Closing Affirmation About ATSDR

NCEH/ATSDR confronts environmental health challenges. Our passionate workforce drives forward to address the risks we all bear from chemicals in our environment. We advance environmental health science in the importance of what we do. We translate science into practice by developing tools, conducting research, and partnering with local health departments, officials, and practitioners. And most important, we make a difference in people's lives. 🐾

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▶ DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES BRANCH



Martin A. Kalis,
MA



Bernice W.
Zaidel

New Emergency Response Training for Environmental Health Professionals

Editor's Note: NEHA strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, we feature a column from the Environmental Health Services Branch (EHSB) of the Centers for Disease Control and Prevention (CDC) in every issue of the *Journal*.

In these columns, EHSB and guest authors share insights and information about environmental health programs, trends, issues, and resources. The conclusions in this article are those of the author(s) and do not necessarily represent the views of CDC.

Martin Kalis is a public health advisor with CDC's EHSB. He is the program manager for CDC's Environmental Health Training in Emergency Response (EHTER). Bernice Zaidel is the assistant director of curriculum development and evaluation at the Federal Emergency Management Agency's Center for Domestic Preparedness (CDP). She is CDP's lead for partnering with EHSB and developing EHTER courses.

Nearly 10 years ago, the Centers for Disease Control and Prevention's (CDC's) Environmental Health Services Branch (EHSB) delivered the first Environmental Health Training in Emergency Response (EHTER) Awareness Level course at the National Environmental Health Association's 2006 Annual Educational Conference & Exhibition in San Antonio, Texas. Based on the tremendous success of this introductory level course, EHSB and the Federal Emergency Management Agency's (FEMA's) Center for Domestic Preparedness (CDP) in Anniston, Alabama, are pleased to announce a new EHTER course focused on emergency operations.

The EHTER Operations course is a four-day, hands-on, performance-based training for environmental health professionals and other responders. The course provides operations level knowledge and skills needed to respond to natural, technological, and human caused disasters. Participants are trained to identify problems, hazards, and risks; plan for team response; select appropriate equipment and instrumentation; perform required tasks using environmental health response protocols; and report and participate in follow-up activities as instructed.

Most of the course involves hands-on operations practice and response to simulated

events. Participants perform environmental health responder tasks while wearing appropriate personal protective equipment. The course also includes training at CDP's Chemical, Ordnance, Biological, and Radiological Training Facility, where participants engage in scenario-based exercises to sharpen skills in selecting and using appropriate equipment and sampling instruments.

Key Skills

The following are some of the critical skills taught during the EHTER Operations course.

- Preparing as a team to respond to suspected water supply contamination in a potentially hazardous environment.
- Determining corrective actions for water supplies contaminated by chemicals and bacteria.
- Determining safety and health requirements for a displaced population and environmental health shelter concerns using CDC's Environmental Health Assessment Form for Shelters.
- Conducting food safety assessments for emergency mass feeding operations, including implementing corrective actions and reporting on foodborne illness outbreaks.
- Identifying nonstructural building safety and health hazards following a major disaster to facilitate reentry and re-occupancy.
- Communicating complex environmental health and safety information to nontechnical audiences, including the media and the public.

The EHTER Operations course provides environmental health professionals and other responders the opportunity to immerse themselves in simulated emergency situations and



Students prepare to conduct an environmental health building assessment following a simulated disaster during the Environmental Health Training in Emergency Response Operations course.

disasters to learn and practice environmental health skills (see photo above). With a small instructor-to-student ratio and ample trained role players and props, participants have ready access to instructors for questions and critiques.

Pilot Course Participants Share Their Experiences

Participants from various environmental health programs and jurisdictions across the country attended and provided critical feedback during four pilot courses. Kim Zabel, deputy assistant secretary of environmental public health for the Washington Department of Health, registered for the pilot course to gain necessary knowledge and skills during a disaster. She brought additional state and local staff with her so they could train

as a team and prepare for future emergencies and disasters in the state. According to Zabel, “The opportunity for so many Washington representatives to attend this course at the same time, learning the same content with local health partners, was a magical moment.” Grateful to attend the course alongside her colleagues, she added, “It’s important to see how they work together.” When a disaster strikes in Washington, part of her role will be determining how to build the team that will respond.

Victor Faconti, an environmental health supervisor who serves as a member of the Florida Environmental Health Strike Team for his region, also attended a pilot course. He said the biggest environmental hazards his team must plan for are hurricanes,

Environmental Health Training in Emergency Response (EHTER) Quick Links

- EHTER Operations course (in person): <https://cdp.dhs.gov/training/courses/ehter%20ops>
- EHTER Awareness Level course (online, independent study): www.cdc.gov/nceh/ehs/eLearn/EHTER.htm

although they prepare for all types of hazards. According to Faconti, “You need to be fresh. You need to be up-to-date. You need to be a good team player.” Faconti said he appreciated the opportunity to participate in the EHTER Operations course and recommends it to all environmental health professionals. “This is awesome training! I’ve worked in environmental health for 29 years and I wish I had known about this training 25 years ago,” Faconti said. “I’m going to recommend to my boss that we send all of our staff here. I’m going to recommend this course to my county and the surrounding counties,” he added. “I have people who work for me who say, ‘What do we do during a disaster?’ This is it! This is what we do during a disaster!”

CDC and FEMA invite you to join with environmental health professionals and other response partners for this exciting new EHTER course. Visit www.cdc.gov/nceh/ehs/eLearn/EHTER.htm today to register. 🐼

Corresponding Author: Martin A. Kalis, Public Health Advisor, EHSB, Division of Emergency and Environmental Health Services, National Center for Environmental Health, CDC, 4770 Buford Highway, NE, MS F-58, Atlanta, GA 30341. E-mail: mkalis@cdc.gov.

Did You Know?

NEHA was awarded the Serve From the Heart grant from Aveda to fund an initiative that will bring Aveda and NEHA staff, local organizations and residents, and environmental health professionals together for service projects that aim to educate the community on environmental threats and its relation to human health.

CAREER OPPORTUNITIES

Food Safety Inspector

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Bismarck, ND	Honolulu, HI	New York, NY	San Diego, CA	Syracuse, NY
Boise, ID	Iowa	Owatonna, MN	San Francisco, CA	Tulsa, OK
Buffalo, NY	Jacksonville, FL	Phoenix, AZ	Sioux City, IA	Wichita, KS
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EH CALENDAR

UPCOMING NEHA CONFERENCE

June 13–16, 2016: NEHA 2016 Annual Educational Conference & Exhibition and HUD Healthy Homes Conference, with presenting sponsor Green & Healthy Homes Initiative, San Antonio, TX. For more information, visit www.neha.org/aec.

NEHA AFFILIATE AND REGIONAL LISTINGS

Alabama

April 12–14, 2016: 2016 Interstate Environmental Health Seminar, hosted by the Alabama Environmental Health Association and held in conjunction with its Annual Education Conference, Guntersville, AL. For more information, visit www.aeha-online.com/upcoming-events.html.

Florida

July 13–17, 2016: Annual Education Meeting, hosted by the Florida Environmental Health Association, Sarasota, FL. For more information, visit www.feha.org/events.

Georgia

June 28–July 1, 2016: Annual Education Conference, hosted by the Georgia Environmental Health Association, Savannah, GA. For more information, visit www.geha-online.org/conferences.

Indiana

April 14, 2016: Spring Conference, hosted by the Indiana Environmental Health Association, Indianapolis, IN. For more information, visit www.iehaind.org/Conference.

Minnesota

May 11–13, 2016: Spring Conference, hosted by the Minnesota Environmental Health Association, Brainerd, MN. For more information, visit www.mehaonline.org/events.

Missouri

April 6–8, 2016: Annual Education Conference, hosted by the Missouri Milk, Food, and Environmental Health Association, Springfield, MO. For more information, visit www.mmfeha.org.

Ohio

April 18–20, 2016: Annual Education Conference, hosted by the Ohio Environmental Health Association, Columbus, OH. For more information, visit www.ohioeha.org/annual-education-conference.aspx.

Utah

April 27–29, 2016: Spring Conference, hosted by the Utah Environmental Health Association, Springdale, UT. For more information, visit www.ueha.org/events.html.

Virginia

April 8, 2016: Spring Educational Conference, hosted by the Virginia Environmental Health Association, Gloucester Point, VA. For more information, visit www.virginiaeha.org/educational-sessions.

Washington

May 26–27, 2016: Annual Education Conference, hosted by the Washington State Environmental Health Association, Vancouver, WA. For more information, visit www.wseha.org.

Wisconsin

April 12, 2016: Spring Educational Conference, hosted by the Wisconsin Environmental Health Association, Eau Claire, WI. For more information, visit www.weha.net.

TOPICAL LISTING

Public Health

April 12–13, 2016: Iowa Governor's Conference on Public Health, Navigating a Changing Landscape: Partnerships for Population Health, Des Moines, IA. For more information, visit www.ieha.net. 🐾

Did You Know?

National Public Health Week is April 4–10, 2016.

Organized for more than 20 years by the American Public Health Association, this week is a time to recognize the contributions of public health and highlight issues that are important to improving our nation.

This year's theme is, "Healthiest Nation 2030." Go to www.nphw.org for more information.



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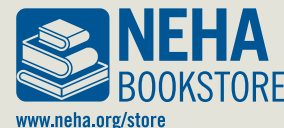


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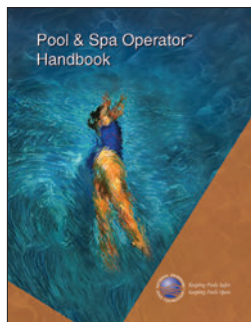
RESOURCE CORNER

Resource Corner highlights different resources that NEHA has available to meet your education and training needs. These timely resources provide you with information and knowledge to advance your professional development. Visit NEHA's online Bookstore for additional information about these, and many other, pertinent resources!



Pool & Spa Operator™ Handbook

National Swimming Pool Foundation (2014)



This fundamental training and reference manual is for professionals who help protect those who use aquatic venues, including operators, health officials, service technicians, retailers, property managers, and manufacturers. Industry leaders recognize it as the single most important resource for the recreational water industry. This *Handbook* educates readers on how to reduce

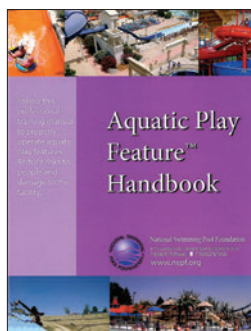
risks in and around the water; provides valuable information to prevent drowning, recreational water illness, suction entrapment, evisceration, diving accidents, electrocutions, chemical hazards, and slips and falls; and summarizes regulatory guidelines, disinfection, water balance, water problems, troubleshooting, chemical testing, record keeping, chemical feed, and control technology. Study reference for NEHA's REHS/RS exam.

298 pages / Spiral-bound paperback

Member: \$55 / Nonmember: \$59

Aquatic Play Feature™ Handbook

National Swimming Pool Foundation (2008)



This handbook provides a professional manual for any facility that has an aquatic play feature, large or small. People who operate and manage these innovative recreational features will appreciate this full-color illustrated handbook. Environmental health professionals will find the book extremely helpful in the inspection and regulation of these aquatic play features. Topics covered include how

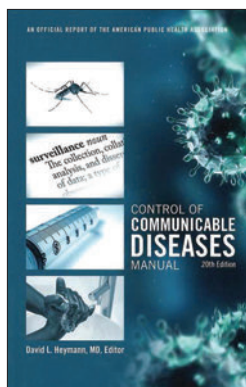
to deal with cloudy water, excessively high make-up water bills, high sanitizer/oxidizer consumption, very short filter runs, maintaining automated control systems, management of water and of water chemistry, chlorine and chemical addition issues, filtration and circulation concerns, play feature operational considerations, usage of chloramines and stabilizers, and more.

67 pages / Paperback

Member: \$18 / Nonmember: \$20

Control of Communicable Diseases Manual (20th Edition)

Edited by David L. Heymann, MD (2015)



The *Control of Communicable Diseases Manual (CCDM)* is revised and republished every several years to provide the most current information and recommendations for communicable-disease prevention.

The *CCDM* is designed to be an authoritative reference for public health workers in official and voluntary health agencies. The 20th edition sticks to the tried and tested structure of previous editions. Chapters have been updated by international experts. New

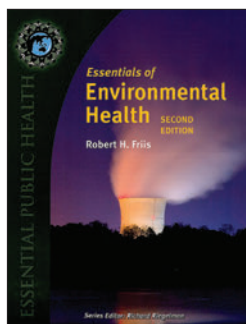
disease variants have been included and some chapters have been fundamentally reworked. This edition is a timely update to a milestone reference work that ensures the relevance and usefulness to every public health professional around the world. The *CCDM* is a study reference for NEHA's REHS/RS and CP-FS exams.

729 pages / Paperback

Member: \$53 / Nonmember: \$59

Essentials of Environmental Health (Second Edition)

Robert H. Friis (2010)



This book provides a clear and comprehensive study of the major topics in environmental health including 1) background on the field and tools of the trade (environmental epidemiology, environmental toxicology, and environmental policy and regulation); 2) environmental diseases (microbial agents and ionizing and nonionizing radiation); and 3) applications and domains of

environmental health (water and air quality, food safety, waste disposal, and occupational health). The second edition is a thorough revision that includes new material such as a chapter on injuries, an expanded discussion of the history of environmental health, a case study on pandemic influenza (H1N1) in 2009, and coverage of environmental controversies.

442 pages / Paperback

Member: \$97 / Nonmember: \$102

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DirectTalk

continued from page 50

York City, they'll sit up and pay attention. Before policy can be made you have to paint a picture about how a problem gets solved. Help me do that and we'll be well on our way to making a difference.

Remember, change is never easy, nor is it fast. If we work together, however, we can bring about real change in the way our country, leaders in DC, and friends rely on NEHA for the final word in environmental health.

Thank you, Joanne, for sharing your thoughts and visions! We are excited to see what you accomplish on our behalf. Check out next month's column where you will hear from our new director of programs, who is also based in Washington, DC. 🐶

Dave

ddyjack@neha.org
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FOCUSING ON ENVIRONMENTAL HEALTH

Why do we do it?

We believe that healthy environments are fundamental to healthy communities. We appreciate the value of Environmental Public Health in keeping the public healthy and safe. Our purpose is to design and build innovative, intuitive, and sophisticated software to allow sanitarians and other health professionals to work efficiently and effectively. We succeed when our products provide you with reliable data for accountability and transparency. We're driven to learn and to grow our products to meet your emerging needs.

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Did You Know?

NEHA hosted a day-long forum in January that brought together experts from the fields of private information technology, local and state environmental health departments, and federal agencies to discuss environmental health informatics as a first step in providing support to smaller-scale environmental health departments to enable the adoption of informatics systems.

IN MEMORIAM: SAN BERNARDINO

On December 2, 2015, 14 people were killed and 22 were seriously injured in a terrorist attack at the Inland Regional Center in San Bernardino, California. The mass shooting took place during a training event and holiday party for about 80 employees of the San Bernardino County Department of Public Health. The tragedy and loss were devastating to the environmental health community and were felt across the country and beyond.

A moment of silence was observed on December 9 at 11 a.m. Pacific Standard Time as the entire environmental health community stood together in an expression of love, respect, sympathy, and solidarity for our fallen brothers and sisters in San Bernardino. The California Environmental Health Association set up a special fund for the victims of San Bernardino. All funds collected will be dispersed to the families. At the time of publication, over \$48,000 had been donated. To learn more about the fund and to donate, please go to www.ceha.org/pages/san-bernardino-strong.

We mourn the loss of our colleagues. From NEHA's staff and board of directors, we offer our deepest sympathies to the families, friends, and colleagues that lost loved ones. Your passion for life, your fellow man, and your work will never be forgotten and will be forever memorialized.

Robert Adams

Robert Adams, 40, was an environmental health specialist for the San Bernardino County Department of Public Health. His responsibilities included inspecting pools and food facilities during the construction phase. He is survived by his wife and 20-month old daughter. He was devoted to his family and adored spending time with his daughter. Summer, his high school sweetheart and wife of 15 years, told CNN's Anderson Cooper, "Anyone that ever met Robert would say that he had an excellent sense of humor." She wants Adams to be remembered as someone who was positive, generous, helpful, and loved everyone.

Isaac Amanios

Isaac Amanios, 60, was a supervising environmental health specialist for the San Bernardino County Department of Public Health. He immigrated from Eritrea to California in 2000 to escape the violence and repression in his home country. Amanios is survived by his wife and three children. He was a family man who doted on his children and saw his move to the U.S. as a means to provide them with a better life. A family member described him as "an amazing father, brother, amazing everything."

Bennetta Bet-Badal

Bennetta Bet-Badal, 46, was an environmental health specialist for the San Bernardino County Department of Public Health and led a team of food establishment inspectors. She was dedicated to her work and was excited to be presenting to her colleagues during

the meeting on December 2. At the age of 18 she fled Iran and traveled to the U.S. with her family to escape religious persecution. Bet-Badal is survived by her husband and three children. "Everything she touched bloomed," said her husband. "She went above and beyond."

Harry Bowman

Harry Bowman, 46, grew up in Pennsylvania and had worked in California for the past 15 years. He graduated with honors from Johns Hopkins University. Bowman was one of the earliest contributors to the National Center for Risk and Economic Analysis of Terrorism Events (CREATE), a center based at the University of Southern California that studied national security and terrorism. He was an expert in spatial data and mapping, and worked as a statistical analyst for the San Bernardino County Department of Public Health. He is survived by two daughters.

Sierra Clayborn

Sierra Clayborn, 27, was an environmental health specialist for the San Bernardino County Department of Public Health. She was described as energetic, thoughtful, and always smiling. She graduated from the University of California at Riverside in 2010. She was passionate about her work, stating on Facebook, "I love my blooming career in public and environmental health." The manager of a pizza shop that she had recently inspected stated, "She was one of the nicest health inspectors that we've ever had. She talked to us like normal people, not just doing her job."

Juan Espinoza

Juan Espinoza, 50, grew up in Mexico and moved to California in his 20s. He put himself through college at California State University, San Bernardino, and was hired as an environmental health inspector for the San Bernardino County Department of Public Health after graduation. His family noted how much he loved his job, how he lived to make his family happy, and how important education was to him. "He always mentioned that having an education is first priority and that an education is a treasure that nobody can take away from you," stated a family member. He is survived by his wife and two children.

Aurora Godoy

Aurora Godoy, 26, was an office assistant for the San Bernardino County Department of Public Health. She had been in that position for less than one year. Godoy was noted for her wide smile, humor, and open heart. She is survived by her husband and two-year old son. Her husband praised her for being a devoted mother. In a Facebook post, Godoy's aunt commented, "We will keep her flame alive so that her young son does not forget his special mother."

IN MEMORIAM: SAN BERNARDINO

Shannon Johnson

Shannon Johnson, 45, was an environmental health specialist for the San Bernardino County Department of Public Health. He traveled 60 miles every day from his home in Los Angeles to work in San Bernardino. His girlfriend called him fun, loving, and kind. His last living gesture was one of kindness as he used his body to shield a colleague, Denise Peraza, during the shooting. Peraza, who was shot in the back but survived, said that Johnson held her and said, "I got you." In a statement from his family, they remembered him as a "generous, fun-loving soul, who very much loved his family and friends.... a protector to all those he loved."

Larry Kaufman

Larry Kaufman, 42, worked at an independent coffee shop at the Inland Regional Center where the shootings occurred. He considered himself a free spirit and was known for starting up long conversations with anyone he met. As Ryan Reyes, Kaufman's boyfriend for three years, observed, "The man could have a 30-minute conversation with a cashier about his cats ... I would literally have to pull him away." In remembering Kaufman, Reyes stated, "[He was] one of those guys that everybody loved, got along with everybody, the life of the party, always funny, always creative."

Damian Meins

Damian Meins, 58, spent 28 years working for Riverside County and had recently returned to a position with the San Bernardino County Department of Public Health's Division of Environmental Health after retiring in 2010. Meins' former employer called him a "bright light" and went on to say, "I will always remember Damian as a caring, jovial man with a warm smile and a hearty laugh." His friends remember him as funny, smart, outgoing, and very friendly. He is survived by his wife and two daughters. "I just want everyone to know that he was a good man. He was an amazing man," said one of his daughters.

Tin Nguyen

Tin Nguyen, 31, was a health inspector for the San Bernardino County Department of Public Health. She graduated from California State University, Fullerton, with a degree in health sciences. She was eight years old when her family fled Vietnam. She was part of a close-knit and extended family that met every Sunday for dinner. She had planned to get engaged next year and married a year after. According to a GoFundMe page set up for her family, Nguyen was "an incredible person with a contagious smile ... you couldn't help but fall in love with her addicting personality and good sense of humor."

Nicholas Thalasinis

Nicholas Thalasinis, 52, was a health inspector for the San Bernardino County Department of Public Health. "He had an incredibly good work ethic. The job of a sanitary inspector is certainly not the most glamorous of professions. He was passionate about it. He wanted to make sure people were safe," stated the husband of one of Thalasinis' former colleagues. Thalasinis was a very devoted man and was passionate about his beliefs. His friends recall him as a man who was always willing to lend a hand. He is survived by his wife and two adult sons. "He became born again a couple of years ago, and because of that I had a very strong faith," said Thalasinis' wife, "so I know that he's in a much better place."

Yvette Velasco

Yvette Velasco, 27, was an environmental health specialist for the San Bernardino County Department of Public Health. Her family felt she embodied intelligence and ambition. Velasco was known for her easy and contagious smile, generosity, and hard work. "She was a bright young girl who showed a caring heart to everyone. She worked hard and never gave up on her dream," said a colleague. Her uncle stated, "Yvette was an intelligent, motivated, and beautiful young woman who was full of life and loved by all who knew her."

Michael Wetzel

Michael Wetzel, 37, was a supervising environmental health specialist for the San Bernardino County Department of Public Health. He was a devoted family man to his wife and six children, volunteering time to coach a local children's soccer team and often seen in his hometown running around doing errands with his six children in tow. Wetzel's wife described him as "my best friend and an incredible father who was loved by all. I have never known a better person. He loved his work and his family so much. Without him, this family will never be the same." 🙏

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NEHA NEWS

NEHA Supports National Healthy Schools Day

National Healthy Schools Day (NHSD) is April 5, 2016. NEHA is pleased to partner again with the Healthy Schools Network (www.healthyschools.org) in supporting and promoting this event. NEHA has been a supporter since 2011.

NHSD is coordinated by the Healthy Schools Network in partnership with many agencies and organizations. Together they promote the use of the U.S. Environmental Protection Agency's (U.S. EPA's) IAQ Tools for Schools guidance (www.epa.gov/iaq/schools/index.html), as well as other U.S. EPA environmental health guidelines and programs for schools and children's health.

The Healthy Schools Network is the leading national voice for children's environmental health in schools and is an award-winning 501c3 nonprofit environmental health organization. Founded in 1995, the network launched the national healthy schools movement with comprehensive state policy recommendations and a model coalition. It has since fostered reform coalitions in many states and localities.

NEHA's thousands of environmental health professionals recognize children's environmental health as being one of its core priority areas. Our work in the area of school food safety and indoor air quality in schools reflects that concern. We are proud to again join our colleagues in offering strong support of this year's NHSD.

For more information about NHSD, please visit www.nationalhealthyschoolsday.org or follow the conversation on Twitter at #HealthySchoolsDay.

NEHA's First Ever App Challenge: Innovating for Environmental Health

NEHA, with the support of Esri and Hedgerow, will be hosting this year its first-ever app challenge, Innovating for Environmental Health. From March–May 2016, individuals will create apps to elevate the field of environmental health. Participants will compete to create apps that help to achieve one of the Healthy People 2020 environmental health objectives as identified by the Department of Health and Human Services.

The Innovating for Environmental Health challenge will bring together technology, government, and environmental health to form a partnership that leads to original solutions to environmental health issues. The goal of the challenge is to inspire environmental health professionals to move towards open data and technology by presenting innovative, data-driven solutions to environmental health concerns that will ultimately serve to promote and protect public health. Participants will have access to Esri's ArcGIS software for app development and the Centers for Disease Control and Prevention's Environmental Public Health Tracking application programming interface (API) for use as a main data source. Other government open data sources will be available to participants.

The top three winners of the app challenge will share a monetary prize. A representative from the first place team will attend the 2016 NEHA Annual Educational Conference & Exhibition and HUD Healthy Homes Conference this June in San Antonio, Texas, to present their app in front of an audience of industry and environmental health professionals.

Please visit <http://innovatingeh.devpost.com> to learn more or to register to participate in the Innovating for Environmental Health app challenge. 🐼

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**Registered Environmental Health Specialist (REHS)/
Registered Sanitarian (RS)**

From climate change and food protection to water quality and zoonoses, REHS/RS credential holders have the training and qualifications to protect our communities and the people in it—from A to Z. Attaining this prestigious credential sets you apart and recognizes your intent to stay at the top of your game.

Learn more at
neha.org/professional-development/credentials



2016 Walter F. Snyder Award

Call for Nominations

Nomination deadline is April 30, 2016.

Given in honor of NSF International's co-founder and first executive director, the *Walter F. Snyder Award* recognizes outstanding leadership in public health and environmental health protection. The annual award is presented jointly by NSF International and the National Environmental Health Association.



Nominations for the 2016 *Walter F. Snyder Award* are being accepted for environmental health professionals achieving peer recognition for:

- outstanding accomplishments in environmental and public health protection,
 - notable contributions to protection of environment and quality of life,
- demonstrated capacity to work with all interests in solving environmental health challenges,
- participation in development and use of voluntary consensus standards for public health and safety, and
- leadership in securing action on behalf of environmental and public health goals.



Past recipients of the *Walter F. Snyder Award* include:

2015 – Ron Grimes	2007 - Wilfried Kreisel	1998 - Chris J. Wiant	1989 - Boyd T. Marsh	1980 - Ray B. Watts
2014 – Priscilla Oliver	2006 - Arthur L. Banks	1997 - J. Roy Hickman	1988 - Mark D. Hollis	1979 - John G. Todd
2013 - Vincent J. Radke	2005 - John B. Conway	1996 - Robert M. Brown	1987 - George A. Kupfer	1978 - Larry J. Gordon
2012 - Harry E. Grenawitzke	2004 - Peter D. Thornton	1995 - Leonard F. Rice	1986 - Albert H. Brunwasser	1977 - Charles C. Johnson, Jr.
2011 - Gary P. Noonan	2002 - Gayle J. Smith	1994 - Nelson E. Fabian	1985 - William G. Walter	1975 - Charles L. Senn
2010 - James Balsamo, Jr.	2001 - Robert W. Powitz	1993 - Amer El-Ahraf	1984 - William Nix Anderson	1974 - James J. Jump
2009 - Terrance B. Gratton	2000 - Friedrich K. Kaferstein	1992 - Robert Galvan	1983 - John R. Bagby, Jr.	1973 - William A. Broadway
2008 - CAPT. Craig A. Shepherd	1999 - Khalil H. Mancy	1991 - Trenton G. Davis	1982 - Emil T. Chanlett	1972 - Ralph C. Pickard
		1990 - Harvey F. Collins	1981 - Charles H. Gillham	1971 - Callis A. Atkins

The 2016 Walter F. Snyder Award will be presented during NEHA's 80th Annual Educational Conference (AEC) & Exhibition to be held in San Antonio, TX June 13-16, 2016.

For more information or to download nomination forms, please visit www.nsf.org or www.neha.org or contact Stan Hazan at NSF at 734-769-5105 or hazan@nsf.org.



NEHA's EXCELLENCE IN SUSTAINABILITY Award Program

NEHA's Excellence in Sustainability Award recognizes organizations, businesses, associations, and individuals who are solving environmental challenges by using innovative and environmentally sustainable practices.

Visit www.neha.org/excellence-sustainability-award to learn more about the Excellence in Sustainability Award Program and submission process.

Submission deadline is April 15, 2016.

For more information, please contact Laura Brister at lbrister@neha.org.





NEHA 2016 AEC and HUD Healthy Homes Conference

SAN ANTONIO, TX ★ JUNE 13-16, 2016



PRESENTED BY
Green & Healthy Homes Initiative*

The State of Big Ideas: Moving Environmental Health Outside the Box

Join us for educational sessions on these tracks and dozens more dedicated to all disciplines of environmental health.



Registration

Early Registration Ends April 15! Register TODAY at neha.org/aec/register.
Discounted rates available for students and retirees.

	Before April 15 Member/Nonmember	After April 15 Member/Nonmember
Full Conference	\$575/\$750	\$675/\$850
Full Conference + 1-year NEHA Membership	\$670	\$770
Single Day Registration	\$310/\$365	\$310/\$365

Grow Your Networks

This year's conference will have all of the valuable networking opportunities to make new connections and strengthen old ones. There is nothing quite like the face-to-face bonding that occurs when you can learn from one another's adventures in the field.

Community Event

Please join HUD, NEHA, the City of San Antonio, and local partners and volunteers for our community event, BUILDING A HEALTHY NEIGHBORHOOD. Come network with colleagues while giving back to our host city! It will be an all-weekend volunteer project that will include multiple opportunities based on housing and community needs, and will conclude with a celebration. FREE registration will open in mid-April. Look for details at neha.org/aec/special-events.

Exhibition

Monday night (June 13) will kick off the conference with the Exhibition Grand Opening & Party—a great place to mingle with your network of colleagues and all our fabulous exhibitors. The Exhibition will be open all day Tuesday with coffee breaks between sessions. This is your chance to connect directly with experts in the industry who can deliver the products and services you need to thrive in your position. There are not many opportunities where all of these resources are gathered in one place representing all spectrums of environmental health!



Annual UL Event



Once again we are thrilled to have UL sponsor our social networking event at the conference! Join us for a boat ride along the San Antonio River, which will take you to dinner at the Pearl Stable

within the historic Pearl Brewery District, a 22-acre brewery complex that has become a community culinary destination. The price includes boat ride with tour guide, dinner, and bus transportation back to the hotel. This always-popular event is **not** included in conference registration so if you want to attend, purchase your tickets early as this event is sure to sell out quickly!



The UL Event will take place on June 14 with boats departing from the Hyatt Regency at 5:30 pm. Tickets are \$45 per person. Purchase your tickets in advance at neha.org/aec/special-events.

The App & More

Everyone had so much fun using the meeting app last year that we are building more ways to interact and score more points for our 2016 app game. Download the Meeting App by searching "NEHA AEC" from iTunes or the Google Play Store. Additional networking will be available at the First Time Attendee Meeting, Breakfast & Town Hall Assembly, and Texas Social, and all are included with full conference registration.



Advance Your Career

Consider taking your career in a new direction or elevate your current position with a credential. A professional credential from NEHA proves competency in a given field and demonstrates to your community and employers that you are competent, properly trained, and current with contemporary standards within the profession to carry out your responsibilities. The following credential review courses and exams will be offered in San Antonio prior to the conference.

Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS)

Friday & Saturday, June 10 & 11, 8 am – 5 pm

Sunday, June 12, 8 am – 12 pm

This two and a half day refresher course is designed to enhance your preparation for NEHA's REHS/RS credential exam. Participants are expected to have a solid foundation of environmental health knowledge and training equal to the eligibility requirements to sit for the REHS/RS credential exam. This course is for refresher purposes and should not be used as the sole source of study for the credential exam. The class will cover exam content areas as described in the REHS/RS Candidate Information Brochure. The instructor will be available during and after the course for questions.

Cost: \$499 for members/\$599 for nonmembers. Includes the *REHS/RS Study Guide*, a \$179 value.

Certified Professional – Food Safety (CP-FS)

Saturday & Sunday, June 11 & 12, 8 am – 5 pm

This two-day refresher course is designed to enhance your preparation for NEHA's CP-FS credential exam. Participants are expected to have prior food safety knowledge and training equal to the eligibility requirements to sit for the CP-FS exam. The course will cover exam content areas as described in the CP-FS Candidate Information Brochure. The instructor will be available during and after the course for questions.

Cost: \$375 for members/\$475 for nonmembers. Includes the CP-FS Study Package (*CP-FS Manual*, NEHA's *Professional Food Manager*, and the 2009 and 2013 FDA *Food Codes* [on CD]), a \$235 value.

Certified in Comprehensive Food Safety (CCFS)

Friday & Saturday, June 10 & 11, 8 am – 5 pm

Sunday, June 12, 8 am – 12 pm

The CCFS is a strong core credential for food safety professionals with a primary concern of overseeing producing, processing, and manufacturing environments of the U.S. food supply. It has been designed to meet the increasing need for highly qualified food safety professionals from both industry and the regulatory communities who provide oversight in preventing food safety breaches. The credential course will cover exam content areas as described in the CCFS Candidate Information Brochure. The course will utilize different learning modalities from critical thinking exercises to small group breakouts and videos.

Cost: \$375 for members/\$475 for nonmembers. Includes NEHA's *CCFS Preparation Guide*, a \$209 value.

Healthy Homes Specialist (HHS) Exam Only

Monday, June 13, 8 – 10 am

HHS credential holders understand the connection between housing hazards and health. This special designation signifies that you are an expert who works with families to identify problems that threaten their health and well-being and make recommendations for resolving these problems. The HHS exam only will be offered and there will not be a pre-conference course.

Take any credential exam at the conference and save \$100 on the testing fee!

Exams offered Monday, June 13. Separate application and exam fees are required. Visit neha.org/credential.

Pre-conference courses and exams will take place at the Hyatt Regency San Antonio.

Be Inspired

Expect an opening session unlike any in recent history. This year's conference promises to be:



Policy Oriented

Julian Castro, secretary of the U.S. Department of Housing and Urban Development (HUD), has been invited to deliver the keynote address at the opening session. Widely considered a rising star in U.S. national politics, he has also served as mayor of San Antonio, our conference host city.

Environmentally Focused

U.S. Environmental Protection Agency Administrator Gina McCarthy has been invited to join the opening session.

Locally Flavored

Umair Shah, MPH, MD, executive director of Harris County Public Health & Environmental Services, will provide a unique Texas perspective.

Expertly Moderated

The opening session panel will be moderated by Eric Pooley, senior vice president for strategy and communications with the Environmental Defense Fund. Pooley was a featured commentator in *Heat*, the 2008 PBS *Frontline* global warming documentary, and has appeared on *Nightline*, *Charlie Rose*, *The CBS Evening News*, *NBC Nightly News*, *Larry King Live*, *Anderson Cooper 360*, *All Things Considered*, and many other programs.

Interactive

What questions would you like to ask of some of the most important personalities in environmental public health? Microphones and dedicated time will be provided for questions and answers with the audience.

Just Added!

Closing Session: Thursday, June 16

From Sandy to San Bernardino: Risk, Response, & Resiliency

Join a nationally recognized behavioral health expert who will moderate and explore workforce resiliency with a panel of disaster-experienced environmental health professionals. Sponsored by the NEHA Business & Industry Affiliate.

Go Green with Us!

Start building your schedule of sessions you plan to attend online before the conference! We are going green with a much smaller program guide this year that will have the general schedule outline rather than listing every session with descriptions. For a full list of educational sessions, visit neha.org/aec/sessions. Once you register for the conference, you will receive a meeting app invitation by e-mail in mid-April!



NEHA 2016 AEC and
HUD Healthy Homes Conference

SAN ANTONIO, TX ★ JUNE 13-16, 2016



Enjoy San Antonio!



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Hotels

Make your hotel reservations early to get the room of your choice. We are pleased to offer special room rates at four hotels located within walking distance of one another and along the historic San Antonio Riverwalk. Mention “NEHA HUD” at any of these hotels to receive the discounted rate.

- Hyatt Regency San Antonio
(Pre-con Courses & Exams, Education on Wed, Thurs)
- San Antonio Marriott Rivercenter
(Exhibition, Education on Mon, Tues)
- San Antonio Marriott Riverwalk
- Hilton Palacio del Rio

For additional details and reservation links, please visit neha.org/aec/hotel.

Local Flavor

Soak up the amazing culture, natural beauty, and wide range of activities that can be found in and around San Antonio. Some popular attractions to discover include:

- Natural Bridge Caverns & Wildlife Ranch
- San Antonio Zoo
- Buckhorn Museum
- The Alamo
- San Antonio Missions National Historical Park
- Six Flags Fiesta Texas
- Schlitterbahn Waterpark & Resort
- Majestic Theatre
- Texas Ranger Museum and Hall of Fame

Find details on these attractions and many more things to do at visitsanantonio.com.

2016 Educational Sessions

Here is a sample of the exciting educational sessions we are preparing for the 2016 conference!

You will find more than 22 environmental health tracks covered in 150 sessions. View all sessions in advance so you can build your schedule by visiting neha.org/aec/sessions.

Climate Change

- Climate Change Is Here Now: We Are the Ones to Act
- Asthma & Climate Change: A Community and Healthy Homes Perspective
- Preparing Environmental Health for Climate Change Through Cross-Program Collaboration
- Arctic Policy, Sustainability, & Governance: Roles for Environmental Health Practitioners

Emerging Environmental Health Issues

- Filling the Void: Safely Opening the Market to the Micromanufacturer
- Addressing Contemporary Challenges for Women in Environmental Health
- Smoke-Free Policies in Selected Texas Public Housing Authorities

Environmental Health & Policy

- Everything You Wanted to Know About Politics In Our Capital But Were Afraid to Ask

Environment Health Impact Assessment

- Environmental Health Science: Tools & Approaches for a Changing World
- Integration of a Built Environment Unit in Environmental Public Health
- Health Impact Assessments & Extreme Weather: A New Approach for Environmental Health
- Asthma Home Visiting Programs: From Research to Sustainability

Food Safety & Defense

- Tools and Resources for Building a Quality Retail Food Protection Program
- Employee Training: Expense or Investment?
- Using Social Media to Predict Foodborne Illness and Drive Inspections
- Implementation of Federal Menu Labeling Requirements in Harris County, Texas
- The A+ Cutting Edge Program: A Food Safety Partnership
- Pushing Through the Hurdles: Advice to Meet the FDA Retail Program Standard
- Making the Grade: Exploration of Retail Food Establishment Scoring & Grade Systems
- Deli Sleuths: Pursuing *Listeria monocytogenes*

Healthy Homes & Communities

- How the National Healthy Housing Standard Can Improve Housing Codes for Health
- Preserving Affordable Housing Through Healthy Home Repairs
- Healthy Home Assessments: Rapid, Intuitive Visual Methods of Risk Characterization in Homes
- Proper Ventilation Really Does Matter to Indoor Air Quality and Health
- Integrating Health and Housing inspections: A Collaboration for Healthy Living
- Is Substandard Housing Compromising the Health and Education of Indigenous Children?

Leadership & Management

- Selecting the Best: 25 Questions Environmental Health Managers Want Answered About Job Candidates
- Engaging Your Customer Base to Maximize Your Environmental Health Program
- Using the Media as a Strategic Partner

Onsite Wastewater

- H₂O & M—The Online Tool to Create Customized Septic System Owner Guides
- Community Septage Disposal: Do You Have a Plan?
- Creating Healthy Homes and Healthy Septic Systems With HUD, CDBG, & SepticSmart

Recreational Waters

- Lessons Learned From Mass Chlorine Exposures at Recreational Swimming Pools
- Local Aquatics Inspection Data as National Surveillance Data
- The Future of Aquatics Health & Safety: Data Needed to Improve the Model Aquatic Health Code
- Drought Concerns, Water Conservation, and Maintaining Healthy Swimming Pool Water
- Helping Crack the Code: Model Aquatic Health Code Speed Mentoring

Vector Control & Zoonotic Diseases

- Keeping the Bugs Out: Promoting Environmental Health in Sensitive Environments
- CDC and NEHA Partner to Support Vector Control Programs
- Taking Control of Bed Bug Management: Lowering Costs With Nonchemical Controls
- Bed Bugs & Baseball: How Social Media Transformed Kansas City's Lodging Ordinance

Water Quality

- Thinking Outside the Cooling Tower Box: *Legionella* & Raw Water Industrial Processes
- What's in the Water: Drinking Water Performance Improvement Project

In the News

- The Zika Virus
- Water Crisis in Flint, Michigan
- Government Accountability Office Speaks on Climate Change
- One Health and EH: Perfect Partners in Securing Global Health

► **DirectTalk** MUSINGS FROM THE 10TH FLOOR



David Dyjack, DrPH, CIH

At our Annual Educational Conference & Exhibition in Orlando, Florida, I publicly committed to you that we would have a presence in Washington, DC, by the end of the year. I kept my promise. With great pleasure allow me to introduce Joanne Zurcher, MPP, our new director of government affairs. Joanne is a physical and symbolic manifestation of our commitment to professionally represent your interests at the highest levels of government. She is based in Washington, DC. I'm pleased to have her "hijack" my column this month so that she can talk directly to you regarding this exciting new endeavor.

Greetings from Washington, DC! Congressman John Dingell, who served for over 40 years in the House of Representatives, famously said of Washington, DC, "If you aren't at the table, you are on the menu." Washington, DC, is a tough town where everyone thinks their issue is the top priority. With the opening of a DC office, NEHA has taken a first step in the process of claiming its seat at the table and leading the nation to better environmental health.

This couldn't have happened at a more opportune time as 2016 is a critical year for legislation. This may come as a surprise to some since it's an election year and there will be a new president and Congress after November. As Washington, DC, insiders know, however, every incoming administration wants to start a host of new initiatives in its first 100 days in office, when it has momentum generated from the recent election. The only successful way

It's a Government Affair

NEHA has taken a first step in the process of claiming its seat at the table and leading the nation to better environmental health.

to keep that pace is to review what has been debated, discussed, and garnered political support during the previous Congress. It's for this reason that 2016 could not be a more important time to introduce NEHA to Congress and start the ball rolling toward increased appropriations for the Centers for Disease Control and Prevention's National Center for Environmental Health, Toxic Substance Control Act reauthorization, Food Safety Modernization Act, and others.

As a policy wonk and health care political junkie with 20-plus years in Washington, DC, politics, I am thrilled to be joining the NEHA family. I have worked for clients making them thought-leaders in Washington, DC, and protecting their interests on Capitol Hill; assisted the Health Resources and Services

Administration in navigating the Affordable Care Act (ACA) debate and worked with the Department of Health and Human Services in implementation of ACA; helped nonprofits increase their appropriations and stature in Washington, DC; and worked as senior staff for two members of Congress. I have my master's degree in public health and international relations policy.

Using my political expertise, especially my skills in and with the executive and legislative branches, I will get your stories and experiences in environmental health in front of key decision makers. Together, with the national office at the helm, we will be an unstoppable team.

But I can't do it without you! I will need your data and best practices. And even more important, I want to know if your mother's best friend's neighbor or you have relationships of any kind with folks in Congress, the current administration, or the presidential candidates. These relationships—even if you think they are inconsequential or that they will never remember you—can be a game changer for our advocacy.

As for the data and stories, I'm looking to build a compelling narrative about how your work has improved the lives of people in your community. Success stories and lessons learned from the field are critical to my work. If we can tell members of Congress that we could have done "X" before the city of Flint changed its water supply to the Flint River or provided 9/11 first responders with "Y" before rescue and recovery efforts in New

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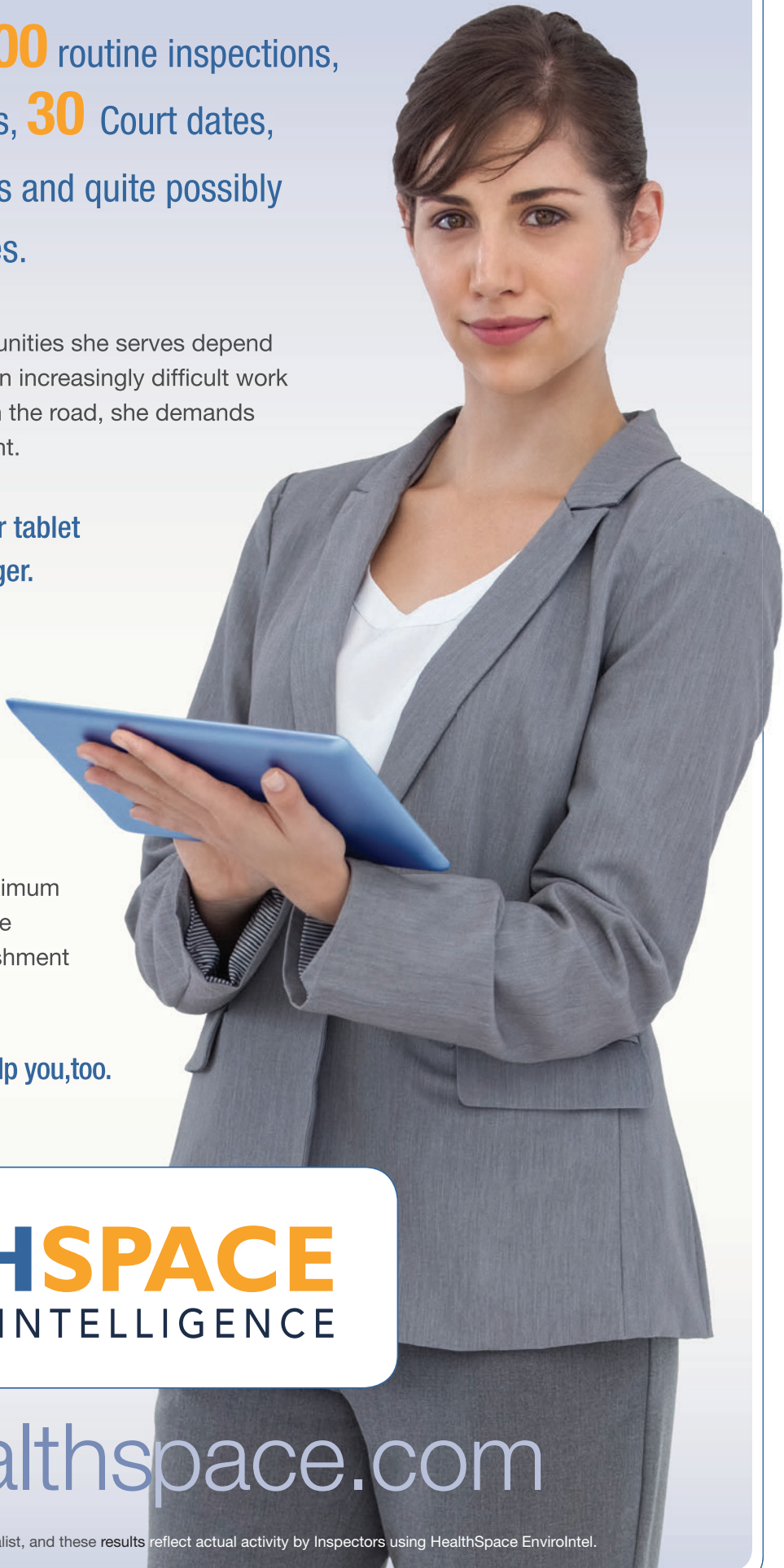
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Community-Acquired Legionnaires' Disease in Dallas County, Texas

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Abstract Community-acquired Legionnaires' disease (LD) cases reported in Dallas County, Texas, from 2000 through 2010 were analyzed to determine the characteristics of disease incidence and burden of community-acquired LD and identify any temporal or geographic variation of the disease occurrences. As elsewhere in the U.S., annual reported cases of LD increased in the county, rising 380% from 2000 to 2010. Almost all cases were sporadic. Clustering of cases both geographically and temporally was observed and cases were found to be concentrated in the northern and eastern parts of the county. The rising incidence of community-acquired LD may require development of a public health policy that takes into consideration risk factors, particularly age. An environmental study would be helpful to identify modifiable environmental factors in the areas with clustered cases.

Introduction

The term legionellosis describes two distinct types of syndromes caused by pathogenic bacteria of the genus *Legionella*. Legionnaires' disease (LD) is a serious form of pneumonia frequently resulting in hospitalization and possibly death. Pontiac fever is a mild flu-like illness without pneumonia. Incubation period of LD is 2–14 days and main symptoms include cough, high fever, chills, and chest pain. Pontiac fever has an incubation period of 2–5 days with self-limiting symptoms including fever, headaches, and muscle aches. Cases of Pontiac fever are typically not reported to local and state health departments. *Legionella pneumophila* bacteria are ubiquitous in fresh water environments and can contaminate potable water systems,

showers, cooling towers, spas, hot tubs, and pools (Centers for Disease Control and Prevention [CDC], 2015; Lane, Ferrari, & Dreher, 2004; U.S. Environmental Protection Agency [U.S. EPA], 2001). Potting soil has also been reported as a source of infection in studies (Duchin et al., 2000; Whiley & Bentham, 2011). Transmission occurs through aerosolization or aspiration of contaminated water (Azara et al., 2006; Barrabeig et al., 2010; U.S. EPA, 2001).

Ashbolt (2009) describes legionellosis as the single largest cause of waterborne disease in the U.S. According to Neil and co-author (2008), a total of 23,076 cases of legionellosis were reported to the Centers for Disease Control and Prevention (CDC) in 1990 through 2005. Furthermore, national and

regional studies indicate that legionellosis is on the rise (Cummings, Rosenberg, & Vugia, 2009; Hicks, Garrison, Nelson, & Hampton, 2011; Neil & Berkelman, 2008). Studies also show the number of reported cases to CDC increased by 70% in 2000 to 2003 (Neil & Berkelman, 2008) and by 217% in 2000 through 2009 (Hicks et al., 2011). Despite these national and few other regional and local studies reviewing geographical and temporal variation of LD, however, the burden and distribution of community-acquired LD has not been analyzed in most communities.

Therefore, the goals of our study were to review reported cases of LD in Dallas County, Texas, to determine the characteristics of disease incidence and burden of community-acquired LD, and to identify any temporal or geographic variation of the disease occurrences.

Methods

Dallas County is an urban metropolitan area with a geographic area of 2,278.2 square kilometers (879.60 square miles) and a population of 2,377,351 as of July 2010 (U.S. Census Bureau, 2010). One hundred seventy LD cases were reported to Dallas County in 2000 through 2010 as part of the National Notifiable Diseases Surveillance System (NNDSS). For our study, data were obtained from the Dallas County Department of Health and Human Services, and cases that met the CDC's case definition for confirmed LD were reviewed (CDC, 2011).

Annual total Dallas County population data for 2000 through 2010 were obtained from the 2010 census and intercensal estimates (U.S.

FIGURE 1

Number of Reported Community-Acquired Legionnaires' Disease Cases and Annual Crude Incidence Rate in Dallas County, Texas, 2000–2010

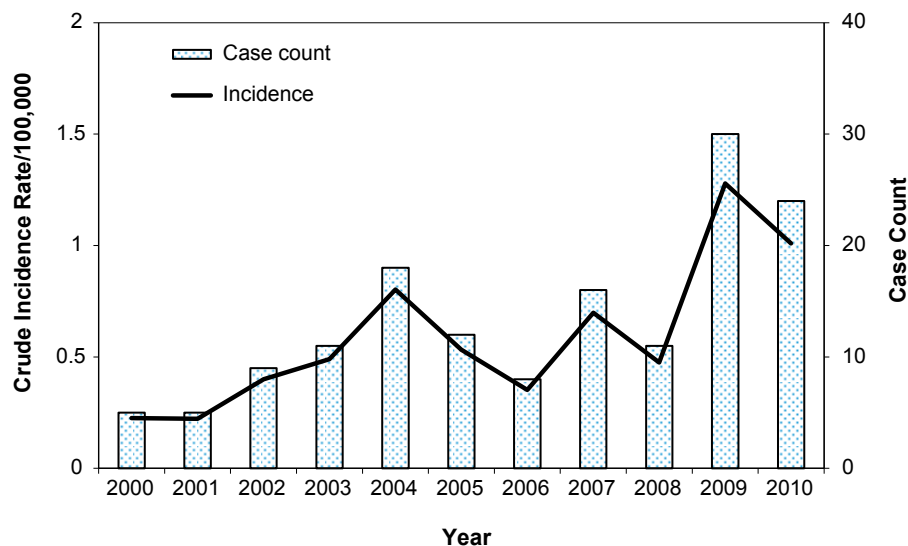


TABLE 1

Number of Reported Cases and Age-Group-Specific Incidence Rate of Community-Acquired Legionnaires' Disease in Dallas County, Texas, 2000–2010

Age Group (yrs.)	# of Cases*	%	Annual Average Incidence/100,000
15–24	1	1	0.03
25–34	16	11	0.35
35–44	15	10	0.36
45–54	36	24	1.2
55–64	37	25	2.1
65–74	24	16	2.12
75–84	15	10	2.2
85+	4	3	1.69

*One male case excluded because of missing age data.

Census Bureau, 2011). The population breakdown by demographic categories for 2000 through 2010 was calculated by multiplying the total annual population in each year with proportions of the different groups in 2000. Crude, age-group-specific, and age-adjusted incidence rates were calculated per 100,000 population, for the general population and for demographic groups classified based on

age and sex. Seven age groups, 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84, and 85+ were used in the analyses. A direct method based on standard million U.S. population of 2000 was used for age adjustment (National Cancer Institute, 2011). A two-tailed *t*-test was utilized to compare means of age-adjusted incidence rates between the two sexes at 5% significance level. Dallas County annual aver-

age age-adjusted incidence rate and case-fatality rate were compared to national or regional average rates reported elsewhere. Seasonal variation was assessed based on onset dates.

A space-time permutation model was also used to conduct cluster detection test using Kulldorff's spatial scan statistics (SaTScan version 9.1.1). A detailed description of SaTScan can be found at www.satscan.org. The space-time permutation model compares the number of observed cases that occurred in a specific part of a geographic area, during a specific time period, with the rest of the geographic area under consideration. Thus, a cluster of LD cases is determined if a particular area of a geographical region has a higher number of cases during a specific time period when compared to the remaining areas of the region (Kulldorff, 2010). Geographic coordinates of home address location of individual cases and onset date were used as input for the test.

Results

All cases of LD reported to the Dallas County Health and Human Services from 2000 through 2010 were reviewed. Eleven cases where investigators concluded the source of infection was nosocomial or suspected to be nosocomial were excluded from our study. Ten more reported cases where the acquisition of infection was thought to have occurred outside of Dallas County were also excluded. Hence, a total of 149 reported cases of community-acquired LD were reviewed, which were reported from 2000 through 2010 in the county. No cases of Pontiac fever were reported.

The number of reported LD cases in the county increased by 380% from 2000 to 2010 with more than one-third of the cases occurring in 2009 and 2010. The highest number of cases (30) was reported in 2009 and the lowest (five) in 2000 and 2001 (Figure 1).

The annual average crude incidence rate was 0.59 (± 0.33) per 100,000, with annual rates ranging from 0.22 in 2001 to 1.28 in 2009 with a generally increasing trend (Figure 1). The mean age-adjusted annual incidence rate of community-acquired LD in the county was 0.92 ($SD \pm 0.26$) in 2000–2010 ranging from 0.29 (2001) to 2.10 (2009) again with a similar trend.

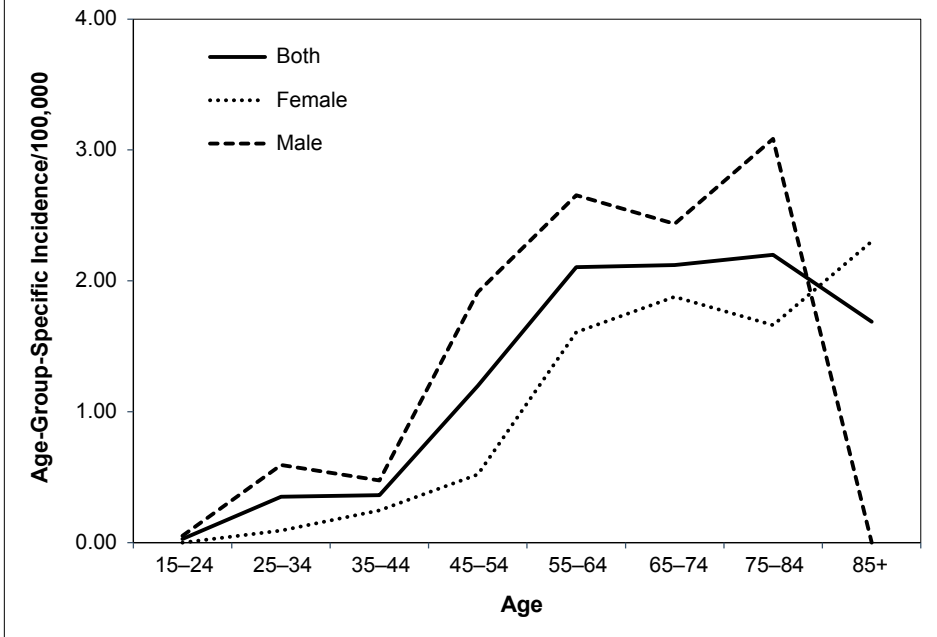
Twelve community-acquired LD related fatalities were reported in the period in the county. The average annual case-fatality rate of reported community-acquired LD in the

TABLE 2

Annual Gender-Specific Age-Adjusted Incidence Rate of Community-Acquired Legionnaires' Disease (LD) in Dallas County, Texas, 2000–2010

Gender	# of LD Cases (%)	Age-Adjusted Incidence/100,000
Female	53 (36)	0.63
Male	96 (64)	1.21
Total	149 (100)	0.92

FIGURE 2

Average Annual Age-Group-Specific Legionnaires' Disease Incidence Rate by Gender in Dallas County, Texas, 2000–2010

county was 6.51% (± 7.79) and was generally lower than rates observed in other regions in the U.S. (Florida Department of Health, 2008; Los Angeles County Department of Public Health, 2009).

Age

Age data were available for all but one case. Age of cases ranged from 24 to 90 with an average of 56. A majority of the cases (49%) occurred among persons aged 45–64, 22% were among ages 15–44, and 29% were among ages 74+. Despite the fact that the 45+ age group represents only 27% of the population, more than 80% of the cases came from this age

group. No pediatric cases of LD were reported in Dallas County during the study period.

Specific incidence rates were calculated for the different age groups. Lower incidence rates (0.03–0.36 per 100,000) were observed among younger populations (15–44). In contrast, the incidence rate in the 75–84 age group was 2.20 per 100,000, followed by 2.12 per 100,000 in 65–74 and 2.10 per 100,000 in 55–64 age groups (Table 1).

Sex

The number of male cases (96) was almost double that of females (53) and was consistently higher except in the 15–24 age group.

The mean annual age-adjusted incidence rate in males, 1.21 (± 0.72) per 100,000, was also nearly double that of females, 0.63 (± 0.51) per 100,000 ($p = .39$, 95% confidence interval [CI] = -1.13 to -0.03) (Table 2).

Female cases tended to be older than male cases, as 41% of female cases were older than 65 in contrast to 21% of male cases. The crude incidence rates among males (0.76 ± 0.37 per 100,000) were higher than in females (0.42 ± 0.33 per 100,000) in all the years except 2010 when it was almost the same. In all but age group 85+, age-group-specific incidences in males were higher than in females and average age-group-specific rates in both sexes generally increased with age except in the 85+ age group (Figure 2).

Spatial Distribution

Comparison of symptom onset date and home address of cases indicated that the majority of the cases were sporadic and only six cases might be part of small outbreaks. Most cases were concentrated in the eastern and northern parts of the county (Figure 3). About 48% of the cases occurred as a single case per zip code area over the period 2000–2010. Repeated occurrence and clustering of cases were observed, however, in some parts of the county. The cluster analysis involving 145 cases identified three important clusters and several others based on a maximum cluster radius of three miles and one-day aggregate time unit. Similar results were obtained for maximum cluster radii of 5 and 10 miles. The p -values for the three clusters were .0015, .006, and 0.081. The other clusters were not statistically significant.

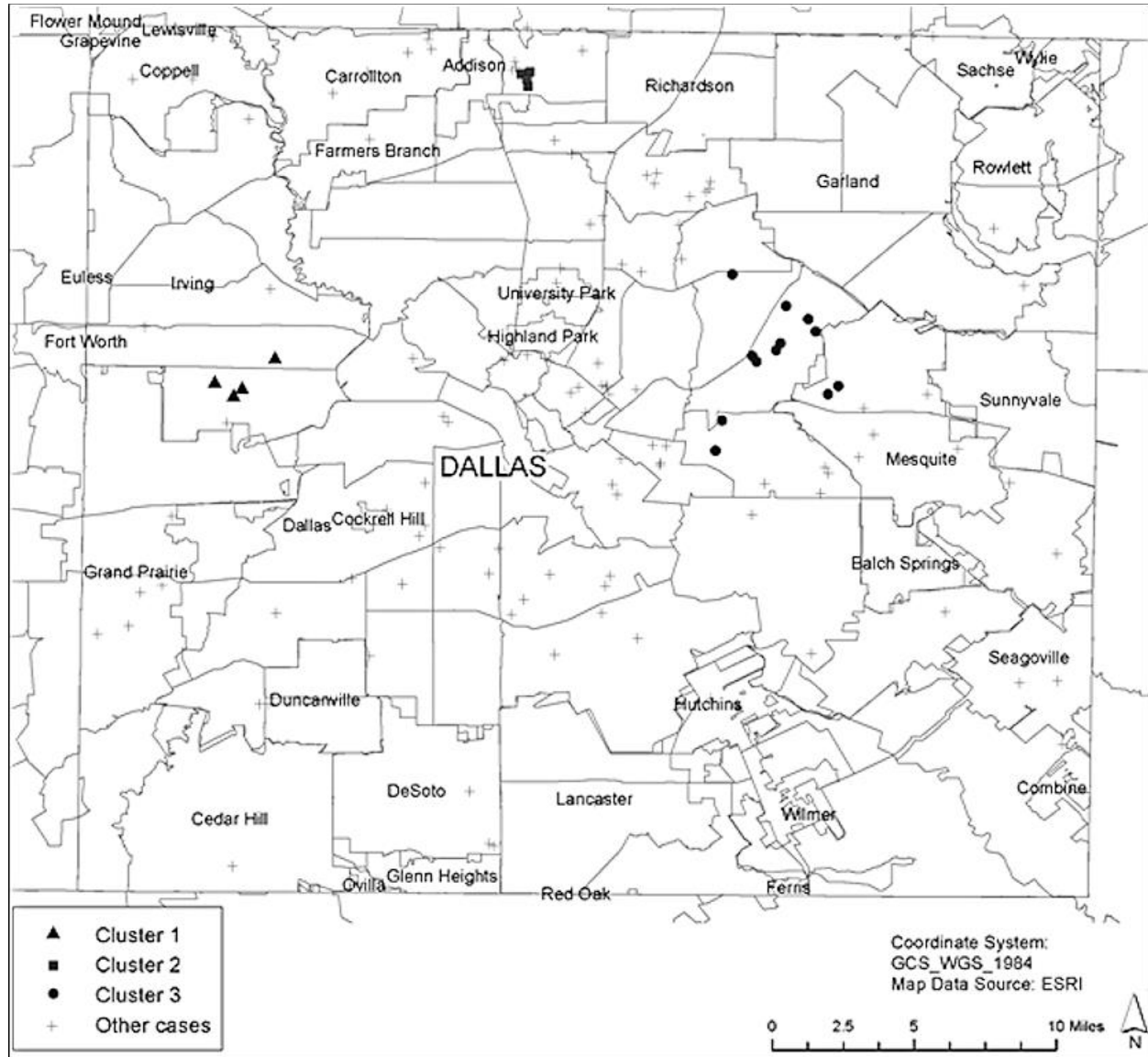
Seasonal Variation

The number of community-acquired LD showed seasonal variation with a clear difference in case count between fall/summer and the rest of the year. The highest number of cases occurred in October and the lowest in April and May.

Discussion

As elsewhere in the U.S., annual reported cases of LD increased in Dallas County, rising by 380% from 2000 to 2010 with an average age adjusted incidence rate of 0.92 per 100,000. The reason for this increase is not clear, however, increased testing, diagnosis, and reporting of cases likely contributed to this observed trend. An increasing size of older population

FIGURE 3

Clustering of Reported Legionnaires' Disease Cases in Dallas County, Texas, 2000–2010

Total cases = 145.

may also be a contributing factor. In many years, these incidence rates were higher than the national averages as reported by Hicks and co-authors (2011) (Figure 4).

The average annual age-group specific incidence rates of community-acquired LD in the county increased in older age groups except in the 85+ age group. Although this result is for

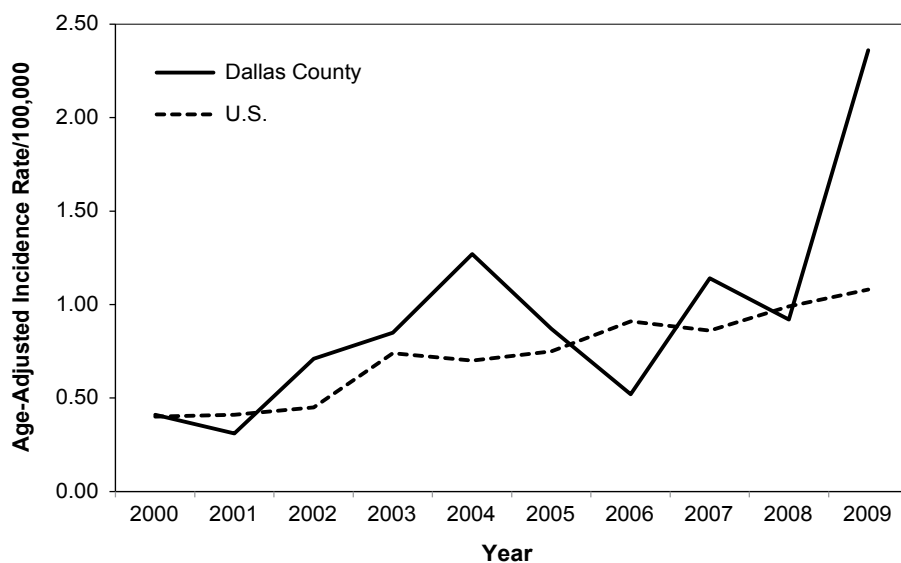
the most part consistent with other studies, we did not come across any previous studies reporting the exception concerning the 85+ age group. Noted in particular was the absence of cases reported in males 85+ from 2000–2010.

Significantly more male cases of LD were reported during the study period. Both case count and age-adjusted incidence rate were

consistently higher in males than in females in each year analyzed. The apparent reason why being male is a risk factor for LD compared to being female is not clear and requires more research.

Almost all cases were sporadic. Clustering of cases, however, both geographically and temporally, was observed. Generally, a higher

FIGURE 4

Comparison Between U.S. and Dallas County, Texas, Annual Age-Adjusted Legionnaires' Disease Incidence Rates, 2000–2009

U.S. rates are as reported by Hicks et al., 2011.

number of cases occurred in the northern and eastern parts of the county. The cluster analysis identified three important clusters, two of which were statistically significant at the significance level of .05. The first cluster represents four cases that occurred at the same residential location with similar onset dates in the northern part of the county. The second one observed in the eastern part similarly involved four cases. A third cluster with a *p*-value of .081 was bigger than the other two and had 11 cases. The identified areas with clustered cases are recommended for an environmental study to determine environmental risk factors and devise appropriate intervention methods.

Limitations

Our study was based on data collected as part of the NNDSS, which is by nature a passive reporting system that might have resulted in underestimation of cases occurring in the county. Another limitation was lack of specific population data by age and sex for 2000–2010. Hence, these breakdowns were estimated using the 2000 proportion of each demographic group and thus would not account for changes in proportions of the different groups that may have occurred during the years studied. This might have affected the estimation of the age-group-specific incidence rates. By contrast, available

data for 2009 and 2010 indicated that the majority of the cases in this study did not travel or spent most of their time at home at least within two weeks prior to onset of symptoms. Hence, in the cluster analysis, it was assumed that a case's home address could be a reasonable proxy for the location of exposure. It should be noted, however, that a case's home might not necessarily be the location where the case was exposed to LD. Zero or inconsequential population shift in the different parts of the county was assumed when interpreting space-time permutation clusters. Therefore, population-shift bias could be a confounding factor.

Conclusion

The increasing trends in incidence of community-acquired LD in Dallas County and other communities require increasing awareness of the public on this disease, as well as health care providers, and may need a public health policy targeting health protection of the more susceptible population, the elderly. Our study also suggests that an environmental study may be necessary to identify modifiable environmental factors that can reduce likelihood of exposure to *L. pneumophila*. 🐼

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