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## Pool Chemical Incidents Health Consequences and Contributing Factors



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**ABOUT THE COVER**



The authors of this month's cover feature, "The Distribution and Public Health Consequences of Releases of Chemicals Intended for Pool Use in 17 States,

2001–2009," analyzed the limited data in the literature about pool chemical incidents. The results of the authors' investigation showed that 60% of the analyzed incidents led to injury and half of those injured were under 18. Human error was the culprit nearly 72% of the time; thus, the authors conclude that public health and safety messages targeting private pool owners and public pool operators could reduce the number of these incidents.

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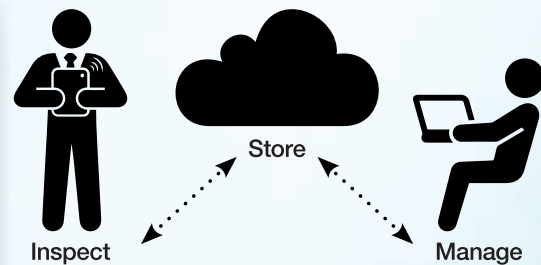
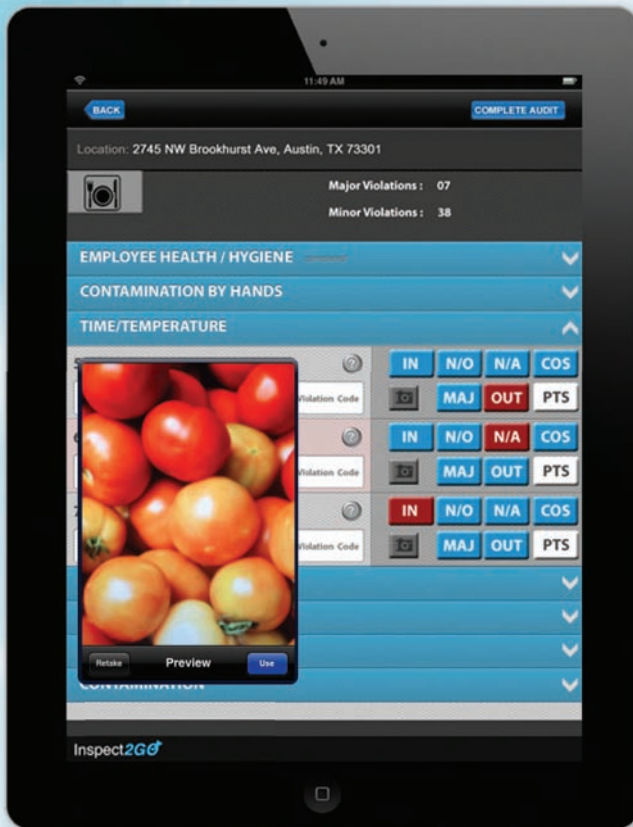




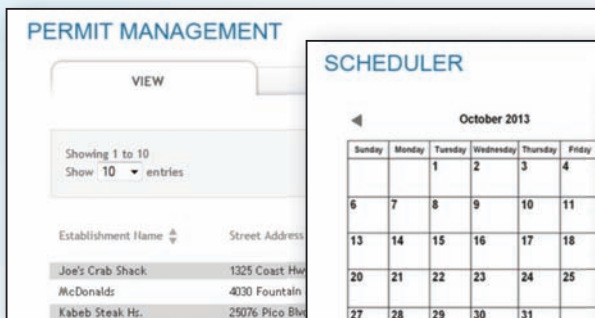
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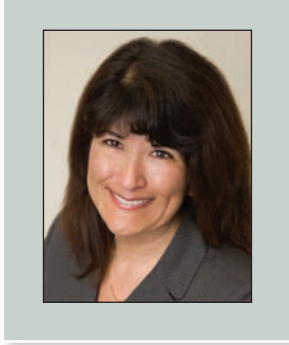
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## ▶ PRESIDENT'S MESSAGE



Alicia Enriquez Collins,  
REHS

## What It Means...

Each year, the NEHA president has the honor of representing our association throughout the country by participating in our local affiliate conferences. In April of this year, I was invited to represent NEHA in my home state of California at the annual California Environmental Health Association (CEHA) symposium. In addition to sharing updates on NEHA initiatives and national trends in environmental health, I was asked to give the following presentation: **What It Means to Be an Environmental Health Professional.**

When the request was initially received, I thought this was tantamount to posing a question such as, “What is the meaning of life?” or essentially, “What is the meaning of our lives?” We dedicate our lives to protecting the health of our communities through education while fulfilling our job responsibilities. This question caused me to reflect upon what I have learned while working for local environmental health agencies and while working with extraordinarily competent and compassionate environmental health professionals during the span of nearly 30 years. It became much more of a query about what being an environmental health professional means to each of us as we dedicate our lives to it every day. It would seem intuitive that this discussion would first lead us toward the topics of credentials, certifications, and technical competencies. Although technical competence is an absolute priority, I would like to share a few insights and lessons learned over the years from many of you, which I believe are important elements of being an environmental health professional and are not unique to our profession. Because we

*It became much more of a query about what being an environmental health professional means to each of us as we dedicate our lives to it every day.*

practice environmental health, each of the concepts mentioned below have greater significance when connected with the technical elements of our jobs.

**Adaptability:** If you take a moment to look back one, three, five, or 10 years, you will easily identify several changes in your work environment—organizational chart, programs gained and lost, technology, resources, and political climate. Reaching success in our rapidly changing environment necessitates being ready, willing, and able to adapt. This also requires anticipating what is ahead.

**Collaboration:** Identifying your partners or stakeholders and establishing lines of communication are helpful in achieving com-

mon environmental health goals. Partners or stakeholders may include industry groups, special interest groups, governing bodies, or other agencies. Joining with partners can be extremely beneficial as it facilitates communication between the parties, builds trust, and allows opportunities for the stakeholders to educate one another. Overall, the partners will have a vested interest in positive outcomes for the protection and betterment of our communities.

**Commitment and Dedication:** Because our field is so vast and dynamic, it definitely requires an individual to be dedicated to continuing education, self-study, and often going the extra mile to provide excellent customer service. It may take the form of a project that needed extensive review or writing a public health message for the media that required perfection in order to avoid misinterpretation by consumers. Hopefully, your ongoing commitment stems from the internal reward and satisfaction of knowing that you are working toward a goal of disease prevention and environmental protection.

**Diplomacy:** So often our jobs call for delivering messages that are unpopular. This is when our own competency and ability to relay public health information in a respectful and compassionate manner to a member of the business community or the public is crucial. As educators, it is also important to explain the logic behind the requirement to assist them with understanding their role in protecting customers and the public. Taking the extra step to understand your customer and having compassion for their difficult predicament will be helpful to you and the



individual or company you are working with as it may assist with developing a workable strategy to resolve the problem. It is during these moments of working to protect public health that you are not only representing your agency, but you are building trust and earning the respect of your public and working toward a successful outcome for all parties. Another benefit in practicing diplomacy in the variety of circumstances that present themselves each day is that we are continually learning how to enhance our communication skills.

**Ethics, a set of moral principles:** Whether or not we are credentialed individuals, our purpose is protecting the public's health and it is so much easier to accomplish that if we have their trust. Every decision we make in environmental health has ramifications. Decisions that are straightforward, fit nicely between the lines of laws or policy, or are simply made for us tend to make our lives easy. The complex situations are those that challenge us to tap into both our competency and our character to make sound and ethical decisions that will pose minimal risk to the public's health and our environment. Making

decisions with integrity and honesty as all of the options and outcomes are weighed will never steer you wrong.

Making every single decision knowing that our actions are an investment into our reputation as credible and trustworthy professionals is also an investment into building the public's trust—not only on your own behalf but on behalf of the organization you represent. Another point to remember is that you may not have control of some decisions that are made and you may very well disagree with decisions made. Managers are often faced with making difficult decisions and are often seeking creative solutions that will satisfy the political circumstances at hand and at the same time will not be detrimental to public health. Throughout the process, it is important to maintain integrity in your own decision making without sacrificing quality or the public's health.

**Leadership:** Regardless of the position you hold within your organization, you are an environmental health professional and leader within your community. Your community rightly expects you to use your expertise and leadership skills while you work to prevent

disease and protect their well-being. You may be recognized while on your own personal time and a member of the community may seek your input. In the role you have established as an educator, expert, and protector, your community depends on you. The same perceptions apply in an office environment. If you conduct yourself in a professional manner, maintain your integrity, and treat others with their due respect, you will be viewed as a leader.

**Mentorship:** Having a mentor is just as important as being a mentor. This can be someone you respect for their leadership skills in any profession. The optimum is to have mentors both within and outside of our profession. Your respected colleagues from other professions have plenty of life lessons and wisdom they are happy to share. Regardless of the number of years of experience you have in the field of practice, there is always someone to give back to—whether it is a student, a person looking for a career change into our profession, a member of the community, or a person new to your agency or company.

**Prioritization:** Sometimes our priorities are determined for us and this can simplify

## What Does Being an Environmental Health Professional Mean to You?

This question was posed to successful environmental health professionals from throughout the country with the caveat that their personal thoughts should be captured in one sentence. I wish to provide my gratitude to our colleagues who replied and hope you will appreciate their very thoughtful and profound responses. I encourage our new generations of environmental health professionals to garner insight from our key leaders.

“Being an EHS provides an opportunity to execute a unique blend of public health-oriented scientific knowledge and technical competence and professionalism that results in a healthier population.”

*Marcy A. Barnett, REHS, MEPP, Emergency Preparedness Liaison, California Department of Public Health, Center for Environmental Health*

“Protecting the health of the community by managing environmental risk factors.”

*Eric Bradley, MPH, REHS, CP-FS, Environmental Health Specialist, Scott County Health Department*

“To me, environmental health is public health because we make sure people have clean air, food, and water; a safe place to live and work; and ways to properly dispose of waste.”

*D. Gary Brown, DrPH, CIH, RS, DAAS, Professor, Eastern Kentucky University*

“I see environmental health professionals as having a niche of practice in various fields of science that relate to the balance of human well-being with that of the environment. To contextually paraphrase Samuel Johnson, environmental health practitioners mitigate human and environmental injury, illness, and disease that ‘generally begins that equality which death completes.’”

*Brian Collins, MS, REHS, DAAS, Director of Environmental Health (ret.), NEHA Past President*

“I believe environmental health professionals are truly the quiet professionals who go about their often thankless tasks protecting the public from disease and, in the end, saving lives.”

*Richard F. Collins, MSEH, RS/REHS, DAAS, Senior Environmental Health Scientist, Office for Environmental Health Emergencies, National Center for Environmental Health/Agency for Toxic Substances and Disease Registry, Centers for Disease Control and Prevention, NEHA Past President*

“It means that at the end of the day I can be proud of the work I do because I know that I help to make this world a healthier and safer place.”

*Jim Dingman, MS, REHS, DLAAS, Lead Regulatory Engineer, Underwriters Laboratories, Inc., NEHA Past President*

*continued on page 8*

## What Does Being an Environmental Health Professional Mean to You?

*continued from page 7*

“To be an environmental health professional is to have the opportunity to both understand and practice a science and ... serve people.”

*Nelson Fabian, MS, Executive Director, NEHA*

“As an environmental health professional, I have the privilege and great satisfaction of working in a field that is dedicated to making people’s lives healthier, safer, and more enjoyable.”

*CAPT Michael E. Herring, REHS, MPH, USPHS, Senior Environmental Health Scientist/Training and Technical Assistance Team Leader, National Center for Environmental Health, Centers for Disease Control and Prevention*

“It means that every single day, my profession (environmental health) provides me with the challenging and fulfilling opportunity to protect people’s health and the environment upon which all life depends. It means that I am one small part of a larger constellation of professions collaborating to cause positive change in this world so that our children, and our children’s children, will have cleaner air, cleaner water, safer food, and a sustainable planet.”

*Scott E. Holmes, REHS, MS, Manager, Environmental Public Health Division, Lincoln-Lancaster County Health Department*

“To be an environmental health professional is awesome because it allows me the opportunity to teach, learn from, protect, and serve people on issues relating to their health, their cultures and customs, and the environments in which they live.”

*Lois Maisel, RN, CP-FS, Environmental Health Specialist II, Fairfax County Health Department*

“Dedication, service, pride, commitment, collaboration, and prevention are what being an environmental health professional means to me.”

*Patrick J. Maloney, MPAH, RS, CHO, Chief of Environmental Health Assistant Director of Public Health, Brookline Health Department; Adjunct Professor, University Of Massachusetts-Lowell*

“An environmental health professional is someone intent on making the world a better place to live.”

*John A. Marcello, REHS, CP-FS, Pacific Region Retail Food Specialist, Food and Drug Administration*

“Being a local, state, federal, or industry environmental health professional means that you are continually practicing/applying current public health and safety principles that protect and serve your community’s environmental, public health, and safety needs by utilizing and executing a comprehensive proactive plan of action rather than a typical verbiage-only response.”

*George M. Nakamura, REHS, MPA, DAAS, FSSME*

“Being an environmental health professional means being able to take care of the health, safety, and well-being of all people every minute of the day ... through the protection of life, the water, air, and land.”

*Priscilla Oliver, PhD, Senior Life Scientist, U.S. Environmental Protection Agency; Adjunct Professor, Morehouse School of Medicine*

“Being an environmental [health] professional means being the unsung hero who saves the public from death and disease.”

*Dick Pantages, NEHA Past President*

“A committed individual utilizing science and public health principles to protect people and the environment from illness, death, and disease.”

*Eric Pessell, REHS, Environmental Health Director, Kent County Health Department*

“It is dedication to the work of making life safer and healthier for people along with the joy of doing it.”

*Vince Radke, MPH, RS, CP-FS, DAAS, CPH, Sanitarian, National Center for Environmental Health, Centers for Disease Control and Prevention*

“The course of history is influenced by disease outbreaks and environmental disasters; therefore, environmental health and the expertise of environmental health professionals can shape the future by applying knowledge and tools that prevent diseases and relieve environmental stresses to protect our ecosystems and the public’s health.”

*Welford C. Roberts, PhD, DAAS, RS/REHS, NEHA Past President*

“Protecting people’s health and the environment through education, learning opportunities, and sharing information are what it means to me to be an environmental health professional.”

*Zia Siddiqi, PhD, BCE, Director of Quality Systems, Orkin, Inc.*

“Environmental health professionals act as educators, consultants, and enforcement officers, using specialized technical skills and knowledge, to ensure people are able to live, work, and play in safe, healthy environments.”

*Sharon L. Smith, RS, West Central Region Supervisor, Drinking Water Protection, Minnesota Department of Health*

“We in the environmental health profession come from many backgrounds and have an ethos and a desire to achieve common goals; we create healthy communities through our abilities to recognize and analyze environmental health problems, develop plans for improvement, and to take appropriate actions.”

*John Steward, REHS, MPH, CAPT, USPHS (ret.), School of Public Health, Georgia State University*

“Being an environmental health professional allows me to help people understand the links between (individual and public) health and our environment (homes, restaurants, the natural environment, etc.), and improve the condition of both those things.”

*M.L. Tanner, HHS, Environmental Health Manager III, Bureau of Environmental Health Services, South Carolina Department of Health and Environmental Control*

“To be an environmental health professional is to not only understand the environmental causes of illness and death, but also be able to explain them to nonenvironmental health professionals, and develop [and implement] interventions to minimize the health effects of those environmental causes of illness and death.”

*Felix I. Zemel, MCP, MPH, REHS/RS, DAAS, Health Agent/Administrator, Cohasset Board of Health*



our lives or it can prove to be stressful. We have probably all now experienced firsthand what doing “more with less” means. It often translates into doing the job of more than one person and it doesn't take long to realize that this is not sustainable for the long term. You may find yourself in a daily juggling act of sorts. Decreased staffing, squeezed budgets, inherited programs, and politics can all have a role in our rapidly changing priorities. Accomplishing the same goals with the same high quality standards and using the same timelines as before resources were reduced can lead to a compromised quality product, employee burnout, and low morale. It is likely your boss is experiencing similar demands and stressors. One bit of advice to address this ongoing challenge of managing priorities is to engage in open and frequent

communication with management to assist with evaluating the competing demands for your time.

**Resourcefulness:** Knowing when a situation has gone beyond your level of expertise and knowing who to call upon are equally important. Do your best to stay current in your areas of expertise through literature reviews, attending technical workshops, and staying connected with colleagues. Both your state association and NEHA fit perfectly into helping us to be resourceful.

These are just a few thoughts that came to mind when the question of what it means to be an environmental health professional was asked. Endless approaches are available to address this question. We could lead the discussion toward several other valid pathways—how it means that we are educators,

scientists, policy makers, and stewards. My approach for the CEHA presentation focused on the above concepts: adaptability, collaboration, commitment and dedication, diplomacy, ethics, leadership, mentorship, prioritization, and resourcefulness. I truly hope my message was enlightening and empowering to the audience, as well as to you, the reader of this column. Please let me know if you have any comments about what being an environmental health professional means to you. This is a thought-provoking question that pertains to the essence of who we are as environmental health professionals. 🐼

*Alicia Iris Collins*  
enriqueza@comcast.net

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# The Distribution and Public Health Consequences of Releases of Chemicals Intended for Pool Use in 17 States, 2001–2009

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 and Disease Registry*

**Abstract** To keep swimming pool water clean and clear, consumers purchase, transport, store, use, and dispose of large amounts of potentially hazardous chemicals. Data about incidents due to the use of these chemicals and the resultant public health impacts are limited. The authors analyzed pool chemical release data from 17 states that participated in the Agency for Toxic Substances and Disease Registry’s chemical event surveillance system during 2001–2009. In 400 pool chemical incidents, 60% resulted in injuries. Of the 732 injured persons, 67% were members of the public and 50% were under 18 years old. Incidents occurred most frequently in private residences (39%), but incidents with the most injured persons (34%) occurred at recreational facilities. Human error (71.9%) was the most frequent primary contributing factor, followed by equipment failure (22.8%). Interventions designed to mitigate the public health impact associated with pool chemical releases should target both private pool owners and public pool operators.

## Introduction

In 2009, swimming was the fourth most popular recreational sport in the U.S., with over 50 million individuals swimming at least six times within the year (U.S. Census Bureau, 2012). Various chemicals are used to maintain pool water quality and protect against the transmission of pathogens. These chemicals include bromine-based disinfectants (e.g., hypobromous acid), chlorine based-disinfectants (e.g., chlorine gas), and chemicals that adjust pH (e.g., soda ash) (De Haan & Johannsmeier, 1997). Pool chemicals,

which are safe when handled properly, can cause injury when mishandled. Depending on the severity, symptoms from exposure to hydrochloric acid, bromine, hypochlorites, and chlorine can include nose, eye, and throat irritation; dermatitis; abdominal pain; nausea; vomiting; headache; and dizziness (National Institute for Occupational Safety and Health, 2010).

Because the reporting of pool chemical incidents is not universally mandated, completely characterizing their public health impact is difficult (Agabiti et al., 2001; Thomas & Mur-

ray, 2008). Three publications describe a series of incidents involving various pool chemical releases in the U.S.; however, the articles have different measures and time frames. The first article, using data from the National Electronic Injury Surveillance System (NEISS), reported an annual median of 4,120 emergency department (ED) visits for injuries associated with pool chemicals for 1998–2007 (Centers for Disease Control and Prevention [CDC], 2009). The second article, using data from NEISS and the Sentinel Event Notification System for Occupational Risk (SENSOR), reported an annual average of 4,010 work-related illnesses or injuries associated with pool chemicals for 2002–2008 (CDC, 2011a). The third article reported data from three databases: the Hazardous Substances Emergency Events Surveillance (HSEES) had 92 pool chemical incidents that occurred at aquatic facilities during 2007–2008; NEISS reported a total of 4,574 ED visits resulting from pool chemical incidents for 2008; and the Waterborne Disease and Outbreak Surveillance System (WDOSS) reported 32 pool chemical incidents that occurred in Michigan and Maryland with two or more persons linked epidemiologically by time, location of water exposure, and illness characteristics and evidence implicating recreational water (CDC, 2011b).

Our analysis used data from the Agency for Toxic Substances and Disease Registry (ATSDR) HSEES program to describe the distribution and public health consequences of “pool chemical incidents,” which are defined



TABLE 1

**Summary of Pool Chemical Incidents Compared With All Hazardous Substances Emergency Events Surveillance Incidents, 2001–2009**

Category	Pool Chemical Incidents	All Incidents
Events	400	71,747
Evacuations ordered	84 (21.0%)	4,796 (6.7%)
Total people evacuated <sup>a</sup>	4,867	378,966
Events with injured persons	240 (60.0%)	6,642 (9.3%)
Injured persons	732	18,468
Events with shelter in place order	10 (2.5%)	680 (0.9%)

<sup>a</sup>Number indicates the number of known evacuees. When large areas were evacuated, not all the evacuees could be counted, so the number for evacuees is an underestimate.

as incidents in any location involving any chemical intended for pool use. HSEES data differ from NEISS data, which focus on ED patients, and from SENSOR data, which are occupational. HSEES data are comprehensive and include chemical incidents with and without injuries and from all sectors including transportation.

## Methods

Our study included data from the HSEES system from 2001 to 2009. During various periods within this time frame, 17 states participated in HSEES (Colorado, Florida, Iowa, Louisiana, Michigan, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Oregon, Rhode Island, Texas, Utah, Washington, and Wisconsin). HSEES served as an active state-based surveillance system of hazardous substance incidents collected from multiple sources, including state and local environmental protection agencies, police and fire departments, poison control centers, hospitals, local media, and various federal databases (e.g., U.S. Department of Transportation Hazardous Material Incident Reporting Systems and the U.S. Coast Guard's National Response Center). States entered their data directly into a secure web-based application. A hazardous substance release was included in the HSEES system if it was an uncontrolled or illegal release of any hazardous substance, exclusive of petroleum-only incidents. Releases were included if they had to be cleaned up according to federal, state, or local law.

Pool chemical incidents involved at least one chemical intended to be used to maintain

water quality or equipment at an aquatic venue (e.g., hot tub, water park, or pool). To identify potential pool chemical incidents, we queried the HSEES database for the following terms: "swim," "pool," "Jacuzzi," "spa," and "hot tub." We also queried pool chemicals mentioned in De Haan and Johanningsmeier's (1997) pool operator training manual: "algaecide," "bromide," "chlorinated isocyanurate," "cyanuric acid," "lithium hypochlorite," "hypobromous acid," "dichlor," "trichlor," "muriatic acid," "chlorine," "calcium hypochlorite," "hypochlorous solution," "hydrogen peroxide," "hydrochloric acid," "sodium hypochlorite," "potassium monopersulfate," "biguanide," "soda ash," "sodium bisulfate," and "copper sulfate."

We manually reviewed the incident records to confirm that pool chemicals were actually involved. We performed descriptive analysis of HSEES data by using SAS version 9.2. We used the North American Industry Classification System (NAICS) industry codes to identify sectors where pool chemical incidents occurred. Hereafter, NAICS industry codes will be referred to as sectors.

## Results

### Summary of Incidents

A total of 71,747 HSEES incidents occurred during 2001–2009. Pool chemical incidents were a small percentage of all HSEES incidents (400, 0.6%) but were a six-fold higher percentage (240, 3.6%) of the 6,642 HSEES incidents with injured persons. Pool chemical incidents had a higher percentage of evacuations than all HSEES incidents (21.0% vs. 6.7%, respec-

tively) (Table 1). Pool chemical incidents also had a higher percentage of incidents with injuries than all HSEES incidents (60.0% vs. 9.3%, respectively). Of the 428 pool chemicals released in the 400 incidents, 61% were chlorine or chlorine-based disinfectants (calcium, sodium, or lithium hypochlorite; dichloro- or trichloroisocyanuric acid) (Figure 1).

Most pool chemical incidents occurred during the warmer months, May–September (70%), with the most in July ( $n = 93$ ). Pool chemical incidents most frequently occurred at private residences (38.8%) (Table 2). Incidents occurring, however, in the public arts, entertainment, and recreation sectors injured the most persons (34.3%), followed by the accommodations sector (hotels) (23.6%). Both sectors are places that typically have a public pool or other aquatic venue. Other sectors where chemical incidents occurred and aquatic venues were likely to be were educational services (schools); real estate, rental, and leasing (apartment complexes); and health care and social assistance (i.e., retirement homes and hospitals). Sectors least likely to have aquatic venues included waste management and remediation services (disposal); utilities; construction; wholesale trade; transportation and warehousing; and administration of housing, urban planning, and community development.

The most commonly reported contributing factors to acute pool chemical incidents were human error (71.9%) and equipment failure (22.8%). The remaining primary contributing factors were intentional or illegal action (4.7%) and bad weather (0.5%). A more detailed secondary contributing factor was reported for 221 (55.3%) incidents. The most frequent secondary contributing factors were improper mixing (39.8%); improper filling, loading, or packing (12.2%); fire (10%); illegal or improper dumping (6.8%); and overspray or misapplication (5.9%). Secondary factors for the remaining 25.3% of incidents included equipment failure; improperly performing maintenance; system process upset; improper system start-up or shutdown; power failure or electrical problems; illegal or intentional acts; vehicle or vessel collision; vehicle or vessel derailment/rollover/capsizing, explosion, load shift; or other.

### Injured Persons

During 2001–2009, 732 persons were injured in pool chemical incidents. The one reported

death was a suicide involving intentional chemical mixing. The following demographic groups were affected by pool chemical incidents: general public (67.4%), employees (23.2%), students (7%), and responders (2.4%). Age was reported for 485 (66.3%) injured persons (median: 17 years, range: <1–87 years). The majority of injured persons (63.5%) were treated at a hospital and released (Table 3). A total of 1,233 injuries/symptoms for the 732 injured persons were reported (Table 4). The most frequently reported injuries/symptoms were respiratory irritation (47.9%) and eye irritation (19.4%).

**Personal Protective Equipment (PPE)**

PPE use was reported for 19 injured persons: 13 responders, 3 employees, and 3 members of the public. All the responders wore the standard firefighter turnout gear (nine with respiratory protection, four without). The three employees wore level D PPE (a work uniform that provides minimum protection), and the three members of the public reported wearing other types of protection (i.e., gloves and/or eye protection).

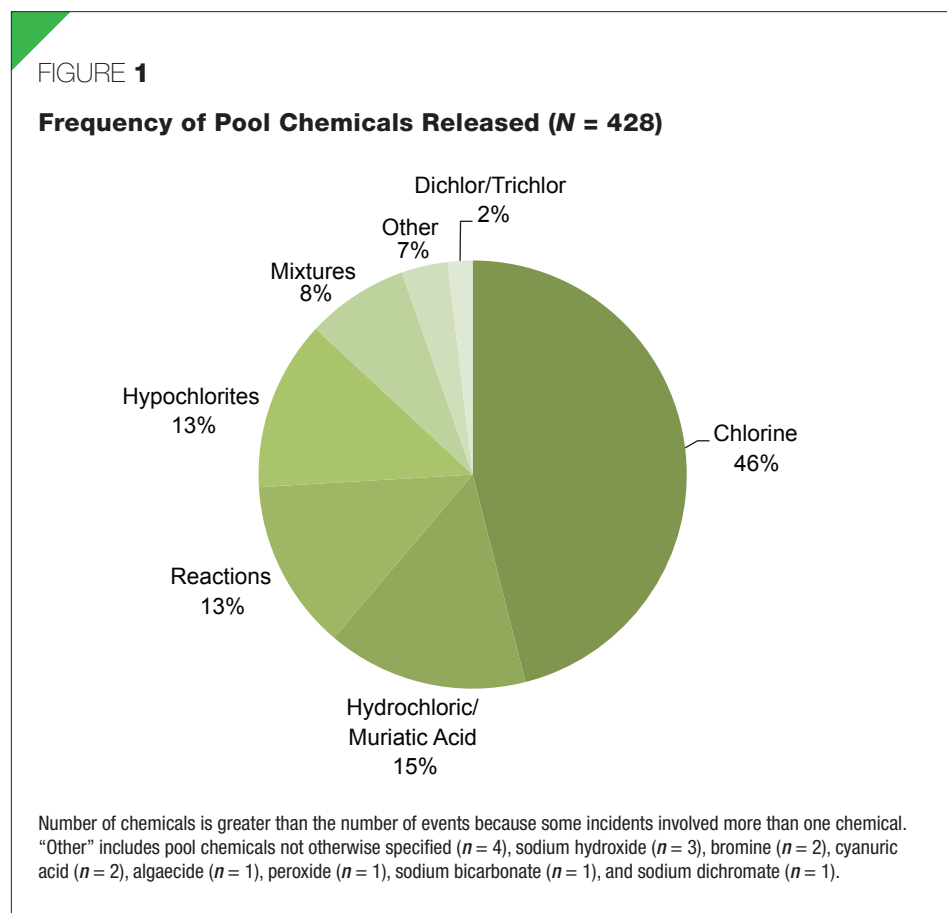
**Illustrative Case Reports**

*New York State*

In 2003, a homeowner mixed calcium hypochlorite (pool shock treatment) and hydrochloric acid in an aluminum pan in the kitchen. The resulting reaction blew out the window and sent two adults to the hospital with breathing problems. The fire department called in the county hazmat team to neutralize the area. Four responders required decontamination after the incident. The homeowner was advised not to reenter the home until a hazmat contractor could complete the cleanup.

*Wisconsin*

In 2008, at a community care facility for the elderly, a swimming pool chlorine flow sensor malfunctioned, turning the pool water recirculation pump off and then back on. While the pump was off, “chlorine backed up in the apparatus; when the pump came back on, it delivered higher-than-normal amounts of chlorine into the water and air of the pool room.” Two adult staff members and 42 school children using the facility became symptomatic. All 44 persons were decontaminated at the facility. One person received first



aid at the facility, 42 received care in the ED but were not admitted, and one was admitted to the hospital. The majority of injured persons (42) reported respiratory issues; one reported skin irritation, one had gastrointestinal problems, and one reported having shortness of breath.

**Discussion**

This analysis provides data on 400 pool chemical incidents that occurred during nine years in 17 HSEES states and adds to the data published previously. These data illustrate the diversity of incident sectors where pool chemicals can be released including retail trade, educational services, real estate, waste management (disposal), construction, transportation, warehousing, and private residence. Similar to previous findings from WDOSS and NEISS (CDC, 2009, 2011a, 2011b), this report shows that a high proportion of pool chemical incidents resulting in injured persons (49.6%) occurred at private residences. Unlike the SENSOR and NEISS data, however, which show that most persons were injured at

private residences (CDC, 2009, 2011b), our data show that incidents in public settings (recreation and hotels, 57.9%) resulted in more injured persons. Additionally, our data show that a higher portion of injured persons were under 18 years old (50.0%) compared to NEISS data (37.0%) (CDC, 2009).

The most commonly reported primary contributing factor was human error (71.9%). Many secondary contributing factors were related to mishandling (e.g., mixing of pool chemicals, such as the New York case report). Given the frequency of incidents occurring at residences and in public settings, pool chemical safety messages need to target both residential pool owners and public pool operators. Public health officials should collaborate with pool chemical retailers to educate residential pool owners and public pool operators about safe chemical storage and use. Particularly, important messages would be education about reading the label, following directions, and using PPE (CDC, 2009). The second most commonly reported primary contributing factor was equipment failure. Chlorine feed mal-

TABLE 2

**Sectors Where Pool Chemical Incidents Occurred by Events With Injured Persons and Number of Injured Persons, Hazardous Substances Emergency Events Surveillance, 2001–2009**

Sector <sup>a</sup>	# Events	%	# Events With Injured Persons	%	# Injured Persons	%
Private residence	155	38.8	119	49.6	152	20.8
Art, entertainment, and recreation	87	21.8	47	19.6	251	34.3
Accommodation and food services	39	9.8	34	14.2	173	23.6
Other <sup>b</sup>	29	7.3	12	5.0	92	12.6
Unknown sector	25	6.3	8	3.3	9	1.2
Retail trade	23	5.8	3	1.3	21	2.9
Educational services	16	4.0	8	3.3	11	1.5
Real estate, rental, and leasing	14	3.5	4	1.7	7	1.0
Waste management and remediation services (disposal)	12	3.0	5	2.1	16	2.2
Total	400	100.3 <sup>c</sup>	240	100.0	732	100.0

<sup>a</sup>Sectors are derived from the North American Industry Classification System.

<sup>b</sup>Other includes utilities, construction, wholesale trade, transportation and warehousing, health care and social assistance, and public administration.

<sup>c</sup>Total percentage total is greater than 100 because of rounding.

TABLE 3

**Medical Disposition of Injured Persons in Pool Chemical Incidents, Hazardous Substances Emergency Events Surveillance, 2001–2009**

Disposition	Frequency	%
Treated at hospital (not admitted)	414	63.5
Treated on scene (first aid)	106	16.3
Treated at hospital (admitted)	74	11.3
Seen by private physician within 24 hours	32	4.9
Injury reported by official	23	3.5
Observation at hospital, no treatment	2	0.3
Death	1	0.2
Total	652 <sup>a</sup>	100.0

<sup>a</sup>Data are missing for 80 persons.

function, such as the Wisconsin case report, is a common occurrence. Maintenance practices and engineering controls are available to prevent these types of incidents (CDC, 2009, 2011b, 2013).

Currently, only 25 states require pool operator training (National Swimming Pool Foundation, 2011), but training should be mandatory for all pool operators (Buss et al., 2009; CDC, 2010). The literature indicates that compared

to noncertified operators, certified operators showed significant improvements in properly maintaining the pH level of pool water, the level of combined chlorine, and the compliance-chlorine standard (Johnston & Kinziger, 2007). The U.S. has neither nationally standardized regulations for pool management and operation nor a standardized national database to collect pool chemical release data in all states. Management and operation are regulated at the state or local level (CDC, 2003; Kaydos-Daniels, Beach, Shwe, Magri, & Bixler, 2008). Regulations might be effective in preventing releases in public venues and could be enforced through regular pool inspections. The Centers for Disease Control and Prevention (CDC) have reported, however, that because of lack of resources each pool is inspected only one to three times yearly (CDC, 2003, 2010).

In recent years, some initiatives have focused on proper pool chemical management and on preventing injuries associated with pool chemicals. When Wisconsin HSEES staff members found that 3% of their incidents for 1993–2003 involved chlorine and that those incidents resulted in 16% of all injured persons and 5% of all evacuees, they decided to conduct telephone outreach. They called major chlorine users, public pools, and 132 swimming pool operators, advising on safe-handling practices of chlorine products. Afterward, each pool operator received a follow-up questionnaire; 49% were returned. The majority of the operators (74%) stated that the telephone outreach resulted in a discussion among staff, and 70% stated that the telephone call was a useful reminder about swimming pool chemical safety practices (Kaye, Orr, & Wattigney, 2005).

In recent years, CDC and the U.S. Environmental Protection Agency (U.S. EPA) have developed resources to promote pool chemical safety, including recommendations for design of pool chemical storage areas and pump rooms, chemical storage, chemical handling, maintenance and repair of equipment, pool chemical training for aquatic facility staff, emergency response plans, and chemical packaging and labeling (CDC, 2009, 2013; U.S. EPA, 2001). U.S. EPA, which has regulatory authority over the labels on pool chemicals because they are considered pesticides, conducted consumer research to improve labels and developed downloadable posters and brochures as part of their “Read the Label First” campaign (U.S. EPA, 1996).



Recent studies have suggested, however, that the current regulated labels might not be sufficient to protect consumers (CDC, 2011a).

CDC is working with state and local public health officials and aquatic industry representatives to develop a Model Aquatic Health Code (MAHC). The MAHC consists of 14 modules and provides sample guidelines for design, construction, operation, maintenance, and management standards ([www.cdc.gov/healthywater/swimming/pools/mahc/index.html](http://www.cdc.gov/healthywater/swimming/pools/mahc/index.html)). In the absence of federal regulations, the MAHC will serve as a resource for local and state officials reviewing and updating their individual pools codes to promote healthy and safe swimming at public pools and other treated recreational water venues (CDC, 2011b, 2011c).

In 2010, ATSDR established the National Toxic Substance Incidents Program (NTSIP), a new surveillance program that expanded on the HSEES activities in a subset of states, placing a special emphasis on layered data analyses of the GIS location of chemically vulnerable areas and populations. Each of the seven NTSIP state programs (Louisiana, New York, North Carolina, Oregon, Tennessee, Utah, and Wisconsin) has analyzed multiple data sets (e.g., spills, chemical storage, U.S. Census, U.S. Department of Transportation data, and other data sources) to identify areas vulnerable to chemical incidents. New York NTSIP staff used GIS to map pool chemical incidents and the manufacturers, distributors, and retailers of pool chemicals and also mapped the locations of private pools at the zip code level to identify areas of greatest pool density in the state. These data are being used to identify the origins and distribution of pool chemicals and the areas with the highest density of private pools for targeted education and outreach. Based on the resulting data, New York NTSIP staff developed a set of fact sheets with detailed guidance on topics such as tips for safe pool chemical storage, preventing chemical wetting, and emergency response. To promote pool chemical safety, staff summarized key points about safe storage design, safe chemical handling, adjusting chemical levels, and emergency response into a single fact sheet that can be printed and posted in a suitable location for easy reference ([www.health.ny.gov/environmental/chemicals/pool\\_chems/factsheet.htm](http://www.health.ny.gov/environmental/chemicals/pool_chems/factsheet.htm)). During the summer of 2012, the New York State Department of Health regularly released

TABLE 4

**Frequency of Reported Injuries/Symptoms Occurring in Pool Chemical Incidents, Hazardous Substances Emergency Events Surveillance, 2001–2009**

Injury	Frequency	%
Respiratory irritation	590	47.9
Eye irritation	239	19.4
Gastrointestinal problems	105	8.5
Skin irritation	97	7.9
Shortness of breath	96	7.8
Headache	48	3.9
Burns	17	1.4
Dizziness/central nervous system symptoms	15	1.2
Heart problems	8	0.6
Trauma	8	0.6
Other	7	0.6
Heat stress	3	0.2
Total	1,233 <sup>a</sup>	100.0

<sup>a</sup>The total number of injuries exceeds the number of injured persons ( $n = 732$ ) because as many as seven injuries can be reported for each injured person.

messages on pool chemical safety through Facebook and Twitter.

The HSEES data that were analyzed have some limitations. First, not all pool chemical incidents are reported to the HSEES states' notification sources, and some pool incidents may have been missed. This is particularly true for incidents that occurred at private residences but did not result in an emergency response. Some states, such as Florida, have been able to overcome this limitation by negotiating data-sharing agreements with local poison control centers, which identify more incidents at private residences. Poison control centers capture data only on incidents with potentially exposed persons; therefore, using this notification source increases the percentage of incidents with injuries. Second, although HSEES states are geographically and demographically diverse (Mary Kay O'Connor Process Safety Center, 2008), the surveillance system was not designed specifically to track pool chemical incidents. Therefore, HSEES pool chemical incidents might not be nationally representative. Also, because we had to rely on search terms to identify pool chemical incidents, some incidents might have been missed, particularly if the comments or synopsis field was blank or very brief and did not provide the details that

would indicate a pool chemical incident. Third, misidentification of some chemicals during data entry might have occurred, particularly if "chlorine" was reported to HSEES when, in reality, the chemical was a chlorine-based disinfectant. Finally, because not all 17 states participated during 2001–2009, trend analysis could not be performed.

**Conclusion**

This analysis shows that about 60% of pool chemical incidents resulted in injured persons, a much higher number than the percentage of incidents with injured persons in all incidents in the HSEES database. We have concluded that many of these pool chemical incidents could have been prevented with the following: improved design and engineering; education and training that stress safe pool chemical handling and storage practices (available on material safety data sheets); and safe, preventive equipment maintenance.

Further, we believe that education targeting not only pool operators but also anyone involved in any phase of pool chemical handling, including transporters, retailers, wholesalers, warehouse workers, consumers, residential pool owners, and waste haulers, will reduce the frequency of these incidents. 🐼

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# Environmental Survivability and Surface Sampling Efficiencies for *Pseudomonas aeruginosa* on Various Fomites

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**Abstract** The study described in this article evaluated surface survivability of culturable *Pseudomonas aeruginosa* by time and type (glass, stainless steel, and laminate) using two sampling techniques: contact plates and surface swabs. Recovery of *P. aeruginosa* decreased logarithmically over time and varied by surface type. *P. aeruginosa* survival averaged 3.75, 5.75, and 6.75 hours on laminate, glass, and stainless steel, respectively. Culturable *P. aeruginosa* loss on stainless steel and glass were not different ( $p > .05$ ); however, laminate had significantly greater loss at each time point than either glass or stainless ( $p < .05$ ). A comparison of surface swab and contact plate collection efficiencies found no significant difference for laminate surfaces. Swabs, however, had a higher collection efficiency than contact plates ( $p < .05$ ).

For the first time, the authors report *P. aeruginosa* mean survival time of 3.75–6.75 hours on clinically relevant surfaces, with *P. aeruginosa* on stainless steel surviving the longest. Their data also indicate that culturable surface sampling appears to most accurately represent actual *P. aeruginosa* surface loading when swab sampling is used.

## Introduction

*Pseudomonas aeruginosa* is one of the most significant nosocomial Gram-negative bacteria, with a mortality rate exceeding 50% (Akhabue, Synnestvedt, Weiner, Bilker, & Lautenbach, 2011; Gang, Bang, Sanyal, Mokkadas, & Lari, 1999; Van Delden & Iglewski, 1998; Vitkauskiene, Skrodeniene, Dambrauskiene, Macas, & Sakalauskas, 2011). *P. aeruginosa* is also reported to be responsible for 16% of nosocomial pneumonia cases, 12% of hospital-acquired urinary tract infections, 8% of surgical wound infections, and 10% of bloodstream infections (Gordon et al., 1998; Kluytmans, 1997; Pollack, 1995; Wiblin,

1997). Despite continued infection control efforts, *P. aeruginosa* significantly increases the morbidity and mortality among patients with cystic fibrosis, malignancy, burns, and trauma (Gang et al., 1999).

*P. aeruginosa* is aerobic and motile, surviving and reproducing in clinical environments outside the host (Cross et al., 1983). *P. aeruginosa* is suspected of transmitting to patients via numerous pathways, including direct contact with contaminated water; and through ingestion, inhalation of aerosols, and medical devices rinsed with contaminated water; and indirect contact from contaminated surfaces via health workers' hands (Clifton & Peck-

ham, 2010). Even though several routes of transmission have been postulated, the specific relationship between clinical fomite contamination and infection is unclear (Kumari & Ichhpujani, 2000). Correspondingly, the length of time that *P. aeruginosa* survives on clinical fomites is not known. Given clinically relevant ambient temperature and relative humidity, we hypothesized that the recovery rate of culturable *P. aeruginosa* from dry fomite surfaces will decrease over time and vary by surface type.

Further, when surface contamination status is in question, the ability of standard culture-based fomite sampling methods to accurately represent actual culturable presence of selected organisms is paramount. The *P. aeruginosa* collection efficiencies for surface swab and contact plates—two of the most common environmental surface sampling methods—is not known. Therefore, our study also compared the culture-based collection efficiencies of both methods over time.

## Methods

To elucidate the temporal culturability of *P. aeruginosa* for various clinically relevant surface types, a laboratory-based survivability evaluation was performed using three new fomites: glass, stainless steel, and laminate. Each surface type was divided into 40 cm<sup>2</sup> grid patterns of 3 rows (runs) and 10 columns (time points) and sterilized. All work was performed within a biological safety cabinet at clinically relevant indoor temperatures and humidity (20°C–22°C; ~68% relative humidity). Fresh colonies of *P. aeruginosa* (American Type Culture Collection 15692) were prepared by plating *P.*



TABLE 1

Mean Number of Culturable *Pseudomonas aeruginosa* Colonies Recovered by Time (Hours)

Method	Mean # of Culturable <i>Pseudomonas aeruginosa</i> Colonies Recovered									
	Time									
Swab	0	0.25	0.75	1.25	1.75	2.75	3.75	4.75	5.75	6.75
Glass	207.111	105.556	63.778	48.778	27.667	16.556	3.889	5.111	1.000	1.333
Stainless steel	137.222	125.444	57.536	61.444	51.778	18.667	8.667	4.333	1.556	0.222
Laminate	111.000	36.222	10.444	5.889	3.778	1.333	0.556	0.222	0.444	0.000
Contact Plate	Time									
	0	0.25	0.75	1.25	1.75	2.75	3.75	4.75	5.75	6.75
Glass	180.889	163.778	146.556	85.333	86.444	54.333	46.333	35.000	13.889	0.000
Stainless steel	113.833	66.868	33.127	29.340	21.243	9.827	4.216	3.604	2.188	0.000
Laminate	91.067	53.544	26.652	23.722	17.345	8.411	4.122	3.833	2.900	0.000

*aeruginosa* on *Pseudomonas* isolation agar (PIA) and incubating at 37°C for 24 hours (Kramer, Schwabke, & Kampf, 2006; U.S. Environmental Protection Agency [U.S. EPA], 2013). Three freshly grown colonies were harvested and gently vortexed with 5 mL of a phosphate buffered solution (PBS) for 20 seconds. Immediately from this solution, each grid was inoculated with 10 µL aliquots of the *P. aeruginosa* solution and evenly spread using a new sterile cotton swab per grid. Identical methods were employed for glass, stainless steel, and laminate, and directly to PIA agar plates (time 0 concentrations), in triplicate per surface type, to establish the relative culturable starting concentrations in CFU/cm<sup>2</sup>.

Using identical methods for glass, stainless steel, and laminate, new, sterile cotton swabs saturated with PBS were used to collect bacteria from preidentified random grids, at times 0.25, 0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0, and 7.0 hours. Swab contents were immediately spread onto PIA plates using a light, methodic, twisting-spreading motion and processed as described above (U.S. EPA, 2013). After incubating for 24 hours, colony counts were collected for each plate as CFU/cm<sup>2</sup>. The experiment was performed in triplicate and replicated three times for each surface type ( $n = 3$  samples/fomite at each time point \* 3 fomites \* 11 time points [including zero point] \* 3 replications = 297 samples).

In order to more fully understand the role that environmental sampling methods play

in the observed *P. aeruginosa* count results, the above described methods were repeated identically for glass, stainless steel, and laminate, except that *P. aeruginosa* collection was performed using contact plates. After the random *P. aeruginosa* inoculation of grids, plates filled with PIA were gently pressed onto individual preidentified grids at the time intervals 0.25, 0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, and 6.0 hours. The plates were incubated for 24 hours and enumerated as CFU/cm<sup>2</sup>. The experiment was performed in triplicate and replicated three times for each surface type ( $n = 3$  samples/fomite at each time point \* 3 fomites \* 10 time points (including zero point) \* 3 replications = 270 samples).

Statistical analyses were performed using Stata InterCooled, v. 11 and Excel. An analysis of variance was used to evaluate the variability in mean total CFU/cm<sup>2</sup> by time point for each fomite. Comparison of the swab and plate collection efficiencies (time 0 starting concentration of *P. aeruginosa* and recovery of spiked *P. aeruginosa* in CFU/cm<sup>2</sup>) was conducted using a Mann-Whitney-Wilcoxon test. A  $p$ -value of less than .05 was considered statistically significant.

## Results

For swab collection, the average time before reaching nondetects for culturable *P. aeruginosa*, by surface type, was 5.75 hours on glass, 6.75 hours on stainless steel, and 3.75 hours on laminate. Provided in Table 1, the survival of *P. aeruginosa* on glass at time 5.75 hours had decreased to less than 1% of the bacteria

inoculated at time 0 ( $\text{CFU}_{\text{glass } 5.75 \text{ hours}}/\text{CFU}_{\text{glass } 0 \text{ hours}}$ ). Similarly, the decrease in *P. aeruginosa* on stainless steel at time 5.75 hours was 1.13% of the original quantity ( $\text{CFU}_{\text{ss } 5.75 \text{ hours}}/\text{CFU}_{\text{ss } 0 \text{ hours}}$ ). At time 5.75 hours, however, the laminate had <1% of the culturable *P. aeruginosa* remaining ( $\text{CFU}_{\text{laminate } 5.75 \text{ hours}}/\text{CFU}_{\text{laminate } 0 \text{ hours}}$ ). Further, a significant difference existed between the *P. aeruginosa* survivability on glass and laminate ( $p < .05$ ) at all time points, except time 0, 2.75, and 5.75 hours. Also, a statistically significant difference in *P. aeruginosa* was observed between stainless steel and laminate ( $p < .02$ ) at all time points except at 0, 4.75, 5.75, and 6.75 hours. No significant difference in *P. aeruginosa* survival at any time point was found, however, between the glass and stainless steel ( $p > .05$ ). The degradation curves provided in Figure 1 illustrate the differences in rate of survival of *P. aeruginosa* on all fomites. The swab rate of decay for each surface material type was 0.757, 0.873, and 0.955 for glass, stainless steel, and laminate, respectively.

For contact plates, the average time before reaching nondetects for culturable *P. aeruginosa*, by surface type, was 4.75, 3.75, and 5.75 hours on stainless steel, laminate, and glass, respectively (Table 1). The survival of *P. aeruginosa* on laminate at time 3.75 hours had decreased to less than 1% of the bacteria inoculated at time 0 (initial  $\text{CFU}_{\text{laminate } 3.75 \text{ hours}}/\text{CFU}_{\text{laminate } 0 \text{ hours}}$ ). At time 3.75 hours, however, stainless steel had 2.90% of the culturable *P. aeruginosa* ( $\text{CFU}_{\text{ss } 3.75 \text{ hours}}/\text{CFU}_{\text{ss } 0 \text{ hours}}$ ). Furthermore, the decrease in *P. aeruginosa* on glass at time 3.75 hours yielded 25.6% of the

original quantity ( $CFU_{\text{glass 3.75 hours}}/\#_{\text{glass 0 hours}}$ ). When comparing the collected culturable *P. aeruginosa* at each time point for all three surface types, we found a significant difference between the bacterial survivability on glass and stainless steel ( $p < .04$ ) at all time points except at 0 and 0.25 hours. Also, a significant difference existed between glass and laminate at all time periods ( $p < .04$ ). The results did show a significant difference, however, in culturable *P. aeruginosa* between laminate and stainless steel ( $p < .05$ ) at all time periods except at times 0.25, 1.25, 4.75, and 5.75 hours. Figure 2 illustrates the percentage of degradation with respect to the time elapsed on all fomites using swabs. The mean surface contact-plate rate of decay for each material type was 0.4, 0.895, and 1.016 for glass, stainless steel, and laminate, respectively.

A comparison of the collection efficiencies of surface swabs to contact plates resulted in contact plates yielding a lower initial colony count at time 0.25 hours for each surface material ( $p < .05$ ). Further, for the glass surface no statistically significant difference existed in collection method, except at times 1.75 and 3.75 hours ( $p < .05$ ). Similarly, the collection efficiency for stainless steel also showed no statistical difference at all time points, except 1.25 and 2.75 hours ( $p < .05$ ). At all time points, however, laminate showed no significant difference in collection methods ( $p > .5$ ). Figure 3 illustrates the culturable collection count over time for contact plates for each surface type. No statistically significant difference existed in the *P. aeruginosa* rate of decay between swab and contact plate sampling methods. Statistical evidence existed, however, that the rate of decay differed by surface type.

### Discussion

For the first time, the culturable survival rates of *P. aeruginosa* on glass, stainless steel, and laminate surfaces at clinically relevant ambient temperature and relative humidity were quantified using two different collection methods. Significant differences existed between the length of time that *P. aeruginosa* survived on laminate (shorter) versus either glass or stainless steel, indicating that fomite material type has the potential to significantly impact availability of the bacteria for secondary transfer by re-aerosolization or contact. As seen in Table 1, *P. aeruginosa* on

FIGURE 1

Degradation Curves for Glass, Stainless Steel, and Laminate Using Swab Method

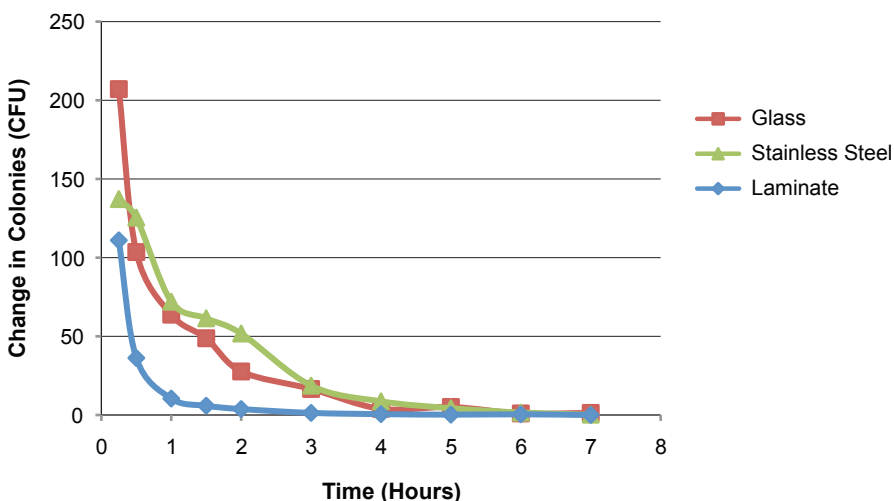
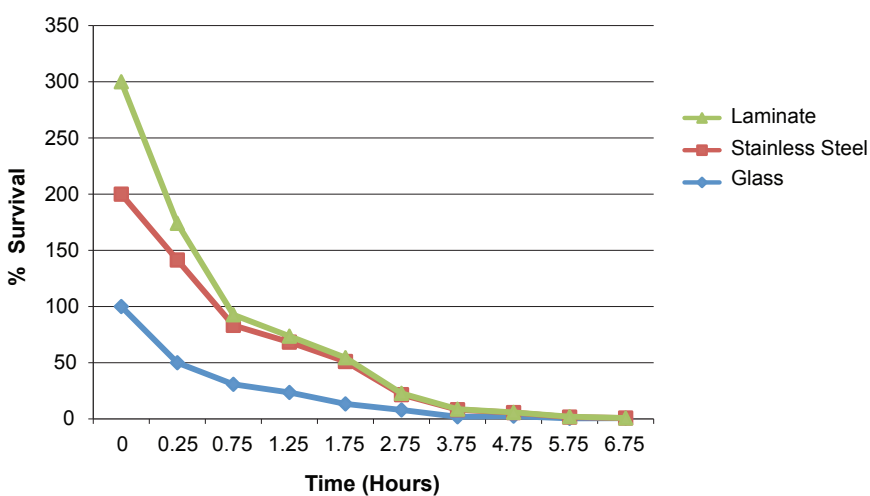


FIGURE 2

Percentage Survival of *Pseudomonas aeruginosa* Over Time Using Surface Swabs

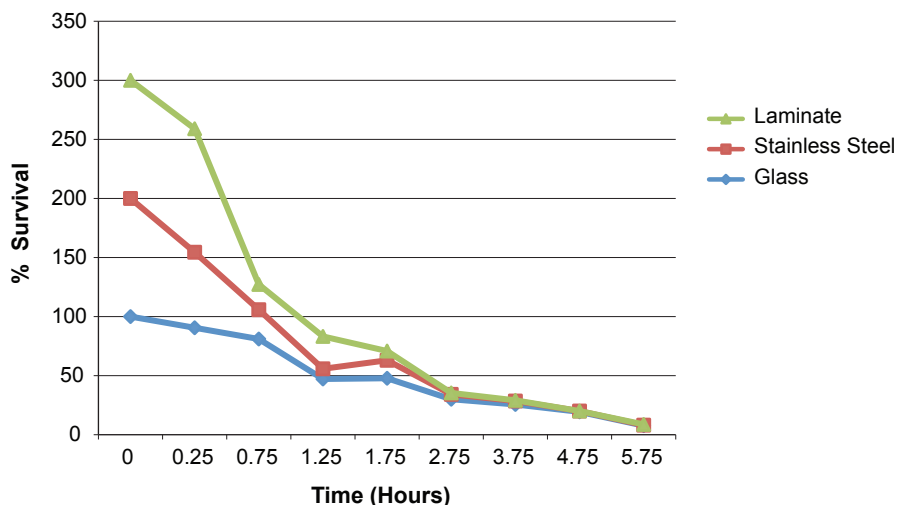


these surfaces as detected using swab sampling persisted for periods up to 6.75 hours, demonstrating that *P. aeruginosa* survives for a limited time under clinically relevant environmental conditions. The data collected using plates supported the previous claim of *P. aeruginosa*'s short survivability, by showing a mean survival time of 5.75 hours.

In research presented by Kramer and co-authors (2006), it was concluded that Gram-negative bacteria, such as *Acinetobacter* spp., *E. coli*, *Serratia marcescens*, or *P. aeruginosa*, can survive on inanimate surfaces for months. They also concluded that overall, Gram-negative bacteria can persist longer than Gram-positive bacteria, especially under

FIGURE 3

**Percentage Survival of *Pseudomonas aeruginosa* Over Time From Contact Plates**



humid conditions. Further, Neely and Maley (2000) showed that Gram-positive *Enterococci* and *Staphylococci* could survive for days to months on commonly used hospital fabrics and plastic. These results are inconsistent with the findings of our research. Our results

test the survivability of Gram-negative bacteria on nonporous surfaces, however, whereas Neely and co-authors tested the survivability on porous surfaces. This variation in surface types would account for the difference in surface survivability over time.

**Conclusion**

In clinical settings, environmental contamination is frequently overlooked due to alternate focus on contact precautions, hand hygiene, and contact isolation. Outside of outbreak mitigation, however, typically no standard environmental surveillance differential exists in infection control programs. As glass, stainless steel, and laminate are common materials used in health care settings, knowing the length of time that culturable *P. aeruginosa* persists, and how the material type influences that persistence, enables more efficient application of infection control resources. 🐼

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# Use of Household Bleach for Emergency Disinfection of Drinking Water

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**Abstract** Household bleach is typically used as a disinfectant for water in times of emergencies and by those engaging in recreational activities such as camping or rafting. The Centers for Disease Control and Prevention recommend a concentration of free chlorine of 1 mg/L for 30 minutes, or about 0.75 mL (1/8 teaspoon) of household bleach per gallon of water. The goal of the study described in this article was to assess two household bleach products to kill waterborne bacteria and viruses using the test procedures in the U.S. Environmental Protection Agency's *Guide Standard and Protocol for Testing Microbiological Purifiers*. Bleach was found to meet these requirements in waters of low turbidity and organic matter. While the test bacterium was reduced by six logs in high turbid and organic-laden waters, the test viruses were reduced only by one-half to one log. In such waters greater chlorine doses or contact times are needed to achieve greater reduction of viruses.

## Introduction

Surface waters can be expected to be contaminated from time to time by fecal matter from animals and humans. Many people such as military personnel, campers, hikers, and rafters who use water from rivers, lakes, and other surface water sources that may be contaminated are at risk of becoming ill from enteric pathogens excreted in feces. Natural disasters such as hurricanes, floods, and earthquakes can also cause contamination of drinking water sources. Drinking water contamination can also be a problem for visitors to foreign countries where treatment and

distribution deficiencies may be common. Disinfection in these situations to reduce the risk of illness from waterborne disease-causing microorganisms is necessary.

Currently, the Centers for Disease Control and Prevention (CDC) recommend that household bleach be used as a drinking water disinfectant (for bacteria and viruses) in emergency situations by adding 0.75 mL (1/8 teaspoon) to one gallon of water and letting it stand for 30 minutes before use (CDC, 2009). This yields an effective free chlorine concentration in the water of approximately 1 mg/L. The efficacy of this recommenda-

tion has never been tested, however, against enteric bacteria and viruses. Both the U.S. Environmental Protection Agency (U.S. EPA) and the World Health Organization (WHO) have recommendations for efficacy testing of water treatment (U.S. EPA, 1987; WHO, 2011). The goal of our research was to test the CDC recommendation against the U.S. EPA and WHO protocols for enteric bacteria and viruses. These protocols require minimum reductions of both enteric bacteria and viruses to ensure the safety of the treated water. The U.S. EPA protocol requires a minimum of a 6 log reduction (greater than 99.9999% reduction) of the coliform bacterium *Klebsiella terrigena*, and 4 log reductions of poliovirus type and rotavirus SA-11. Levels of reduction are based on a likely occurrence of the organism in sewage-polluted water to reach a risk of infection of less than 1:10,000 per year (Regli, Rose, Haas, & Gerba, 1991).

## Materials and Methods

The general test procedures for individual water treatment as outlined in the *Guide Standard and Protocol for Testing Microbiological Water Purifiers* were used in our study (U.S. EPA, 1987). Regular household bleach (Clorox) and Clorox Anywhere bleach were purchased at a local grocery store. Clorox Anywhere bleach was included in our study because it does not stain like regular bleach and does not leave a bleach taste in the water, which some people find unpleasant.



TABLE 1

**Test Waters Used in Microbiological Challenges**

Water Type	Turbidity (NTU <sup>a</sup> )	pH	Total Organic Carbon (mg/L)
Average case	<0.50	7.5	<1.0
Worst case	30	9.0	10

Source: U.S. Environmental Protection Agency, 1987.  
<sup>a</sup>NTU = nephelometric turbidity units.

TABLE 2

**Inactivation of *Klebsiella terrigena* by Bleach, pH 7.5, 25°C**

Disinfectant	Time (Min.)	CFU/mL	Free Chlorine Residual (mg/L)	Log <sub>10</sub> Reduction
Regular bleach	0	1.57 x 10 <sup>7</sup>	1.12	NA <sup>a</sup>
	1	<5	0.91	>6.35
	10	<5	0.53	>6.35
	20	<5	0.27	<6.35
	30	<5	0.26	>4.35
Anywhere bleach	0	1.13 x 10 <sup>7</sup>	1.17	NA
	1	<5	0.87	>6.44
	10	<5	0.55	>6.44
	20	<5	0.43	>6.44
	30	<5	0.28	>6.44

<sup>a</sup>NA = Not applicable.

**Preparation of Test Waters**

Approximately 3 gallons of dechlorinated Tucson, Arizona, tap water (Table 1) were collected in a 6-gallon (22.7 L) plastic carboy. Tucson tap water uses a blend of groundwater and surface water from the Colorado River, the ratio of which varies based on seasonal differences in customer demand. The pH was adjusted with 1 N NaOH (sodium hydroxide) to the desired test pH and the turbidity adjusted according to the desired test turbidity of 30 nephelometric turbidity units (NTU) using an AC fine dust. Humic acid was added for an organic carbon concentration of 10 mg/L. Two types of test water used are referred to as average and worst case (or challenge water) water conditions (U.S. EPA, 1987). Table 1 shows the composition of average and worst case water.

**Preparation of Bacteria**

*K. terrigena* was obtained from the American Type Culture Collection (ATCC 33257). *K. terrigena* was grown and incubated on an orbital shaker at 300 rpm at 37°C overnight. After incubation, the *K. terrigena* were pelleted via centrifugation (9,800 × g, 15 minutes, 25°C). The pelleted cells were washed by resuspension in 100 mL of 0.01 M phosphate buffered solution (PBS), agitated, followed by centrifugation as described previously. This step was repeated two additional times. The final pellet was resuspended in 10 mL of PBS.

**Preparation of Virus**

Poliovirus type 1 (strain LSc-2ab) and rotavirus SA11 (ATCC VR-899) were obtained from ATCC. Poliovirus type 1 was propagated using the buffalo green monkey cell line and rotavirus SA-11 on the MA-104 cell line. A

freeze-thaw cycle was performed three times (to release the virus from the cells) by freezing at -20°C and thawing at 37°C. Following the freeze thaw, the cell culture fluid was subject to concentration with polyethylene glycol extraction (Thurston-Enriquez, Haas, Jacangelo, & Gerba, 2003). The virus concentrate was then stirred overnight at 4°C, centrifuged at 4°C for 30 minutes, and resuspended in 10% 0.01 M PBS. A final Vertrel XF extraction was done to reduce the dissolved organics. The virus was stored at -80°C until it was needed.

**Experimental Procedure**

Following the adjustment of the test water to the appropriate test conditions, 3.78 L were divided into two 4-L sterile plastic beakers. One beaker was used as a control (no disinfectant) and the other beaker was dosed with 1 mg/L (0.75 mL) household bleach. The same chlorine concentrations were used for both *K. terrigena* and poliovirus type 1/rotavirus SA-11. The test bacterium and virus were tested in separate experiments. Each beaker was inoculated with either approximately 1.0 x 10<sup>7</sup> CFU/mL of *K. terrigena* or 1.0 x 10<sup>5</sup> plaque forming units/mL of each test virus. Prior to adding the disinfectant, a 5-mL sample was collected to determine the initial concentration (T<sub>0</sub>) of the test organisms in both beakers. These samples were immediately placed in sterile tubes containing 1 mL of 10% sodium thiosulfate to neutralize the chlorine. Samples for microbial testing and chlorine residual were collected after 1, 10, and 30 minutes. A 10-mL sample was collected for chlorine residual and measured using Standard Method #4500 (Clesceri, Greenberg, & Eaton, 2005) and a HACH DR 2000 spectrophotometer. The control beaker without disinfectant was also tested at the beginning and end of the experiment to ensure that no die-off of the test organism occurred during the experiment in the absence of chlorine. All bacterial samples were assayed in duplicate by Standard Method 9215 on mEndo media (Clesceri et al., 2005). This media is selective for coliform bacteria, which appear as colonies with a green sheen.

Virus samples were stored at -20°C until assayed. Before assay the virus samples were filtered through sterile 0.22-µm pore-sized Acrodisc syringe filters pretreated with 3% beef extract, pH 7.00, to remove bacteria. Sam-

ples were assayed in six-well plates in volumes of 100 µL or in 25 cm<sup>2</sup> flasks in duplicate. Both viruses were assayed using cell monolayers of the MA-104 cell line by the TCID<sub>50</sub> method (Payment & Trudel, 1993).

Positive and negative assays were conducted for all the test organisms to ensure performance of assay methods.

### Results

The inactivation of *K. terrigena* under general water quality conditions at pH 7.5 is shown in Table 2 and pH 9.0 in Table 3 in both types of bleach. In all cases the test bacterium was reduced by more than 6.0 logs within one minute. The free chlorine level declined over the 30 minutes of the test period under both conditions, but to a greater degree at pH 9.0. Some bacteria were detected in regular bleach after one minute, but not after five at pH 9.0. *K. terrigena* was also reduced by more than six logs at low temperature and in the presence of high turbidity and organic load (Table 3).

Poliovirus and rotavirus were reduced by more than four logs at room temperature at both pH 7.5 and 9.0, but high turbidity and the presence of organic matter seriously interfered with the action of the bleach (Table 4).

### Discussion

Previous recommendations and studies on dose of chlorine needed for treating drinking water only looked at the amount of free residual rather than the ability to meet recommended reduction of waterborne pathogens (Lantagne, 2008). The goal of our study was to determine dose based on ability to meet U.S. EPA and WHO requirements based on reduction of enteric bacteria and viruses. U.S. EPA requires that personal drinking water treatment be capable of killing/inactivating 99.9999% (6 log<sub>10</sub>) *K. terrigena*, and 4 log<sub>10</sub> of poliovirus type 1 and rotavirus SA-11 to ensure its microbiological safety. The disinfectant must achieve these levels of inactivation at both pH 7.5 and pH 9.0 in clear and turbid water containing a heavy organic load (U.S. EPA, 1987). The more recently released WHO guidance document suggests a 3 log<sub>10</sub> removal of rotavirus for what they define as a “protective” treatment and a 4 log reduction of enteric bacteria for “highly protective” from waterborne bacteria (WHO, 2011). The greater level of required removal for “highly protective” is based upon the greater level of

TABLE 3

#### Inactivation of *Klebsiella terrigena* by Bleach, pH 9.0, 25°C

Disinfectant	Time (Min.)	CFU/mL	Free Chlorine Residual (mg/L)	Log <sub>10</sub> Reduction
Regular bleach	0	7.1 X 10 <sup>6</sup>	0.00	NA <sup>a</sup>
	1	55	1.02	5.11
	5	<5	0.88	>6.85
	10	<5	0.78	>6.85
	20	<5	0.59	>6.85
	30	<5	0.49	>6.85
Anywhere bleach	0	7.0 x 10 <sup>6</sup>	0.00	NA
	1	<5	1.14	>6.14
	5	<5	0.96	>6.14
	10	<5	0.76	>6.14
	20	<5	0.64	>6.14
	30	<5	0.53	>6.14

<sup>a</sup>NA = Not applicable.

TABLE 4

#### Inactivation of *Klebsiella terrigena* and Virus by Bleach (Reduction Log<sub>10</sub>) After 30 Minutes

Organism	pH 7.5, 25°C	pH 9.0, 25°C	pH 7.5, 25°C, 30 NTU <sup>a</sup>	pH 9.0, 25°C, 30 NTU	pH 9.0, 5°C, 30 NTU
<b>Regular bleach</b>					
Polio/rota	>4.15	>4.50	0.598	0.477	0.550
<i>K. terrigena</i>	>6.26	>5.94	>6.02	>5.99	>6.11
<b>Anywhere bleach</b>					
Polio/rota	>4.20	>4.10	0.850	ND <sup>b</sup>	1.16
<i>K. terrigena</i>	>6.44	>6.38	>6.21	>6.05	>6.33

<sup>a</sup>NTU = nephelometric turbidity units.

<sup>b</sup>ND = not done.

viruses likely to be found in sewage polluted waters in the developing world. Filtration of the water in addition to disinfection is recommended if *Cryptosporidium* oocysts are suspected to be present since it is very resistant to disinfection by chlorine.

Household bleach appeared effective against *K. terrigena* in the various test waters. It was capable of killing 6 log of *K. terrigena* in less than one minute in low and high turbidity water at pH 7.5 even in the presence of a heavy organic load. Only at pH 9.0 was the time increased from one to five minutes to achieve the same level of effectiveness. Approximately

a 3 log<sub>10</sub> reduction of poliovirus in water occurred with pH 7.5, 25°C, and no turbidity after one minute. With the conditions of pH 9.0, 30 NTU, and 5°C, household bleach demonstrated a 1 log<sub>10</sub> reduction of poliovirus. A 0.5 log<sub>10</sub> reduction of poliovirus occurred with household bleach when the conditions of pH 7.5, 25°C, and 30 NTU were used.

### Conclusion

The results of our study suggest that the current recommendations for treatment of drinking water in emergency situations only meet the recommendation for enteric viruses

by the U.S. EPA when the water is treated at near room temperature and near neutral pH. The Clorox Anywhere bleach product was equal in killing the test organisms to regular household bleach. This household product is formulated so it does not have the smell or taste of bleach, which some people find objectionable. It also does not stain fabrics. Caution should be used in treatment of high turbidity water and pH containing high concentrations of organic matter if viruses are suspected of being present. In her studies, Lantagne (2008) concluded that for water of turbidities

of 10–100 NTU that a dose of 3.75 mg/L be used and that chlorine was not recommended for disinfection with turbidities greater than 100 NTU, based on remaining free residuals of chlorine in the water. The results of our study using enteric bacteria and viruses would concur with these recommendations. Studies suggest, however, that organically laden water with a turbidity of 30 NTU may not provide the degree of reduction suggested by U.S. EPA and WHO for viruses. Additional studies on turbidity and organic load would help better refine these recommendations. 🐼

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# National Expenditures, Jobs, and Economic Growth Associated With Indoor Air Quality in the United States

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**Abstract** While a number of studies have addressed the economic cost associated with adverse health and productivity effects of poor indoor air quality (IAQ), few have addressed the value of economic expenditures and job creation associated with this industry. This article estimates that the annual sale of IAQ products and services is valued at \$18–\$30 billion and is associated with approximately 150,000–250,000 current jobs. Compared with other familiar industries, the IAQ market remains relatively small. Given the close association between good IAQ and both job performance of adults and learning performance of children, however, the expenditure to maintain good IAQ in commercial and educational facilities is a useful complement to programs designed to improve education and economic growth.

## Introduction

### Public Awareness and Concern for Indoor Air Quality (IAQ)

In 2005, Hal Levin developed the first comprehensive study of national annual expenditures for IAQ goods and services, which he estimated to be \$12–\$20 billion per year, with a midpoint estimate of \$16 billion (Levin, 2005). IAQ has been developing as a new subject of public concern since the 1970s, when in response to the oil embargo of 1973, the U.S. began a concerted effort to reduce energy use, including reducing outdoor air ventilation in buildings. Since ventilation dilutes indoor pollutants from indoor sources, that reduction inadvertently created a significant uptake in incidences of discomfort and illnesses related to indoor pollution. These illnesses, which came to be known as “sick building syndrome” and “building-related illness,” attracted attention in the building sector and from public health

authorities. Significant events related to the discovery of Legionnaires’ disease, exposure to radon in homes, and formaldehyde from insulation and other building materials contributed to this awareness. Further, the scientific community began developing evidence that poor IAQ diminishes occupant health, comfort, and productivity. Also, in 2001, the public became acutely aware of the health consequences of the indoor pollution associated with the terrorist attack on the World Trade Center in New York City. Thus, by the early 2000s, about 95% of the general population reported in surveys by the Chelsea Group that they were concerned about IAQ in their homes (BCC Research, 2012).

### Concern About Markets and Jobs

The recent economic recession and concern about the impact of budgetary decisions on the number of jobs in the U.S. have heightened interest in the degree of economic activity and jobs associated with various policy

areas of interest. While some studies have estimated the economic cost of poor IAQ in terms of health and productivity (Mudarri, 2010a), few have estimated market expenditures and jobs associated with the IAQ products and services. Levin gave a comprehensive treatment of this subject in 2005, but that study is now out of date. Other studies, while more current, tend to cover one or two aspects of IAQ and are therefore limited in scope (Association of Nonwoven Fabrics Industry, 2008; BCC Research, 2012; Freedonia Custom Research, 2009; Greenguard Environmental Institute, 2011; Kline & Company, 2010; Packaged Facts, 2011). This article updates and broadens the Levin study by incorporating information from more recent market analyses in an attempt to provide useful grounding for policy decision makers concerned with the economic impact of budgetary decisions related to IAQ activities.

### Methods Overview

Levin estimated the size of the U.S. market in 2003. Most of the cost and revenue data for that study came from approximately 150 interviews with knowledgeable industry representatives including IAQ mitigation firms, laboratories, trade associations, and manufacturers, plus summaries of industry market research reports and Web sites. The Levin analysis established the following market segments for IAQ:

- consultant services for IAQ problem investigation, diagnosis, and resolution;
- building remediation for IAQ;
- laboratory services pertaining to IAQ diagnostics or related aspects of building design;
- emissions testing for certification/labeling;
- air duct cleaning;

- purchase and use of and improved filtration;
- IAQ litigation and insurance;
- radon mitigation and prevention; and
- asbestos and lead abatement.

This article updates and expands the Levin analysis in three phases. First, the economic growth in the U.S. economy as measured by the real growth rate of the gross domestic product (GDP) and the inflation rate as measured by the consumer price index between 2003 and 2011 was determined. These rates were assumed to be appropriate as default updating factors for any IAQ market segment in Levin for which no evidence was found suggesting that different updating factors would be more appropriate.

Second, an analysis was conducted of trends in IAQ activity using summary reports of more recent market research and from the general literature. This analysis sought to identify (a) market segments identified by Levin whose growth and inflation significantly deviated from the U.S. economy, (b) market segments that were not identified by Levin but had shown considerable activity, and (c) market segments that ought to be redefined to better represent current market realities. Market segments so identified were analyzed to determine appropriate sales volume for 2011.

Levin recognized that many IAQ problem prevention or mitigation activities are also part of standard practice by building professionals and ought not to be attributed specifically to IAQ. Therefore, he defined IAQ expenditures as those “incurred primarily to avoid or mitigate IAQ problems that were not standard practice prior to the early 1970s when IAQ first started to be recognized as a national concern.” This definition is also used in this current analysis and is used primarily when making professional judgments about expenditures attributable to the IAQ industry. In addition, Levin recognized the significant uncertainty in the estimates and therefore used a range of plus or minus 25% to account for this uncertainty. Estimates in this article reflect activity as of 2011, enumerated in 2011 dollars, and using the same range of uncertainty.

Third, in addition to estimating the size of the IAQ market in terms of annual sales of products and services, this article estimates the total number of jobs associated with the IAQ industry in 2011. To account for all the jobs associated with IAQ products and ser-

vices, one could possibly trace all of the jobs associated with the sale of final products and services plus those used throughout the supply chain that make up final products and services associated with IAQ. That is, one might try to include jobs in all the products from the raw materials that go into the parts that go into the equipment that are used to make the final product, including the jobs associated with the energy used and the jobs that go into the manufacture of every nut and bolt and wire, as well as the services, and so on. To account for each job or portion of a job associated in this way would not be feasible.

A simpler approach recognizes that the sales value of all final products and services already accounts for the value of all intermediate products throughout their supply chain. This is also true throughout the economy. Thus, if one assumes that the labor intensity of IAQ products and services including the supply chain is similar to the average labor intensity throughout the economy, one could take the ratio of employed persons in the economy to GDP and multiply it by the total annual expenditures for IAQ products and services to approximate the number of jobs associated with IAQ. This is the approach taken in this article.

To put the size of the IAQ market in perspective, the estimates for IAQ sales are compared to retail sales of other retail categories taken from the U.S. Census (2013). In addition, the importance of IAQ in economic growth is assessed in terms of the impact of IAQ on productivity and educational achievement and the relationship of these issues to economic growth and vitality.

## Analysis

*Growth and Inflation in the U.S. Economy as Default Updating Factors for the IAQ Market* Between 2003 and 2011, the U.S. real GDP (absent inflation) rose by 12.36% (U.S. Department of Agriculture, 2012), while inflation as measured by the consumer price index rose by 22.25% (U.S. Bureau of Labor Statistics, 2012a). Combining the real growth in GDP with inflation yields a growth of 37.36% ( $1.1236 \times 1.2225 = 1.3736$ ). Therefore, this is the default factor used to update those IAQ market segments in Levin for which no evidence was found to indicate that a different updating factor would be more appropriate.

## IAQ Market Segments Identified for Special Analysis

Analysis of recent market research on various IAQ market segments revealed that two market segments—emissions testing and certification/labeling and asbestos and lead abatement—deserved more individualized updating factors, and two market segments—IAQ equipment and green cleaning—not included in Levin needed to be added. Further, since some equipment sales were implicitly included by Levin in the building remediation market segment as well as the purchase and use of improved filtration segment, these segments would need to be adjusted to avoid double counting with the new IAQ equipment category. For these market segments, information from market research summary reports was used to determine the best appropriate estimates of IAQ market activity in 2011. A discussion of these market segments follows.

### *Emission Testing, Certification, and Product Modifications*

Expenditures for testing and certification were estimated by Levin to be \$0.1 billion in 2003. In November 2003, the Greenguard Environmental Institute, the largest certification organization for indoor product emissions, had listed approximately 1,400 products as having been certified. By August 2011, that number had risen to over 2,000, excluding furniture, plus approximately 8,000 pieces of furniture (Greenguard Environmental Institute, 2011). Excluding furniture, this represents a 43% increase in product certifications over that period, compared to the growth in real GDP of just over 12%. Including each piece of furniture as a separate product, the average annual growth rate would be approximately 700%, but the dominance of furniture in this data suggests that it is overrepresented. It is therefore assumed that product emission testing and certification activity for all products has experienced a real growth rate of approximately 50%, which when added to inflation would bring the 2011 estimate to \$0.18 billion.

In addition, Levin did not include expenditures by manufacturers to reduce emissions by modifying their products' design and content. Yet the cost of testing is likely to be minor relative to the cost of redesign and reformulation of products. While such expenditures

would be considerably different for different products or product lines, it is conservatively assumed that the cost of product modification is 10 times the cost of testing, and that such an estimate also accounts for the modifications of products that are not tested or certified by third parties. Accordingly, the estimate for product modification in 2011 is \$1.8 billion. These values rounded to the nearest \$0.1 billion are presented in Table 1.

*IAQ Equipment*

Expenditures for IAQ equipment were not included as a separate category in the Levin report though some are implicit in the building remediation and filtration market segments. BCC Research (2012) estimates that the IAQ equipment market was worth \$3.0 billion in 2003 and \$3.6 billion in 2011, a growth that was slowed considerably by the recent recession. That analysis limits its concern, however, mostly to pollution-oriented portions of IAQ such as filtration, pollutant measurement, and ventilation. Thus, much of the equipment market designed to improve the thermal and moisture aspects of IAQ are not included. Nor does it include new chemical-free cleaning equipment that replaces cleaning chemicals. It is therefore assumed that an added \$0.2 billion to the BCC Research 2011 estimate would account for these differences. The estimate for IAQ equipment in 2011 is therefore estimated to be \$3.8 billion.

Levin estimated the sales in the “building remediation for IAQ” market segment to be \$2.1 billion in 2003. If this estimate were updated to 2011 using the default increase of 37.36%, the 2011 value would be \$4.7 billion. It is assumed, however, that \$0.5 billion is captured in that portion of building remediation dealing with equipment that is already reflected in the new IAQ equipment category. Therefore, the 2011 value for building remediation is reduced to \$4.2 billion. Similarly, if the air cleaning and improved filtration category in Levin were updated to reflect the growth in U.S. GDP and inflation, the 2011 value would be \$2.1 billion. It is assumed that all of this is also included in the new IAQ equipment category. These adjustments and estimates are also presented in Table 1.

*Asbestos and Lead Abatement*

Levin estimated that the asbestos and lead abatement market accounted for approxi-

TABLE 1

**New and Adjusted Estimates for Select Indoor Air Quality (IAQ) Market Segments (2003 and 2011)**

Market Segment	2003 (Billions)	2011 (Billions)
Product certification or labeling	\$0.1	\$0.2
Product modification	—	\$1.8
IAQ equipment	—	\$3.8
Building remediation for IAQ	\$3.4	\$4.2
Air cleaning and improved filtration	\$1.5	Included in IAQ equipment above
Asbestos and lead abatement	\$4.0	\$3.0
Green cleaning	—	\$0.9

TABLE 2

**Estimated Nationwide Expenditures for Indoor Air Quality (IAQ) in 2003 and 2011**

Market Segment	Estimated Expenditure (Billions)*		Comments
	2003	2011	
Consultant services for IAQ problem investigation, diagnosis, and resolution	\$2.1	\$2.9	Includes consultant investigations and diagnostic services. Does not include in-house diagnostic services or in-house response to or resolution of complaints.
Laboratory services	\$0.1	\$0.1	Includes testing of mold, lead, asbestos, and volatile organic compounds.
Building remediation for IAQ	\$3.4	\$4.2	Covers repair and upgrade of controls, ventilation, filtration of HVAC <sup>a</sup> systems, and contaminant removal.
Duct cleaning	\$4.0	\$5.5	Residential and commercial.
Air cleaning and improved filtration	\$1.5	**	Includes sales of residential units and annual expenditures to operate residential and commercial units.
IAQ equipment	—	\$3.8	Encompasses all equipment, including ventilation, filtration, air cleaning, cleaning, and monitoring.
Product certification or labeling	\$0.1	\$0.2	Includes testing and certification expenditures.
Product modification		\$1.8	Modifying products to reduce emissions but excludes green cleaners.
IAQ litigation and insurance	\$0.5	\$0.7	All litigation and insurance claim payments.
Radon mitigation and prevention	\$0.2	\$0.3	Radon testing, mitigation, and radon resistant new construction.
Asbestos and lead abatement	\$4.0	\$3.0	Residential and commercial for asbestos, residential for lead.
Green cleaning for IAQ	—	\$0.9	Cleaners but not equipment.
Total estimated expenditures for IAQ	\$15.9	\$23.4	Range: \$12–\$20 billion in 2003 and \$18–\$30 billion in 2011.

<sup>a</sup>HVAC = heating, ventilation, and air conditioning.

\*Estimated expenditures in 2011 account for inflation and market growth. 2003 estimates are in 2003 dollars.

\*\*Included in 2011 IAQ equipment estimate.



TABLE 3

**2011 Comparison of Indoor Air Quality (IAQ) Sales With Other Retail Sales Categories**

Retail Store	Market Size in Retail Sales* (Millions)	IAQ Market Size as % of Other Retail Markets
New car dealers	\$614,000	4%
Supermarket and grocery store	\$519,000	4%
Warehouse, club, and super stores	\$445,000	5%
Full service restaurants	\$212,000	11%
Department stores	\$188,000	12%
Furniture stores	\$48,000	48%
Beer, wine, and liquor stores	\$43,000	53%
Sporting goods stores	\$40,000	58%
Indoor air quality*	\$23,000	100%
Shoe stores	\$20,000	115%
Office supplies and stationery stores	\$20,000	115%
Book stores	\$14,000	164%

\*Source: U.S. Census, 2013.

mately \$4.0 billion in 2003. Indications are that this market has waned since 2003, however, and the cost of asbestos remediation has declined considerably (BCC Research, 2012). Therefore, it is assumed that this market has declined in both real and nominal dollars, from \$4.0 billion in 1993 (1993 dollars) to \$3.0 billion in 2011. This estimate is included in Table 1.

**Green Cleaning Products**

Levin did not include green cleaning associated with reducing harmful emissions of cleaning product chemicals as a separate category, and it was not included in the emissions testing category because certification of such products relies on chemical content information rather than emissions testing. In the residential market, the market for green household cleaners in 2009 was \$0.34 billion and constituted 60% of the residential green cleaners and laundry product market (Air Quality Services, 2011). In addition, the proportion of all household cleaning and laundry products that are green has expanded significantly over the past decade from 3% in 2008 to an expected 30% in 2013 (Air Quality Services, 2011). Cleaning and laundry products in the commercial and institutional market were valued at \$3.6 billion in 2010 and are also experiencing a strong movement toward

green (Kline & Company, 2010). If, as with household products, 30% of the commercial and institutional market is also green, and 60% are green cleaners, then the green commercial and institutional market for green cleaners would be valued at approximately \$0.65 billion. Adding the residential market would yield a total green cleaning market of \$0.99 billion. Not all of green cleaning is related, however, to the toxicity of the chemical cleaners as it relates to the health of users and occupants. Adjusting for this, it is estimated that the IAQ portion of the green cleaning market in 2010 was approximately \$0.9 billion. This figure is also used to represent the market in 2011. Since green cleaning products are not generally tested in emission testing chambers, these are not included in the category of emission testing and certification. Further, this does not include green cleaning equipment, which is included in the IAQ equipment category. The value of the green cleaning market portion related to IAQ is presented as the last market segment in Table 1.

**Results****Size of the IAQ Sales Market**

Table 2 provides the Levin estimates for national expenditures in the IAQ market in

2003 (2003 dollars), as well as the current estimates for 2011 (2011 dollars) based on the analysis above. Accordingly, Table 2 suggests that total national expenditures for IAQ is currently \$23 billion per year, or, accounting for uncertainty, between \$18 and \$30 billion per year.

To put the size of the U.S. market for IAQ products and services in perspective, Table 3 lists the annual sales of various retail enterprise categories as defined by the U.S. Census Bureau (2013) along with the IAQ sales estimate. To facilitate comparison, the IAQ market as a percentage of each of these retail sectors is also included. For example, the size of the IAQ market, as measured by the sale of IAQ products and services, is approximately only 4% of the size of the new car retail sales market, but is 164% larger than the book store sales market.

**Jobs Associated With IAQ**

One might ask, if there were no IAQ products and services, how many jobs would be lost? Or alternatively, how many jobs are associated directly or indirectly with IAQ? As described in the methods section, this estimate is derived by multiplying the estimated expenditures of IAQ products and services by the ratio of current U.S. employment to GDP. One hundred thirty million persons were employed in 2011 (U.S. Bureau of Labor Statistics, 2012b) while the value of GDP was \$15.1 trillion (Kim, Gilmore, & Joliff, 2012), leaving a ratio of employment to GDP of  $8.6 \times 10^{-6}$ . Multiplying this ratio by the estimated expenditure for IAQ of \$23.4 billion yields an estimate of approximately 200,000 jobs associated with IAQ, or, accounting for uncertainty, between 150,000 and 250,000 jobs.

**Discussion****Market Trends in IAQ**

The current updated estimate of the national expenditures in the IAQ market reflects changes that have taken place since 2003. Since 2003, public awareness and concern for IAQ has been solidified, partly because of the proliferation of information from sources such as the U.S. Environmental Protection Agency (2014), the Institute of Medicine (2000, 2004), and from many other sources. This awareness plus general advancements in emission testing and certification technol-

ogy appear to have resulted in a substantial increase in concern about the chemical emissions of products. In addition, buoyed by the desire for energy independence and concerns about greenhouse gas emissions, federal policies have mandated the development of new energy building codes that currently call for reduction in natural infiltration in buildings and minimal mechanical ventilation. This places an increased burden on building architects and engineers to ensure adequate IAQ by other means (Mudarri, 2010b). Therefore, considerable interest exists in energy recovery and other energy efficient ventilation solutions (BCC Research, 2012).

Model green building programs and national building codes are beginning to call for mechanical ventilation in residential buildings plus other IAQ protections to accompany tighter building envelopes. Improved IAQ controls, air cleaning devices, moisture control, and monitoring equipment are being introduced to support improved IAQ, as are dedicated outdoor air systems, ventilation monitoring and controls, demand control ventilation, and liquid desiccant cooling for moisture control. Medium-efficiency filters have largely replaced the standard furnace filter, while high-efficiency filtration is now a fast growing filter medium (Association of Nonwovens Fabrics Industry, 2008; Freedonia Custom Research, 2009). In addition, air quality monitors (e.g., carbon dioxide monitors, carbon monoxide monitors, and moisture meters) have become popular for not only consultants and diagnosticians, but also now for building maintenance personnel.

Thus, the product emission control segment of the IAQ market and the IAQ equipment segment have grown faster than other

segments. In addition, since 2003, the cleaning industry has greatly accelerated the movement toward “cleaning for health” as opposed to “cleaning for appearance” by introducing low toxicity products and chemical free cleaning equipment that improves IAQ (Mudarri, 2011).

These changes appear to be trends that are likely to continue in the future. Climate change, with its implications for reduced infiltration and ventilation in buildings, will likely promote further interest in energy-efficient ventilation solutions as well as alternative IAQ improvement mechanisms (Environmental News Network, 2008). By contrast, asbestos and lead abatement are on the decline. This can be expected because these substances have been highly restricted for a long time, few currently manufactured products contain them, and many of the past problems have already been mitigated.

### The Comparative Size and Importance of the IAQ Market

Despite its relatively small size, the IAQ market is surprisingly important to the economy because of the impact of good IAQ on learning and productivity (Lawrence Berkeley National Laboratory, 2012). An abundance of research shows a close positive relationship between the education level of a country and its GDP. But the research emphasizes that “level of educational achievement” is not only the educational level from which one graduates, but also the level of knowledge and skills acquired while being educated (Hanushek, Woessmann, & Jamison, 2008). With respect to learning, children have been shown to have greater ability to perform men-

tal tasks, to have lower absentee rates, and to have higher test scores with better IAQ (Lawrence Berkeley National Laboratory, 2012). In the adult world, improved IAQ increases productivity and reduces absenteeism at work (Lawrence Berkeley National Laboratory, 2012). These research findings highlight the importance of IAQ to economic growth.

### Conclusion

In general, IAQ is estimated to represent approximately \$18 billion–\$30 billion annually in economic activity, and that activity is associated with approximately 150,000–250,000 jobs. Given the rising public awareness of and sensitivity to IAQ, combined with the increasing emphasis on IAQ protections from energy conservation and climate change activities, the IAQ market should show healthy growth in the future. In the long term, promotion of good IAQ has a strong role to play to ensure robust economic growth and improve both the number and quality of jobs enjoyed by all Americans. This is because of the positive impact of good IAQ on productivity and educational achievement. 🐼

**Disclaimer:** The development of this article was supported by the U.S. Environmental Protection Agency (U.S. EPA), Office of Radiation and Indoor Air, Indoor Environments Division. This article presents the findings and views of its author and not necessarily those of U.S. EPA.

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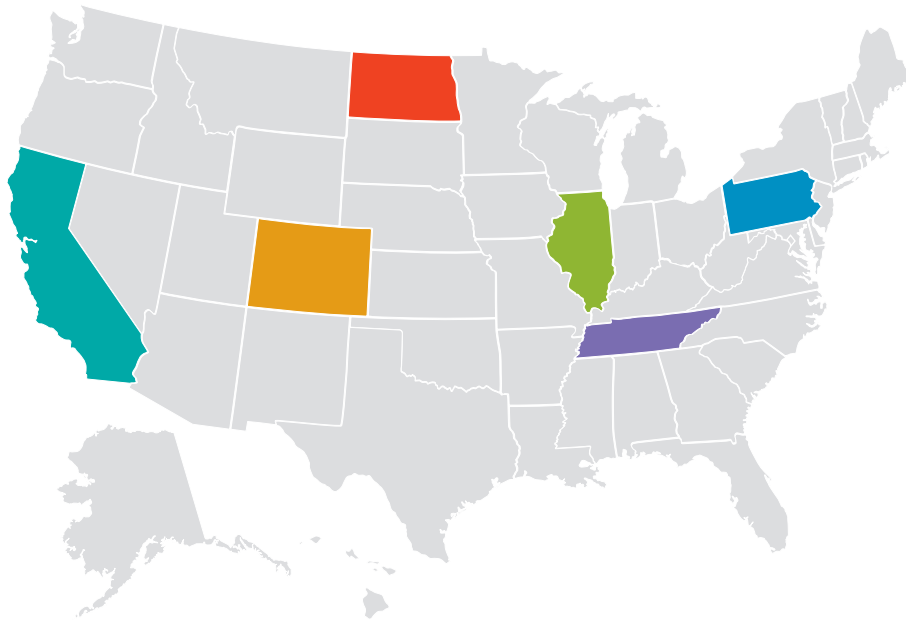
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▶ **ACROSS THE COUNTRY** WHAT'S HAPPENING IN ENVIRONMENTAL HEALTH



**Editor's Note:** This feature in the *Journal* is intended to provide readers with interesting and novel stories of environmental health being practiced across the country that offer an avenue for story sharing and community building. This month's installment focuses on stories of hydraulic fracturing, commonly called fracking, from several different states to illustrate how this controversial issue relates to environmental health. Do you have a story to share? Please contact Terry Osner at [tosner@neha.org](mailto:tosner@neha.org).

**CALIFORNIA**

**California Drilling**

As of March 1, the U.S. Environmental Protection Agency (U.S. EPA) now requires oil and gas companies that are fracking off the southern California coast to report chemicals discharged into the ocean. The move comes after a series of stories by the Associated Press last year revealed at least a dozen offshore fracking jobs in the Santa Barbara Channel, and more than 200 in near-shore waters.

The new U.S. EPA rule applies only to new drilling jobs on nearly two dozen grandfathered-in platforms in federal waters off the Santa Barbara coast, site of a 1969 oil platform blowout that spilled

more than three million gallons of crude oil, ruined miles of beaches, and killed thousands of birds and other wildlife.

Fracking in the ocean uses far less fracking fluids, so potential environmental effects are unknown. Environmentalists have said that the new federal rule is a step in the right direction, but they still want the government to ban the practice altogether.

Separately, state oil regulators have drafted rules requiring companies to test groundwater and alert landowners before fracking or other well stimulation. Companies would also have to disclose the chemicals used and acquire permits before a job.

**COLORADO**

**The Microbe That Consumes Methane**

A microbe capable of digesting methane could save countless tons of greenhouse gas from reaching the atmosphere during the fracking process. Fracking's vented byproduct, methane, can contribute heftily to greenhouse gases in the atmosphere. Every molecule of methane vented to the atmosphere in the fracking process has the global-warming capacity of 20 molecules of carbon dioxide.

Scientists and engineers at the U.S. Department of Energy's National Renewable Energy Laboratory in Colorado are working with colleagues at the University of Washington, LanzaTech, and Johnson Matthey to develop microbes that convert the methane found in natural gas into liquid diesel fuel. The scientists chose a novel

microbe, *Methylobacterium buryatense* 5GB1, which is one of just a few bacteria that have a high natural potential for producing lipids (a good biological feedstock for hydrocarbon-based fuels) from any carbon source. Within that small subset, 5GB1 is a rare species that can use methane to produce lipids—the precursor to fuel.

Challenges remain. Using microbes to convert methane depends on the mass transfer of gaseous oxygen and methane, neither of which are very soluble in water. In addition, the heat generated by the rapid growth must be removed.

The possibility to save trillions of tons of greenhouse gas, produce liquid diesel cheaply and safely, and create a source of nutrition for livestock and people—not bad for an organism too small to see!

## ILLINOIS

### Comminution as an Alternative to Fracking

Fracking has great economic benefits for the U.S. but not without environmental costs. While much less severe than those of coal technology, the costs include the danger of possible contamination of groundwater. Instead of pumping deep underground enormous amounts of water to fracture shale, Northwestern University Professor Zdeněk P. Bažant proposes exploring another possibility: using the kinetic energy of high-rate shearing generated by an underground explosion to reduce the rock to small fragments, to release the gas trapped in its pores.

“We have verified that this method of fragmentation, known as comminution, works for predicting the effects of high-rate shearing

of concrete under impact, and in principle it also should work for shale,” said Bažant.

“This theory is not proven for fracturing shale—we don’t know whether it would work—but it is an idea that is worth investigating,” Bažant said. “An oil company or a national laboratory would need to conduct experiments and learn how to handle the practical issues.”

It remains to be verified whether the resulting shock waves would suffice to fracture a large enough region of shale and release the gas. Bažant’s method would allow analyzing it computationally. Should comminution succeed, virtually no contaminated water would come out of the well, Bažant said.

## NORTH DAKOTA

### Whiskey or Water? What’s Your Pleasure?

In towns across North Dakota, the wellhead of the North American energy boom, the locals have taken to quoting the adage: “Whiskey is for drinking, and water is for fighting.” As the state’s Bakken shale fields have grown, so has the fight over who has the right to tap into the multimillion-dollar market to supply water to the energy sector.

North Dakota accounts for over 10% of U.S. energy output, and production could double over the next decade. Fracking in North Dakota is a somewhat different prospect as the Bakken lies more than a mile deep at its shallowest point. Its nearest aquifer is the

Dakota Sandstone, which is separated by at least 500 feet vertically from any fracking operations. The fracking process is water intensive and requires more than two million gallons of water per well, equal to baths for some 40,000 people.

Currently, municipal and industrial allocators speak for all groundwater resources in western North Dakota. Fracking operations are now looking to Lake Sakakawea as a source for fracking water. This could potentially use up to 1% of the lake volume. While it does not sound like much, consider that the lake has 1,350 miles of shoreline and its deepest portions are 140 ft. deep.

## PENNSYLVANIA

### Methane Geyser

In June 2012, a methane geyser shooting methane-infused water 30 feet in the air was found in Pennsylvania’s Tioga County. Once discovered, the county immediately turned to Shell, which was drilling in three nearby locations. Shell and the Pennsylvania Department of Environmental Protection began investigating, and it was correctly suspected that an abandoned well from the 1930s contributed to the problem. A follow-up report confirmed that the well drilled in 1932 was part of the chain reaction that triggered the

geyser. The fracking displaced methane pockets underground into the well and shot up to the surface.

Wells drilled long before required permits or filed records and then improperly abandoned are difficult to uncover. As many as 300,000 wells were drilled in Pennsylvania over the past 150 years and it is unknown how many abandoned wells could be dangerous. While agencies inform potential drillers like Shell of abandoned wells, drilling regulations do not require drilling companies to search for, inspect, and plug abandon wells.

## TENNESSEE

### Fracking 101 at the University of Tennessee

How do you fund studies of the environmental impact of fracking? The University of Tennessee has an idea. University officials look to lease more than 8,000 acres of public land in Cumberland Forest to an energy company for fracking and then use the profits from the lease to study fracking’s effects.

The Tennessee Building Commission, despite protests, accepted the idea unanimously. The University of Tennessee already operates on the acreage in question as part of its Forest Resources AgResearch and Education Center. The university system has several research projects in Cumberland Forest, where researchers study air quality, stream restoration, and strip-mine reclamation.

Larry Arrington, chancellor of the university’s Institute of Agriculture, explained that this “is a science-based investigation and we will move forward in a transparent manner.”

A public fact sheet distributed by the university in relation to the plan said the project “will provide science-based facts for the scientific community, regulatory agencies, environmental groups and citizens, and the industry.” Areas the university proposed investigating through the project include water and air quality, microseismic activity (fracking has been linked to earthquakes in some regions), the ecological impacts of the natural gas infrastructure, best practices for controlling erosion, and community education.



Robert Blake, MPH, REHS

## Update on the Model Aquatic Health Code

**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 this column, EHSB and guest authors from across CDC will highlight a variety of concerns, opportunities, challenges, and successes that we all share in environmental public health. EHSB's objective is to strengthen the role of state, local, tribal, and national environmental health programs and professionals to anticipate, identify, and respond to adverse environmental exposures and the consequences of these exposures for human health.

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

Robert Blake is a health scientist of the EHSB at CDC and has been working in the environmental health field for more than 30 years.

The Centers for Disease Control and Prevention (CDC) recognize swimming as an excellent form of physical activity, with benefits of reducing risk for chronic diseases and improving mental health. Aquatic facilities can pose a risk, however, to public health from both illness and injury.

Although local and state public health codes typically regulate pools, spas, and other aquatic venues, these codes may not always be based on up-to-date science, cover the newest construction developments in the aquatics field, or respond to new outbreak data such as those addressing spray pad-associated outbreaks or indoor air quality events. Lack of consistent health regulation in state

and local codes not only confuses pool and spa owners, operators, suppliers and users, but also leaves persons unnecessarily vulnerable to disease and injury.

In recent years reported recreational waterborne disease outbreaks linked to aquatic facilities have steadily increased (Hlavsa et al., 2014). Figure 1 illustrates this increase, which is driven largely by the challenges of maintaining an aquatic facility and preventing the transmission of a variety of ailments, particularly diarrheal diseases.

Additionally, aquatic venues are the sites for many injuries, particularly among children. Some of those injuries include the more common slips, falls, cuts, and bruises; others

are life threatening, such as drowning, suction entrapment from pool drains, diving injuries, and chemical injuries (Hlavsa & Beach, 2013).

### The Model Aquatic Health Code (MAHC)

In response to the increase in outbreaks of waterborne illness, in February 2005 CDC sponsored a workshop in Atlanta, Georgia, at which a variety of stakeholders made recommendations about how to improve public health outcomes in public aquatic facilities. A key recommendation was to develop a model aquatic health code to do the following:

- be driven by data;
- address outbreaks, injuries, and other public health issues associated with aquatic facilities; and
- be available for free for local and state jurisdictions to use to create their own codes (Blake & Peters, 2012).

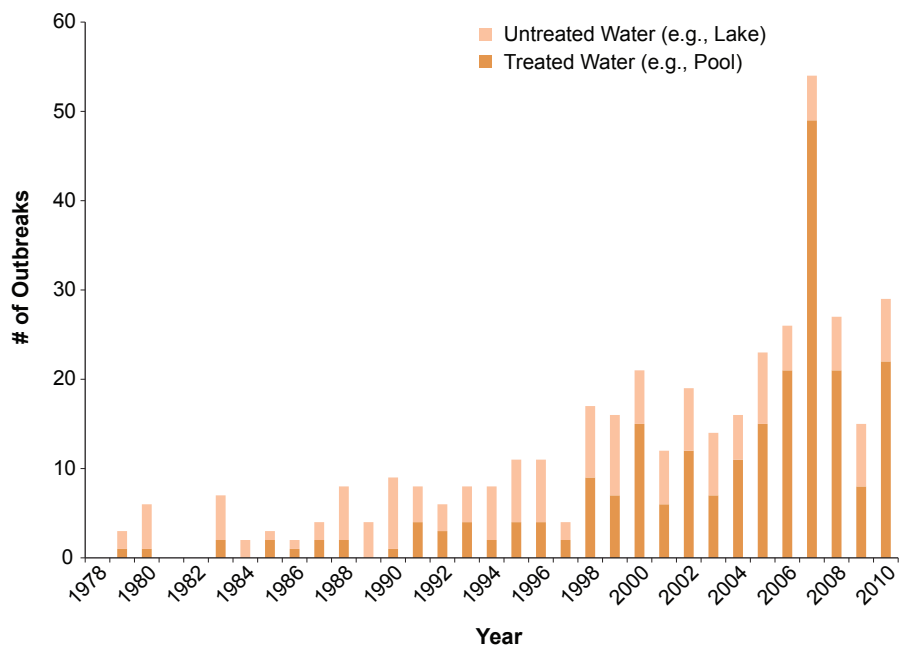
Since the workshop, CDC units with expertise in environmental health, infectious disease, injury prevention, and public health law have collaborated on the MAHC effort. CDC worked with hundreds of volunteer stakeholders from public health, academia, and the aquatics industry who have served on various technical committees to compile the MAHC's proposed code language and the supporting annex materials. A MAHC steering committee and CDC staff oversaw all committee work. This long-term project is now culminating with the MAHC launch planned for the summer of 2014.

CDC staff and committee members have spent 2013 and the first part of 2014 responding to the thousands of public comments that



FIGURE 1

### Recreational Waterborne Disease Outbreaks in Treated and Untreated Water



were submitted during formal public comment periods on topical modules, as well as integrating these discrete modules into one cohesive document and making the document available for a final round of public comment. Once these final comments are addressed, the first edition of the MAHC will be launched. The MAHC Web site ([www.cdc.gov/mahc](http://www.cdc.gov/mahc)) provides MAHC provisions and explanatory annex materials with the public health rationale (Centers for Disease Control and Prevention, 2014).

### Operational Guidelines for the MAHC

Because the MAHC is not a federal law, it is enforceable only if state and local authorities adopt it. During the public comment period for the regulatory program module, some regulators recommended that code provisions for the regulatory community at the local and state levels should not be included in the MAHC. Successful implementation of the MAHC, however, would require improvements in all sectors of aquatic health including local and state inspec-

tion programs. To provide such guidance, CDC staff have moved these pool program operational guidelines out of the MAHC into separate stand-alone guidance to help supplement existing and in some cases new swimming pool inspection programs (sidebar). The content for the operational guidelines follows a similar structure as that used in the Food and Drug Administration (FDA) Annexes in their model *Food Code*.

### The Conference for the Model Aquatic Health Code

Once the MAHC is fully launched and jurisdictions adopt the MAHC and begin to implement its provisions, questions and new research gaps will surface. Again learning from the FDA's process, CDC and the National Conference of State Legislatures led the creation of an independent tax-exempt body called the Conference for the Model Aquatic Health Code (CMAHC) for updating the MAHC. This body will facilitate expert examination of new data and emerging issues, which in turn will prompt updates to the MAHC. CDC staff will main-

### Proposed Model Aquatic Health Code (MAHC) Operational Guidelines

- The public health reasons for a strong pool inspection program
- MAHC implementation processes for different jurisdictions
- Inspection program resources included fee categories
- Equipping pool inspection staff for complete pool inspections
- Recommended training and standardization of inspections in job functions
- Collaboration with building, plumbing, mechanical, and other inspectors
- Risk-based inspections
- Inspection forms
- Inspection data collection and use
- Outbreak investigations
- Injury and drowning investigations
- Emergency closures
- Enforcement processes

tain leadership through liaison and scientific review roles within the CMAHC.

The MAHC process has been very labor intensive, but the use of the final product by local and state jurisdictions should eventually lead to fewer facility closures and reductions in waterborne disease outbreaks, drowning, and chemical injuries (Figure 2). 🐼

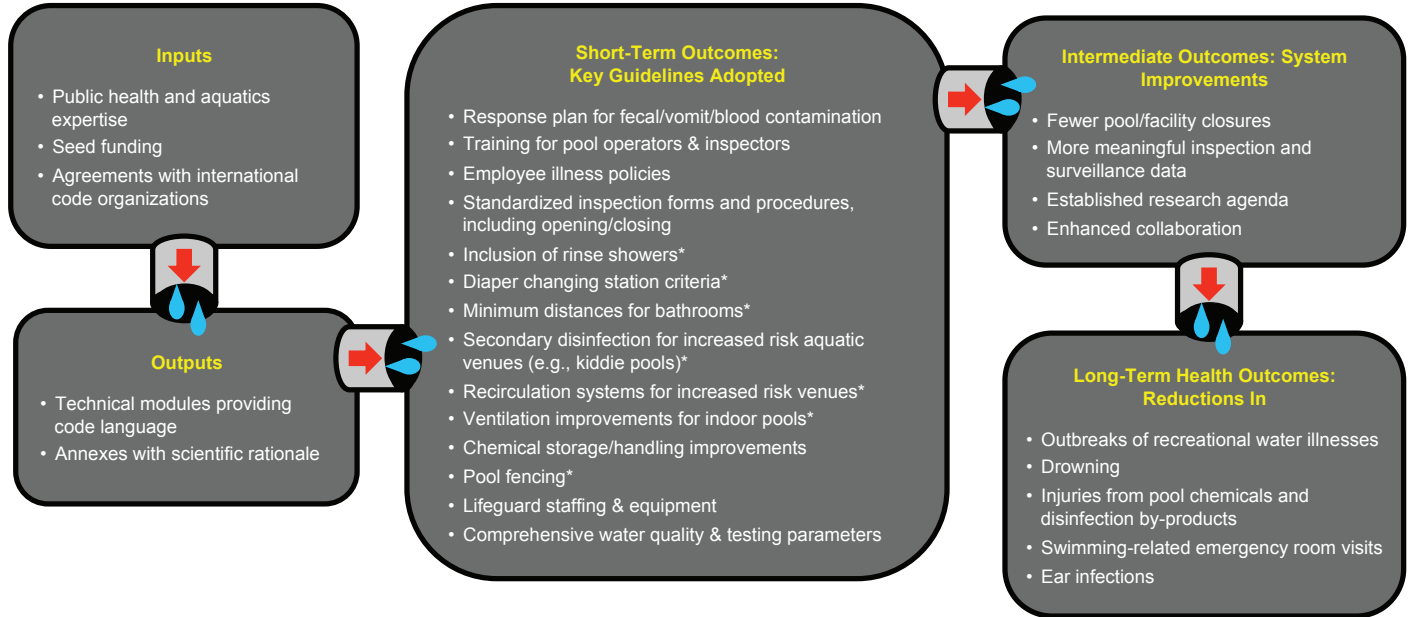
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*continued on page 36*

continued from page 35

FIGURE 2

**Model Aquatic Health Code Logic Model**



\*Provisions pertaining primarily to new or modified construction.

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# NEHA CREDENTIALS



## New REHS/RS Exam Offered in July

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NEHA recently updated the exam for the Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) in order to ensure that the credential exam tests on the most up-to-date and relevant information. Candidates who are preparing for or are eligible to take the REHS/RS exam must apply by May 30, 2014, to take the exam at the NEHA 2014 AEC in Las Vegas.

Visit NEHA's Web site to find details on:

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▶ **DIRECT FROM CDC** ENVIRONMENTAL PUBLIC HEALTH TRACKING NETWORK

Jennifer M. Moore, MPH

## CDC's National Environmental Public Health Tracking Network Classroom Modules

**Editor's Note:** As part of our continuing effort to highlight innovative approaches and tools to improve the health and environment of communities, the *Journal* is pleased to publish a bimonthly column from the Centers for Disease Control and Prevention's (CDC's) Environmental Public Health Tracking Network (Tracking Network). The Tracking Network is a system of integrated health, exposure, and hazard information and data from a variety of national, state, and city sources. The Tracking Network brings together data concerning health and environmental problems with the goal of providing information to help improve where we live, work, and play.

Environmental causes of chronic diseases are hard to identify. Measuring amounts of hazardous substances in our environment in a standard way, tracing the spread of these over time and area, seeing how they show up in human tissues, and understanding how they may cause illness is critical. The Tracking Network is a tool that can help connect these efforts. Through these columns, readers will learn about the program and the resources, tools, and information available from CDC's Tracking Network.

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

Jennifer Moore is a health communication specialist within CDC's Environmental Health Tracking Branch and has been with CDC for six years. She has extensive experience in health communications and education.

CDC's Environmental Public Health Tracking Program (Tracking Program) recently released the *Keeping Track, Promoting Health* classroom modules. These free learning modules provide college-level information on environmental public health using the National Environmental Public Health Tracking Network (Tracking Network). The modules include adaptable, interactive resources that emphasize the wide-reaching implications of environmental health as well as the practical application of

the Tracking Network. The information addresses three key learning objectives:

- to increase knowledge of the fundamental aspects of environmental public health,
- to increase knowledge of the Tracking Network, and
- to develop skills for using the Tracking Network to identify and solve public health problems.

The modules are available at <http://ephttracking.cdc.gov/training.action>.

### Background

Education lays the foundation for practice throughout a career. What we first learn becomes our default; the tools we discover become our "go-to" resources. Very limited environmental health teaching resources exist for undergraduate and graduate-level students, particularly easy-to-understand materials for classroom instruction. The *Keeping Track, Promoting Health* classroom modules were developed in an effort to fill this gap.

Academic educators face tremendous and diverse pressures: student requests, course planning, research projects, grant writing, university leadership roles, and many more. What we think of as the primary role of an academic instructor has become just one piece of a demanding puzzle. With this in mind, the Tracking Program followed two basic principles in developing the classroom modules: make them easy to use and make them versatile. The modules are intended to educate future public health and environmental health professionals on the basics of environmental public health, and application of those principles within the Tracking Network, through real-life case-based scenarios.

### Development

Since the classroom modules were developed for professors and students, it was important to engage them from the inception. Before beginning development of the modules, the program conducted a round of key informant interviews with five professors. These interviews allowed the program to gather formative information about the needs of this audience that helped guide development of the materials. Based on this formative evaluation, the program developed presentations with speaker

FIGURE 1

### Module 1—Introduction to Environmental Public Health

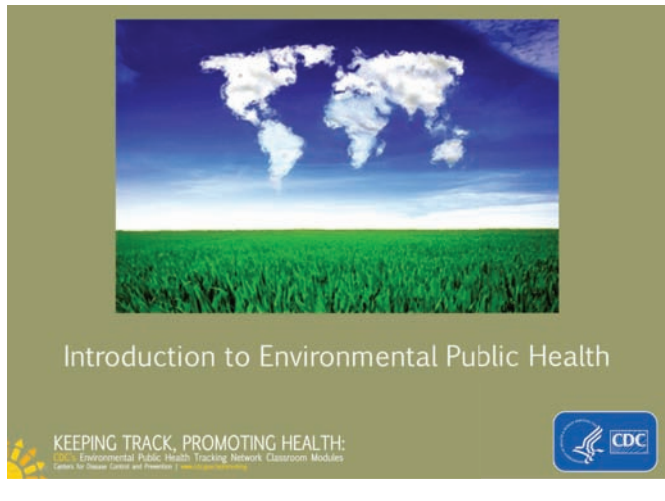
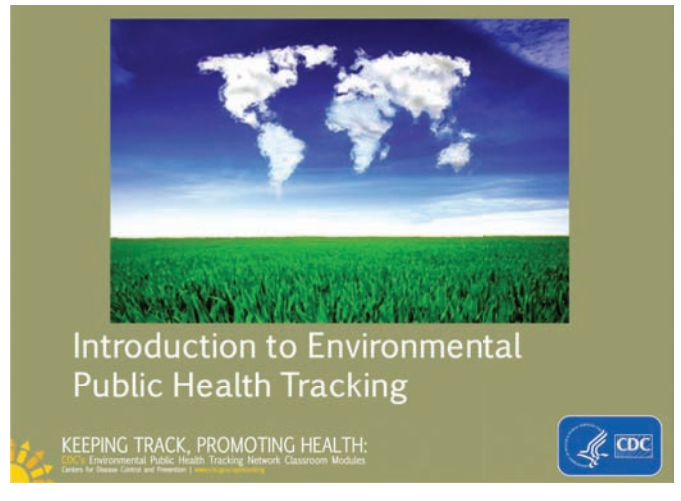


FIGURE 2

### Module 2—Introduction to Environmental Public Health Tracking



notes written in plain language and other supporting materials to fit classroom needs.

#### Key Components

Two modules are included in this suite of resources:

- Module I—Introduction to Environmental Public Health (Figure 1) and
- Module II—Introduction to Environmental Public Health Tracking (Figure 2).

Both modules are available as PowerPoint slide decks, including speaker notes. The modules also include the following:

- in-class activities,
- homework assignments,
- sample exam questions,
- an activity and assignment guide, and
- an adaptation guide.

Module I includes 35 PowerPoint slides that cover general environmental public health topics, such as the role of environmental health in public health, monitoring environmental public health, and career opportunities. Module II includes 59 slides that provide an overview of the Tracking Network, how to use the Tracking Network, and success stories from state and local health departments. Both modules include audiovisual pieces, such as videos and podcasts, to help make the materials more engaging for students.

The adaptation guide that comes with the materials highlights the adaptability and flex-

ibility of the modules. It includes tips for preparing to use the materials and provides four examples of how the lessons and supporting materials can be adapted to fit different class structures, including one three-hour class, three 50-minute classes, one 50-minute class, and two 50-minute classes.

#### Other Training Materials Available

In addition to the *Keeping Track, Promoting Health* classroom modules, a number of other Tracking Network training resources are available for different levels of education and experience. CDC has partnered for many years with the National Environmental Health Association (NEHA) to provide two tracking-related trainings accessible through the Tracking Network Web site and NEHA's online training Web site:

- Environmental Public Health Tracking 101 (Tracking 101)  
Tracking 101 gives an overview of the major components of environmental public health tracking. Topics include the National Tracking Network and Program, surveillance and epidemiology, types of tracking data, GIS, policies, and communication. Users can earn free continuing education credits from CDC and NEHA.
- Tracking in Action: Workforce Implementation  
Tracking in Action provides real-life examples of grantee Tracking Programs and Networks and how they have partnered with

local programs and organizations to identify and address environmental health concerns.

CDC also has written a “how-to” guide for states or cities that are not funded by the national program but may be interested in starting environmental public health tracking activities. It is available on the Tracking Network Web site.

The Tracking Network is the nation's most comprehensive environmental public health surveillance system. If you have not had an opportunity to explore it, please visit today at <http://www.cdc.gov/ephracking>.

If you are interested in the *Keeping Track, Promoting Health* classroom modules, or any other training resource available, visit the Tracking Network Training Web page at <http://ephracking.cdc.gov/training.action> to request copies of this free resource.

The best way to stay connected with the Tracking Program is by joining our LISTSERV. Send an e-mail to [epht@cdc.gov](mailto:epht@cdc.gov) and you will receive updates about new data, tools, and other resources as they become available. 📧

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► DEMYSTIFYING THE FUTURE



Thomas Frey

## Fifty-Five Jobs of the Future: Part Two

**Editor's Note:** Significant and fast-paced change is occurring across society in general and our profession in particular. With so much confusion in the air, NEHA is looking for a way to help our profession better understand what the future is likely to look like. The clearer our sense for the future is, the more able we are to both understand and take advantage of trends working their way through virtually every aspect of our lives today. To help us see what these trends are and where they appear to be taking us, NEHA has made arrangements to publish the critical thinking of the highly regarded futurist, Thomas Frey.

The opinions expressed in this column are solely that of the author and do not in any way reflect the policies and positions of NEHA and the *Journal of Environmental Health*.

Thomas Frey is Google's top-rated futurist speaker and the executive director of the DaVinci Institute®. At the Institute, he has developed original research studies enabling him to speak on unusual topics, translating trends into unique opportunities. Frey continually pushes the envelope of understanding, creating fascinating images of the world to come. His talks on futurist topics have captivated people ranging from high-level government officials to executives in Fortune 500 companies. He has also authored the book *Communicating with the Future*. Frey is a powerful visionary who is revolutionizing our thinking about the future.

**T**here is no future in any job. The future lies in the person who holds the job.—George W. Crane

Last month's column dealt with 26 different new positions that will likely be spawned within the next 10 years. This month's column looks at a different job type—dismantlers—and delves further into the future to predict those jobs that may evolve as technology advances.

### The Dismantlers

Over the coming years we will see a number of industries being dismantled, requiring a skilled workforce of talented people who can perform this task in the least disruptive way. Most of these industries have been built around aging facilities and infrastructure that will become unnecessary and unsustainable in the future. These will include the following.

27. Prison System Dismantlers: More details at <http://www.futuristspeaker.com/2009/12/8-trends-to-watch-in-2010-alternatives-to-incarceration/>.
28. Hospital and Health Care Dismantlers: More details at <http://www.futuristspeaker.com/2011/04/rethinking-the-future-of-health-care/>.
29. Income Tax System Dismantlers: More details at <http://www.futuristspeaker.com/2010/08/reinventing-sales-tax/> and <http://www.futuristspeaker.com/2009/03/watching-the-income-tax-system-implode/>.
30. Government Agency Dismantlers: More details at <http://www.futuristspeaker.com/2010/06/a-country-of-90000-governments/>.
31. Education System Dismantlers: More details at <http://www.futuristspeaker.com/2007/03/the-future-of-education/>; <http://www.futuristspeaker.com/2011/01/curiosity-driven-education/>; and <http://www.futuristspeaker.com/2011/10/accomplishment-based-education/>.
32. College and University Dismantlers: More details at <http://www.futuristspeaker.com/2011/02/charting-a-new-frontier-for-colleges-and-universities/>; <http://www.futuristspeaker.com/2010/04/competing-for-status/>; and <http://www.futuristspeaker.com/2009/12/the-future-of-colleges-universities-part-one/>.

### Jobs in 2030 and Beyond

A number of technologies currently on the drawing board will require a bit longer lead time before the industry comes into its own. Here are a few examples of these kinds of jobs.



33. Drone Dispatchers: Drones will be used to deliver groceries and pizzas, deliver water, remove trash and sewage, monitor traffic and pollution, and change out the batteries on our homes. Skilled dispatchers for future drones will be in high demand. More details at <http://www.futuristspeaker.com/2011/03/the-day-of-the-drone/>.
34. Brain Quants: Where the stock market manipulators of the past meet the brain manipulators of the future to usurp control of Madison Avenue.
35. Tree-Jackers: Plant and tree alteration specialists, who manipulate growth patterns, create grow-to-fit wood products, color-changing leaves, and personalized fruit. More details at <http://www.futuristspeaker.com/2011/05/inventing-the-rocking-chair-tree/>.
36. Plant Psychologists: An entire profession dedicated to undo the damage caused by the Tree-Jackers.
37. Extinction Revivalists: People who revive extinct animals.
38. Robotic Earthworm Drivers: The most valuable land on the planet will soon be the landfills because that is where we have buried our most valuable natural resources. In the future, robotic earthworms will be used to silently mine the landfills and replace whatever is extracted with high-grade soil.
39. Gravity Pullers: The first wave of people to unlock the code for influencing gravity.
40. Time Hackers: If we think cyber terrorists are a pain, it will seem like nothing compared to devious jerry-riggers who start manipulating the time fabric of our lives.
41. Clone Ranchers: Raising “blank” humans will be similar in many respects to cattle ranching. But once a clone is selected, and the personality download is complete, the former clone will instantly be elevated to “human status.”
42. Body Part and Limb Makers: Organ Agents will quickly find themselves out of work as soon as we figure out how to efficiently grow and mass produce our own organs from scratch.
43. Memory Augmentation Therapists: Entertainment is all about the great memories it creates. Creating a better grade of memories can dramatically change who we are and pave the way for an entirely new class of humans.
44. Time Brokers—Time Bank Traders: Where do you go when you run out of time? Naturally, to the time bank, and take out a time loan.
45. Space-Based Power System Designers: At some point, the burning of earth’s natural resources for power will become a thing of the past. Space-based systems will capture and transmit power far more efficiently than anything currently in existence.
46. Geoengineers—Weather Control Specialists: We are moving past the age of meteorology and climatology to one where the true power brokers will wield the forces of nature.
47. Plant Educators: An intelligent plant will be capable of reengineering itself to meet the demands of tomorrow’s marketplace. Plant educators will not work with lesson plans or PowerPoint presentations, but the learning process will be even more effective. More details at <http://www.futuristspeaker.com/2011/10/tapping-into-the-secret-language-of-plants/>.
48. Nano-Weapons Specialists: Many of the weapons of the future will be too small to be seen by the human eye. And naturally, these will be the most dangerous. More details at <http://www.futuristspeaker.com/2008/05/nano-weaponry-entre-to-a-twisted-reality/>.
49. Lip Designers: If you could have any lips in the world, what would they look like?
50. Mass Energy Storage Developers: As a society, we have become very good at generating electricity, but are still terrible at storing it from one day to the next. Once mass energy storage systems are developed and installed, our total energy needs will drop precipitously.
51. Earthquake Forecasters: Everything we know about the inside of the earth has been developed through indirect evidence. We have no maps of the center of the earth. We have no accurate diagrams, no understanding of motion, fluidity, or changes happening with any degree of accuracy. While scientists are developing skills to work with nanoscale precision on the earth’s surface, the best we can muster below the surface is blindfolded guesswork done with 100-mile precision. What we don’t know is literally killing us—over 226,000 killed in 2010 alone. But that will change over time as we begin to understand the inner workings of the earth and accurately forecast when the next big quakes are about to hit. More details at <http://www.futuristspeaker.com/2010/09/prize-competition-1-the-race-to-the-core/>.
52. “Heavy Air” Engineers: Compressed air is useful in a wide variety of ways. We have yet to figure out, however, how to compress streams of air as they pass through our existing atmosphere. Once we do, it will create untold opportunities for non-surface-based housing and transportation systems, weather control, and other kinds of experimentation.
53. Robot Polishers: If we are going to have robots, they will invariably need to be polished.
54. Amnesia Surgeons: Doctors who are skilled in removing bad memories or destructive behavior.
55. Executioners for Virus Builders: In the future, virus builders who get caught will have a choice. They can either go to the electric chair, or spend some quality time with the Amnesia Surgeon.

### Final Thoughts

The jobs and occupations listed above, and in the previous column, are just scratching the surface. This list is intended to help stretch your imagination and start you down a path of imagining your own future.

But I’d love to hear your thoughts. What am I missing? Where have I gone off the deep end and missed the big picture entirely? Are there better names for these professions? And most importantly, how can someone today prepare himself or herself for the changes to come?

Yes, this two-part column includes far more questions than answers. But when it comes to understanding the future, it all begins with asking the right questions.

Interested in sharing your thoughts? Go to [www.FuturistSpeaker.com](http://www.FuturistSpeaker.com). 🐼

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## CAREER OPPORTUNITIES

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Buffalo, NY	Puerto Rico
Butte, MT	Rochester, NY
Cleveland, OH	Shreveport, LA
Columbus, OH	Spearfish, SD
Dallas, TX	St. Louis, MO

Past or current food safety inspecting is required.

Interested applicants can send their resume to: Bill Flynn at Fax: 818-865-0465. E-mail: Bill.Flynn@ul.com. 📧

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### NEHA's Career Center

First job listing **FREE** for city, county, and state health departments with a NEHA member, and for Educational and Sustaining members.

For more information, please visit [neha.org/job\\_center.html](http://neha.org/job_center.html)

## EH CALENDAR

### UPCOMING NEHA CONFERENCE

July 7–10, 2014: NEHA's 78th Annual Educational Conference & Exhibition in Partnership with the International Federation of Environmental Health, The Cosmopolitan of Las Vegas, NV. For more information, visit [www.neha2014aec.org](http://www.neha2014aec.org).

### NEHA AFFILIATE AND REGIONAL LISTINGS

#### Colorado

September 24–26, 2014: 2014 Annual Education Conference & Exhibition, sponsored by the Colorado Environmental Health Association, Steamboat Grand, Steamboat Springs, CO. For more information, visit [www.cehaweb.com/aec.html](http://www.cehaweb.com/aec.html).

#### Florida

July 28–30, 2014: Annual Educational Meeting, sponsored by the Florida Environmental Health Association, Florida Mall Hotel and Conference Center, Orlando, FL. For more information, visit [www.feha.org](http://www.feha.org).

#### Georgia

July 16–18, 2014: 68th Annual Environmental Health Seminar, hosted by the Georgia Environmental Health Association, Hyatt Regency, Savannah, GA. For more information, visit [www.geha-online.org](http://www.geha-online.org).

#### Minnesota

May 1–2, 2014: Spring Conference, sponsored by the Minnesota Environmental Health Association, Arrowwood Resort & Conference Center, Alexandria, MN. For more information, visit [www.mehaonline.org/events](http://www.mehaonline.org/events).

#### Washington

May 12–13, 2014: 2014 Annual Educational Conference, "Environmental Public Health—Improving Quality of Life in Our Communities," sponsored by the Washington State Environmental Health Association, Great Wolf Lodge, Grand Mound, WA. For more information, visit [www.wseha.org/2014-aec/](http://www.wseha.org/2014-aec/).

### TOPICAL LISTINGS

#### Healthy Homes

May 28–30, 2014: National Healthy Homes Conference, sponsored by the U.S. Department of Housing and Urban Development, Rebuilding Together, HGTV, and DIY Network, Nashville, TN. For more information, visit [www.healthyhomesconference.org](http://www.healthyhomesconference.org). 📧

# You ensure food is safe inside the building.

## What about the water and air outside the building?

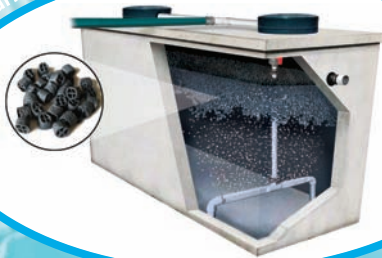
Clean Water



### Puraflo®

Peat Fiber Biofilter with Pad Dispersal for Pathogen and Nitrogen Removal

Clean Water



### PuraMax®

Moving Bed Biological Reactor for High Strength Waste Establishments

Clean Air



### Compact Mónafil

Peat and Seashells Biofiltration for Passive Odor Control

Food service establishment waste streams present numerous challenges when using on-site treatment and dispersal:

- high BOD<sub>5</sub>
- high Fats, Oils and Grease (FOG)
- sanitizers, especially Quaternary Ammonium Compounds (QAC)
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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 (2012)



This reference is a must for professionals who help protect those who use aquatic venues. It is the most current and comprehensive in the field. The *Handbook* features valuable information to help understand and prevent drowning, recreational water illness, suction entrapment, evisceration, diving accidents, electrocutions, chemical hazards, and slips and falls. Fresh

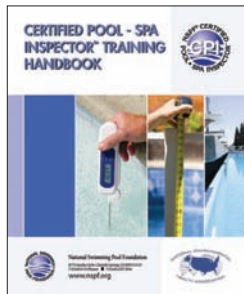
information on regulatory guidelines and vital operation topics are covered, including disinfection, water balance, water problems, troubleshooting, chemical testing, record keeping, chemical feed, and control technology. The *Handbook* serves as a textbook for the Certified Pool-Spa Operator® certification and is a study reference for NEHA's REHS/RS exam.

298 pages / Spiral-bound paperback / Catalog #1014

Member: \$55 / Nonmember: \$59

## Certified Pool/Spa Inspector™ Online Training Program

National Swimming Pool Foundation (2011)



Jointly launched by the National Swimming Pool Foundation and NEHA, this online course expands upon and replaces the popular Certified Pool/Spa Inspector™ training CD introduced by both organizations in 2005. The program is designed to help environmental health specialists conduct effective pool and spa inspections and to minimize exposure to public health hazards. The

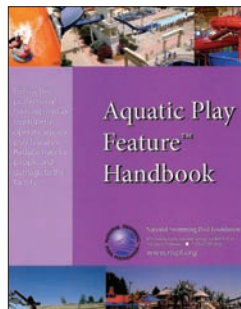
interactive, self-paced course features narration, images, video, and exercises and can be completed in about two hours. The topics covered include the operation and maintenance practices that focus on reducing risk, the workings of the circulation system, procedures to evaluate a facility for Pool & Spa Safety Act compliance, the unique hazards of spas, how to minimize recreational water illnesses, the ways that operation and maintenance records relate to an inspection, how aquatic play features have unique hazards, and teaching about swimming pool design standards and their impact on public health.

Online Course and Handbook (68 pages / Paperback) / Catalog #1067

Member: \$50 / Nonmember: \$55

## 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. Top-

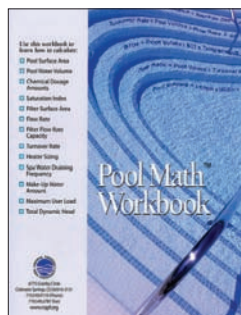
ics covered include how to deal with cloudy water, excessively high make-up water bills, high sanitizer/oxidizer consumption, very short filter runs, maintaining automated control systems, management of water and of water chemistry, chlorine and chemical addition issues, filtration and circulation concerns,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

67 pages / Paperback / Catalog #1116

Member: \$18 / Nonmember: \$20

## Pool Math™ Workbook

National Swimming Pool Foundation (2007)



This workbook is designed for operators, service technicians, health officials, retail technicians, and renovators who need to perform common math. The workbook helps people calculate pool surface area, water volume, chemical dosage amounts, saturation index, filter surface area, flow rate, filter flow rate capacity, turnover rate, heater sizing, spa water draining frequency, make-up water amount, maximum

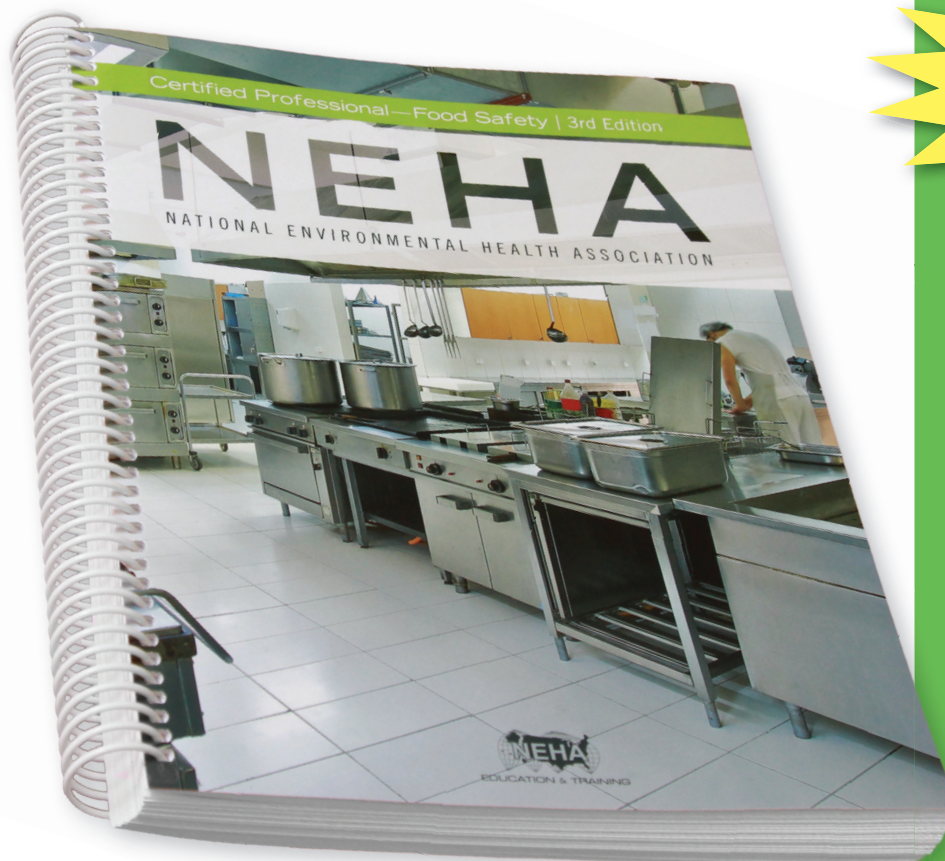
user load, and total dynamic head. The workbook is broken into three parts. Part one reviews important calculations and conversions. The second and third parts work together. Part two contains over 40 pages of math problems, presenting typical calculations. More important "must-know" calculations are highlighted in color to separate them from "nice-to-know" calculations. Part three provides step-by-step answers to solve each problem presented in the second part.

102 pages / Paperback / Catalog #1071

Member: \$18 / Nonmember: \$20



# The go-to resource for students of food safety and industry professionals.



**Introducing...**  
NEHA's ALL-NEW  
Certified Professional—  
Food Safety (CP-FS)  
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NEHA's **Certified Professional—Food Safety** manual was developed by experts from across the various food safety disciplines to help candidates prepare for the updated CP-FS credential examination. This 360-page manual contains science-based, in-depth information about:

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- Cleaning and sanitizing
- Pest control
- Risk-based inspections
- Sampling food for laboratory analysis
- Food defense
- Responding to food emergencies and foodborne illness outbreaks
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Updated to the 2013 *Food Code*

An integral part of Integrated Food Safety System (IFSS) body of knowledge

Includes new Food Safety Modernization Act (FSMA) requirements

Full-color photographs and illustrations throughout

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# JEH QUIZ

## FEATURED ARTICLE QUIZ #6

### The Distribution and Public Health Consequences of Releases of Chemicals Intended for Pool Use in 17 States, 2001–2009

Available to those holding an Individual NEHA membership only, the *JEH* Quiz, offered six times per calendar year through the *Journal of Environmental Health*, is a convenient tool for self-assessment and an easily accessible means to accumulate continuing-education (CE) credits toward maintaining your NEHA credentials.

1. Read the featured article carefully.
  2. Select the correct answer to each *JEH* Quiz question.
  3. a) Complete the online quiz at [www.neha.org](http://www.neha.org) (click on "Continuing Education"),  
b) Fax the quiz to (303) 691-9490, or  
c) Mail the completed quiz to  
*JEH* Quiz, NEHA  
720 S. Colorado Blvd., Suite 1000-N  
Denver, CO 80246.
- Be sure to include your name and membership number!
4. One CE credit will be applied to your account with an effective date of May 1, 2014 (first day of issue).
  5. Check your continuing education account online at [www.neha.org](http://www.neha.org).
  6. You're on your way to earning CE hours!

#### Quiz Registration

Name \_\_\_\_\_

NEHA Member No. \_\_\_\_\_

Home phone \_\_\_\_\_

Work phone \_\_\_\_\_

E-mail \_\_\_\_\_

#### JEH Quiz #4 Answers January/February 2014

- |      |      |      |       |
|------|------|------|-------|
| 1. d | 4. a | 7. c | 10. a |
| 2. b | 5. b | 8. b | 11. b |
| 3. c | 6. b | 9. d | 12. a |

#### → Quiz deadline: August 1, 2014

1. The study analyzed data from both the Hazardous Substances Emergency Events Surveillance (HSEES) system and the National Electronic Injury Surveillance System (NEISS).  
a. True.  
b. False.
2. Pool chemical incidents made up \_\_\_ of all HSEES incidents reported in 2001–2009.  
a. 0.6%  
b. 3.6%  
c. 6.7%  
d. 9.3%
3. The most commonly reported contributing factor to acute pool chemical incidents was  
a. bad weather.  
b. equipment failure.  
c. intentional or illegal action.  
d. human error.
4. The most frequent secondary contributing factor to acute pool chemical incidents was  
a. fire.  
b. illegal or improper dumping.  
c. improper mixing.  
d. improper filling, loading, or packing.
5. \_\_\_ and \_\_\_ were the two demographic groups most affected by pool chemical incidents.  
a. The general public; employees  
b. The general public; students  
c. Students; employees  
d. Responders; the general public
6. The study's data show that a higher proportion of injured persons were \_\_\_ compared to NEISS data.  
a. under 10 years old  
b. under 18 years old  
c. over 18 years old and under 60 years old  
d. over 60 years old
7. The \_\_\_ sector had the second highest percentage of pool chemical incident events and the highest percentage of injured persons.  
a. accommodation and food services  
b. private residence  
c. art, entertainment, and recreation  
d. retail trade
8. Of the 400 pool chemical incident events that occurred in 2001–2009, \_\_\_ happened at private residences.  
a. 7.3%  
b. 9.8%  
c. 21.8%  
d. 38.8%
9. Limitations in using the HSEES data for this study include the following:  
a. Not all pool chemical incidents are reported to the HSEES system.  
b. Misidentification of some chemicals during data entry might have occurred.  
c. The HSEES system was not designed to specifically track pool chemical incidents.  
d. All of the above.
10. \_\_\_ and \_\_\_ were the most frequently reported injuries/symptoms occurring in pool chemical incidents.  
a. Eye irritation; skin irritation  
b. Eye irritation; gastrointestinal problems  
c. Respiratory irritation; eye irritation  
d. Respiratory irritation; skin irritation
11. Of the 428 pool chemicals released in the 400 pool chemical incidents, \_\_\_ were chlorine or chlorine-based disinfectants.  
a. 61%  
b. 46%  
c. 15%  
d. 13%
12. This study shows that about \_\_\_ of pool chemical incidents resulted in injured persons.  
a. 40%  
b. 50%  
c. 60%  
d. 70%

Join NEHA for a

# Food Safety Trainer Webinar

- Advance your career and earn extra income as a Food Safety Trainer
- Learn the steps you can take beyond your certificate or credential to profit from your expertise
- Discover how the experts built their client base and promoted their training businesses to the right people



Webinar:

Becoming a Successful Food Safety Trainer

Date: May 22, 2014

Time: 10:00–11:00 AM (MDT)

Webinar speakers include food safety training experts:

**Lars Johnson, CP-FS**

Owner of *LAJ Consulting* and *TouchPoint Resource Pool*, food safety certification trainer with 20 years of experience.

**Jill Paradis**

Jill created *Culinary Translations LLC* in 2004 to provide food safety training services in Spanish and English in Colorado resort communities.

**Mary Myszka, RS**

As a registered sanitarian for many years in Wisconsin, Mary began her own food safety consultation company, *Food Safety 4U* in 2006.

Register online: [nehatraining.org](http://nehatraining.org)  
Email: [support@neha.org](mailto:support@neha.org)  
Phone: 866-956-2258 ext. 340



# SUPPORT THE NEHA ENDOWMENT FOUNDATION

The NEHA Endowment Foundation was established to enable NEHA to do more for the environmental health profession than its annual budget might allow. Special projects and programs supported by the foundation will be carried out for the sole purpose of advancing the profession and its practitioners.

Individuals who have contributed to the foundation are listed below by club category. These listings are based on what people have actually donated to the foundation—not what they have pledged. Names will be published under the appropriate category for one year; additional contributions will move individuals to a different category in the following year(s). For each of the categories, there are a number of ways NEHA recognizes and thanks contributors to the foundation. If you are interested in contributing to the Endowment Foundation, please fill out the pledge card or call NEHA at 303.756.9090.

*Thank you.*

## DELEGATE CLUB (\$25–\$99)

Name in the Journal for one year and endowment pin.

**Freda W. Bredy**  
Alexandria, VA

**George F. Pinto**  
Elgin, IL

## HONORARY MEMBERS CLUB

(\$100–\$499)

Letter from the NEHA president, name in the Journal for one year, and endowment pin.

**Michele R. DiMaggio**  
Martinez, CA

**H. Harold Lehman**  
Potomac Falls, VA

**B. Robert Rothenhoefer, RS, REHS, CP-FS**  
Falls Church, VA

**James M. Speckhart, MS**  
Norfolk, VA

## 21st CENTURY CLUB (\$500–\$999)

Name in AEC program book, name submitted in drawing for a free one-year NEHA membership, name in the Journal for one year, and endowment pin.

**Scott M. Golden, RS, MSEH**  
Grove City, OH

**Bette J. Packer**  
Ham Lake, MN

**Peter M. Schmitt**  
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**Dr. Bailus Walker, Jr.**  
Arlington, VA

## SUSTAINING MEMBERS CLUB

(\$1,000–\$2,499)

Name in AEC program book, name submitted in drawing for a free two-year NEHA membership, name in the Journal for one year, and endowment pin.

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**Welford C. Roberts, PhD, RS, REHS, DAAS**  
South Riding, VA

**Walter P. Saraniecki, MS, LDN, LEHP, REHS/RS**  
La Grange, IL

## AFFILIATES CLUB

(\$2,500–\$4,999)

Name in AEC program book, name submitted in drawing for a free AEC registration, name in the Journal for one year, and endowment pin.

## EXECUTIVE CLUB AND ABOVE

(\$5,000–\$100,000)

Name in AEC program book, special invitation to the AEC President's Reception, name in the Journal for one year, and endowment pin.

### NEHA ENDOWMENT FOUNDATION PLEDGE CARD

I pledge to be a NEHA Endowment Foundation Contributor in the following category:

- |   |  |  |
|---|--|--|
| <input type="radio"/> Delegate Club (\$25)              | <input type="radio"/> Affiliates Club (\$2,500)            | <input type="radio"/> Visionary Society (\$50,000)   |
| <input type="radio"/> Honorary Members Club (\$100)     | <input type="radio"/> Executive Club (\$5,000)             | <input type="radio"/> Futurists Society (\$100,000)  |
| <input type="radio"/> 21st Century Club (\$500)         | <input type="radio"/> President's Club (\$10,000)          | <input type="radio"/> <b>You have my permission to disclose the fact and amount (by category) of my contribution and pledge.</b> |
| <input type="radio"/> Sustaining Members Club (\$1,000) | <input type="radio"/> Endowment Trustee Society (\$25,000) |  |

I plan to make annual contributions to attain the club level of \_\_\_\_\_ over the next \_\_\_\_\_ years.

Signature \_\_\_\_\_ Print Name \_\_\_\_\_

Organization \_\_\_\_\_ Phone \_\_\_\_\_

Street Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Enclosed is my check in the amount of \$ \_\_\_\_\_ payable to **NEHA Endowment Foundation**.

Please bill my: MasterCard/Visa Card # \_\_\_\_\_ Exp. Date \_\_\_\_\_

Signature \_\_\_\_\_

**MAIL TO: NEHA, 720 S. Colorado Blvd., Suite 1000-N, Denver, CO 80246, or FAX to: 303.691.9490.**

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www.county.allegheeny.pa.us

**American Academy of Sanitarians (AAS)**  
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www.sanitarians.org

**American Chemistry Council**  
www.americanchemistry.com

**Arlington County Public Health Division**  
www.arlingtonva.us

**Ashland-Boyd County Health**  
hollyj.west@ky.gov

**Association of Environmental Health Academic Programs**  
www.aehap.org

**CDP, Inc.**  
www.cdpehs.com

**Chemstar Corporation**  
www.chemstarcorp.com

**City of Bloomington**  
www.ci.bloomington.mn.us

**City of Fall River Health & Human Services**  
(508) 324-2410

**City of Houston Environmental Health**  
www.houstontx.gov/health/Environmental

**Coconino County Public Health**  
www.coconino.az.gov

**Columbia County Health Department**  
www.columbiacountyny.com/depts/health2

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www.decadesoftware.com

**DEH Child Care**  
www.denvergov.org/DEH

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www.deltatrak.com

**Department on Disability Services, District of Columbia**  
http://dds.dc.gov

**Digital Health Department, Inc.**  
www.dhdinspections.com

**Diversey, Inc.**  
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www.diversey.com

**DuPage County Health Department**  
www.dupagehealth.org

**Ecolab**  
robert.casey@ecolab.com  
www.ecolab.com

**EcoSure**  
charlesa.arnold@ecolab.com

**Elite Food Safety Training**  
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**English Sewage Disposal, Inc.**  
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**Erie County Department of Health**  
www.erie.gov/health

**Food Marketing Institute**  
www.fmi.org

**Gass Weber Mullins LLC**  
www.gasswebermullins.com

**Gila River Indian Community, Environmental Health Services**  
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**GLO GERM/Food Safety First**  
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www.glogerm.com

**HealthSpace USA Inc.**  
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www.healthspace.com

**Industrial Test Systems, Inc.**  
www.sensafe.com

**Inspect2Go**  
www.inspect2go.com

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Joe Hainline  
www.jeffcohealth.org

**Jefferson County Public Health (Colorado)**  
csanders@jeffco.us  
http://jeffco.us/health

**Kansas Department of Health & Environmental**  
jrheads@kdheks.gov

**LaMotte Company**  
www.lamotte.com

**Linn County Public Health**  
health@linncounty.org

**Maricopa County Environmental Services**  
jkolman@mail.maricopa.gov

**Mesothelioma Lawyer Center**  
www.mesotheliomalawyercenter.org

**Mid-Iowa Community Action**  
www.micaonline.org

**Mid-Ohio Valley Health Department**  
tim.l.miller@wv.gov  
www.movhd.com

**Mitchell Humphrey**  
www.mitchellhumphrey.com

**Mycometer**  
www.mycometer.com

**National Environmental Health Science and Protection Accreditation Council**  
www.ehacoffice.org

**National Registry of Food Safety Professionals**  
Lawrence Lynch  
www.nrfsp.com

**National Restaurant Association**  
www.restaurant.org

**National Swimming Pool Foundation**  
Michelle Kavanaugh  
www.nspf.org

**New Jersey State Health Department, Consumer and Environmental Health Services**  
Joe Eldridge  
www.njeha.org

**New York City Department of Health & Mental Hygiene**  
www.nyc.gov/health

**North Bay Parry Sound District Health Unit**  
www.healthunit.biz

**Nova Scotia Department of Agriculture**  
www.gov.ns.ca

**NSF International**  
Stan Hazan  
www.nsf.org

**Omaha Healthy Kids Alliance**  
www.omahahealthykids.org

**Oneida Indian Tribe of Wisconsin**  
www.oneidanation.org

**Orkin**  
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www.orkincommercial.com

**Ozark River Hygienic Hand-Wash Station**  
www.ozarkriver.com

**PerkinElmer, Inc.**  
www.perkinelmer.com

**Pinnacle Health Childhood Lead Poisoning Prevention Program**  
www.pinnaclehealth.org/Conditions---Treatments/Services/Children-s-Health/Services/Childhood-Lead-Poisoning-Prevention-Program.aspx

**Prometric**  
www.prometric.com

**Racine City Department of Health**  
www.cityofracine.org/Health.aspx

**San Jamar**  
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www.sonoma-county.org/prmd

**St. Johns Housing Partnership**  
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www.colostate.edu

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worley.johnson@eku.edu  
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www.uis.edu/publichealth

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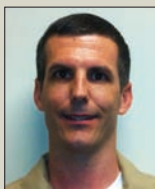
**University of Wisconsin-Stout, College of Science, Technology, Engineering, and Mathematics**  
www.uwstout.edu 

## SPECIAL LISTING

The board of directors includes NEHA's nationally elected officers and regional vice presidents. Affiliate presidents (or appointed representatives) comprise the Affiliate Presidents Council. Technical advisors, the executive director, and all past presidents of the association are ex-officio council members. This list is current as of press time.



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carolyn.harvey@eku.edu

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davidriggs@comcast.net

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nfabian@neha.org

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Arizona, California, Hawaii, and Nevada. Term expires 2015.

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# NEHA NEWS



**Staff Profile: Michael Salgado**

I am the new assistant manager for NEHA's Entrepreneurial Zone (EZ). As the assistant manager, I'm responsible for EZ's profit and loss, overseeing all EZ sales personnel, managing and successfully implementing processes for improved efficiency within the sales process and order fulfillment, managing a quarterly web newsletter to our trainer database of over 1,000 active and inactive trainers,

and assisting in the management of course curriculum and periodic reevaluations of course training material.

I'm also the liaison for all online learning platforms within NEHA's food safety training department and I manage its American National Standards Institute Food Handler program.

I have worked in private health care as a dietary aide for various long-term health care facilities. I was also enlisted in the U.S. Air Force and was stationed in California, England, Korea, and New Jersey. After the Air Force, I worked as a government contractor assisting the Air Force and as an Air Force Reservist in California. I then transitioned back into the private sector and worked with Schneider Electric. After working for Schneider, I made the move to Colorado with my son and began working with NEHA in January 2013.

When not working at NEHA, I enjoy producing and playing electronic dance music in nightclubs in Denver and around the world. I have been deejaying for 15 years in places from California to England. I love music, art, and people—all of which inspire me to deejay and produce music. 🎧

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# PRE-CONFERENCE WORKSHOPS

*Schedule is subject to change.*



## **Industry-Foodborne Illness Investigation Training and Recall Response (I-FITT-RR) Workshop**

**Monday, July 7, 8:00am – 5:00pm**

Do you and your staff know what to do if a foodborne illness or food recall occurs? If not, you need to attend this workshop to get the critical training needed to respond to these issues.

This NEHA/FDA supported workshop is designed to bridge the gap between the retail food industry and local and state regulatory officials in an effort to create stronger working relationships prior to a potential foodborne incident or recall occurring. It will help you

- understand the steps for responding to a potential illness outbreak,
- know what to do when you get customer or product complaints,
- learn what's involved in food recalls and what you need to do, and
- be more familiar with the different agencies that work together to help you get through a food-related crisis.

*This workshop is designed for retail food stores and food service establishments (restaurants, grocery stores, casinos, etc.); single unit to large chains; mid-level managers and above; and quality assurance/quality control professionals.*

*Cost to attend is \$39 per person and space is limited to 30 people.*

## **Springboard to Prevention: The Model Aquatic Health Code, 1st Edition**

**Monday, July 7, 1:00 – 5:00pm**

Over the past six years a group of public health, academic, and industry experts have been working with CDC to develop the first comprehensive public health guidance for swimming pools and aquatic venues in the U.S. This workshop will present the first completed version of the Model Aquatic Health Code (MAHC). The MAHC will be a guidance document that can help local and state authorities update or implement swimming pool and spa codes or standards without having to “recreate the wheel.” The workshop will cover

- common health concerns at aquatic venues,
- key concepts influencing lifeguarding staffing plans,
- secondary disinfection, and
- a science-based operational and communication support toolkit for aquatic and pool programs.

*Cost is free with a full or one-day conference registration to the NEHA 2014 AEC.*

# CREDENTIAL AND CERTIFICATION COURSES AND EXAMS

## Recently Added Courses!

HACCP for Retail Food Service  
HACCP for Manufacturers/Processors  
Visit [neha2014aec.org](http://neha2014aec.org) for details.

*Schedule is subject to change.*

Advance your expertise and career potential by obtaining a NEHA credential or certification at the AEC. You may choose to take just a credential/certification course, just an exam, or both a course and an exam while at the NEHA AEC. (Note: Only qualified applicants will be able to sit for an exam.)

## Certified Professional of Food Safety (CP-FS)

Friday & Saturday, July 11 and 12, 8:00am – 5:00pm

This two-day refresher course is designed to enhance your preparation for the NEHA 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 job task analysis. The instructor will be available during and after the course for questions.

*Cost: \$325 for members and \$425 for non-members, which includes the CP-FS Study Package (newly revised and updated CP-FS manual, NEHA's Professional Food Manager book, and the 2009 and 2013 FDA Food Codes on CD), a \$145 value.*

**Exam: Sunday, July 13, 8:00 – 10:30am**

*Separate application and exam fee required. \$245 member/\$390 non-member. Deadline to apply to take the exam is May 30, 2014.*

## Certified in Comprehensive Food Safety (CCFS)

Wednesday & Thursday, July 9 and 10, 8:00am – 5:00pm

NEHA is pleased to offer the introductory course for the Certified in Comprehensive Food Safety (CCFS) credential at the 2014 AEC. The CCFS is a strong core credential for food safety professionals with a primary concern of overseeing the 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 community that provide oversight in preventing food safety breaches at U.S. production and manufacturing facilities and abroad. The credential course will cover exam content areas as described in the job task analysis. The course will utilize different learning modalities from critical thinking exercises to small group breakouts and videos.

*Cost: \$325 for members and \$425 for non-members, which includes NEHA's brand new CCFS Preparation Guide.*

**Exam: Friday, July 11, 8:00 – 10:30am**

*Separate application and exam fee required. \$245 member/\$390 non-member. Deadline to apply to take the exam is May 30, 2014.*

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

Friday & Saturday, July 11 and 12, 8:00am – 5:00pm  
Sunday, July 13, 8:00am – 12:00pm

This two and a half day refresher course is designed to enhance your preparation for the **NEW 2014 NEHA 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 alone is not enough to pass the REHS/RS credential exam. The class will cover exam content areas as described in the job task analysis. The instructor will be available during and after the course for questions.

*Cost: \$499 for members and \$599 for non-members, which includes the newly revised and updated REHS/RS Study Guide, a \$179 value.*

**Exam: Sunday, July 13 1:00 – 6:00pm**

*Separate application and exam fee required. \$265 member/\$450 non-member. Deadline to apply to take the exam is May 30, 2014.*

*The July 13 REHS/RS exam is newly revised. Visit [neha.org/credential/rehs2014](http://neha.org/credential/rehs2014) for new course outline, updated study guide, and other details.*

## Certified Pool/Spa Operator® Certification Course (CPO®)

Friday & Saturday, July 11 and 12, 8:00 am – 5:00 pm  
(includes exam)

This two-day course is designed to provide individuals with the basic knowledge, techniques, and skills of pool and spa operations. The CPO® certification program includes pool and spa chemistry, testing, treatment, filtration, maintenance, automatic feeding equipment, and government requirements. The CPO® certification program requires an open book written examination and certification is valid for five years.

*Cost: \$300 for members and non-members, which includes the NSPF Pool & Spa Operator Handbook and CPO® certification fee, a \$115 combined value.*

## CONTINUING EDUCATION (CE) CREDITS

Earn up to 24 hours of CE contact hours (enough to meet your full two-year NEHA professional credential requirement) by attending and participating in the NEHA AEC. CEs can be fulfilled by attending:

- First Time Attendee Workshop
- Training and Educational Sessions
- The Keynote Session
- Pre-Conference Workshops
- Credential Review Courses
- Educational sessions via the Virtual AEC while they are being shown live during the AEC or as an archive after the AEC is over

# INNOVATION & INTERNATIONAL SESSIONS

*Building a World of Innovative Ideas for Environmental Health*



This year's combined NEHA and IFEH event will offer sessions that help environmental health professionals adapt to and excel in the ever-changing economic, professional, and global landscape by learning the best tips, tricks, and tweaks needed to thrive in their positions.

## **CHILDREN'S EH**

### **Keeping Children Safe and Healthy Through Comprehensive Child Care Center Regulations**

Are your children protected against secondhand smoke, scalding hot water, and shigellosis outbreaks in the child care center where they spend a great deal of time? Are they assured of receiving healthy meals and regular outdoor exercise in a safe playground? Learn in this session how one county developed environmental health regulations to ensure protections against these and other environmental hazards and how you can do the same in your jurisdiction.

## **EMERGENCY PREPAREDNESS & RESPONSE**

### **Environmental Health and Disaster Management: An International Effort for Training and Awareness**

Globally, environmental health professionals have a critical role in mitigating public health risks before and after disasters. To build this capacity, IFEH, CDC, and NEHA have collaborated to develop the course "Environmental Health and Disaster Management," which was heavily guided by CDC's successful Environmental Health Training in Emergency Response course. Attend this session to see how this type of course promotes the profession and ensures that professionals are adequately equipped to prepare, respond, recover, and mitigate the adverse impacts of disasters internationally.

### **Incorporating Emergency Preparedness into Retail Food Facility Inspections**

What can you do to make food facilities strong and capable of moving forward after a disaster? This session will describe how to efficiently address emergency preparedness with operators during routine food facility inspections and will provide resources for your reference. This approach provides an opportunity for the regulator and operator to partner not only to increase chances of the facility's success after a disaster, but to reduce time spent on post-disaster assessment, and protect the public's health at the same time.

### **Protecting the Living Environment of Survivors in Congregate Shelters During Disasters: Is Public Health Ready?**

Shelters play an important role in providing safety and basic human needs for survival during disaster situations and are an important priority for public health agencies responding to any disaster. This session will describe the current knowledge and use of assessments as well as the importance and benefits of using them as a data collection tool for decision making and occupant protection. Attend this session to see how to implement assessment procedures and tools in your jurisdiction's disaster response.

### **Disaster Management Challenges From Non-Communicable Diseases: Lessons Learned and Questions Going Forward**

Due to population aging and an increase in longevity, there has been a disease transition to non-communicable diseases (NCDs), which are the challenge for the 21st century. This is a new concept for environmental health and disaster management to explore, as the focus has traditionally been on communicable diseases in the disaster setting. Today, damages to public health infrastructure such as food, water, and sanitation place the vulnerable population with NCDs at great





risk. Attend this group exercise to discuss and debate possible approaches to and roles environmental health professionals play in mitigating the risks of disaster.

## **ENVIRONMENTAL JUSTICE**

### **101 Ways to Improve Health Equity**

IFEH works to disseminate knowledge concerning environmental health and promote cooperation between countries where environmental health issues are transboundary. IFEH recently adopted Policy 10, based on the WHO report “Closing the Gap in a Generation,” which aims to improve health equity through action on the social determinants of health. The session will showcase how colleagues around the world are making a difference! What problem are they addressing? What actions have been taken? What outcomes are being delivered? And, how can YOU make a difference where YOU are?

## **FOOD PROTECTION AND DEFENSE**

### **Foods Without Frontiers**

“Farm to Fork” is a great slogan, but how do we really ensure food safety when the farm is in one country, processing in another, and consumers in a third, fourth, or more countries? Using the recent international food safety recall of Karicare Whey Protein Concentrate for a contaminated ingredient, you’ll see that simply knowing about an adverse event in your country is no longer enough. This session will identify gaps in international incident notification systems such that attendees will be equipped to act to fill those gaps and respond promptly and efficiently to the next incident that arrives at the shipping dock.

### **Focusing Disney Magic on Food Safety**

This Learning Lab will demonstrate how the latest Disney technologies and smart temperature probes are being used in food service food safety and impacting inspections. When you put your hands on these technologies in this session, you’ll have a FASTPASS for food safety. Bypass the complexity. Go straight to the critical control points. Take your process for a ride. And when it’s all over, you get a digital “picture” for your records. This session will give you the skills and confidence you need to conduct inspections or audits in facilities using these types of technologies.

### **How to Deliver Effective Food Safety Programs on a Tight Budget**

Due to the worldwide economic downturn and its effect on government spending, existing UK delivery models for food hygiene inspections are now in need of review. This session will quantifiably describe the economic and programmatic challenges agencies are facing using Wales as the example. The session will examine the traditional food hygiene inspection program model and then evaluate contemporary adaptive approaches that are more innovative, imaginative, and targeted. These techniques may help your agency provide a quality service while protecting public health.

### **Catch Me If You Can—Misbranding, Adulterating, and Counterfeiting Foods: A National/International Food Incident Workshop**

Recent food fraud incidents involving melamine, horse meat, and rat meat necessitate that local, national, and international government and industry stakeholders have knowledge of response when an incident occurs in their jurisdictions. The newest FDA Food Related Emergency Exercise Bundle (FREE-B) exercise explores such a food fraud scenario. When faced with this situation, what are the risks? Who gets involved? What are the handoffs to different national or international government agencies? This workshop includes live participation of international stakeholders via a web platform. In addition, related multi-lingual educational materials will provide attendees with immediately applicable resources for the stakeholders in their own jurisdictions.

## **HEALTHY HOMES AND COMMUNITIES**

### **Clever Software Tools That Advance Health in Homes**

Get an introduction to the Housing Health and Safety Rating System (HHSRS) and English housing enforcement work. Then try two useful software tools to help with using HHSRS. Hunt for hazards in a virtual home, a tool which can be taken away for free. Then try an online tool to justify budgets by calculating the cost savings from using the HHSRS. Bring your laptops and tablets!

### **Implementing a Community-Based Child Care Program Utilizing the Healthy Homes Rating System**

This session will review a case study of the expansion of the local healthy homes program to home-based and small child

care providers. A community organization created a new healthy child care assessment program based on the Healthy Homes Rating System. The program rates 29 environmental, health, and safety hazards for their potential to harm residents and enables those risks to be mitigated. The local fire department even accepts the assessment as equivalent to a fire inspection. Attend this session to learn how a program like this can benefit your community.

## **LAND USE PLANNING & DESIGN**

### **Outside-the-Box Advocacy: Organizing Public Health’s Engagement in Built Environment Advocacy**

The buzz phrase “Health in All Policies” has almost become ubiquitous, especially in public health’s efforts to come to the land use planning and infrastructure design discussion. Tulsa Health Department will share their project’s success using community engagement and collaborative relationships. They’ll provide you with some innovative techniques to use when resources are limited to educate and advocate for health with decision makers, the public, and your own agency.

### **Annoyance and Perception of Noise in Rural and Urban Areas of France**

Traffic, urban, and occupational noises are now described as major environmental problems, which can greatly interfere with health. This session will discuss the results of a survey conducted to identify the perception of noise pollution in occupational and domestic environments. Attend this presentation to identify possible interventions and recommendations that may alleviate health risks from noise pollution.

*NEHA and SORA are again partnering to bring together onsite regulators and industry leaders for decentralized and onsite wastewater treatment. The sessions offered by the NEHA and SORA partnership will focus on topics such as sustainability, reuse, reciprocity, and other emerging issues.*

## **ONSITE WASTEWATER**

### **Sustainability Is the Name of the Game: EPA’s Decentralized Wastewater Program Efforts**

There are small and underserved rural communities across the U.S. in need of first-time and adequate access to water and

wastewater infrastructure. Through joint efforts with many government agencies, EPA has developed programs and tools such as workshops in a box to assist these communities in creating sustainable solutions that will meet their current and future needs. Attend this session to gain knowledge and resources to implement programs in your community even on a shrinking budget.

**Currumbin—A Community Designed Around Environmental Sustainability and Wastewater Reuse in Queensland, Australia (NEHA/SORA session)**

On the Gold Coast of Queensland, Australia, EcoVillage at Currumbin is a community focused on implementing and teaching sustainable development principles. Wastewater systems were chosen that created the lowest total impact to the environment in its manufacturing, construction, and operation. After treatment followed by UV and chlorine disinfection, the wastewater from 144 homes and numerous community facilities is recirculated to homes for reuse via toilet flushing, car washing, garden watering, and landscape irrigation. Attend this session to see how these award-winning techniques could make a difference in your community.

**PATHOGENS AND OUTBREAKS**

**Who's Missing From the Table? Building Partnerships With the Medical Community in Foodborne Illness Surveillance**

Detecting increases in self-reported foodborne illnesses and low report rates by medical providers, Kern County Environmental Health implemented an innovative approach to enhance collaboration between environmental health, public health, and the medical community. The execution of the Foodborne Illness Surveillance Guidance Training for Medical Professionals became a successful method in communicating with the medical community and improving foodborne illness surveillance. This presentation will provide an overview of the workshop design, challenges, results, and next steps that you may want to apply within your community.

**Restroom Infection Control: Chlorhexidine, the Final Frontier**

Pioneering, award-winning work at the Queen Elizabeth Hospital, UK, has demonstrated the remarkable residual antimicrobial activity of chlorhexidine on surfaces, thereby maintaining their continuous cleanliness over time. In this school-setting trial, the presenters will

demonstrate significant improvements in continuous cleanliness of restroom door handles. Attend this session and join in the discussion of the possible benefits of applying this simple, inexpensive technique beyond clinical and office environments.

**RECREATIONAL WATER**

**Rethinking Recreational Water Monitoring: Can Predictive Modeling Increase Public Health Outcomes?**

Canadian recreational water safety practices are put into an international context by comparing them with the EPA and WHO guidelines. A review of the use of a geometric mean will identify the limitations of using bacteriology in general, and the geometric mean of *E. coli* in particular, as the basis of recreational water safety decision-making, and determine the most appropriate, evidence-based values of the geometric mean for recreational water to be considered safe. Use these results in your organization to create a comprehensive risk assessment strategy, forecasting models, and risk management approaches to posting recreational water safety.

**Developing a Drowning Prevention Awareness Program That Works for You (NEHA/APSP session)**

The Florida Department of Health, Brevard County, won the 2013 Dr. Neil Lowry Award for their very successful drowning prevention program. This presentation will illustrate the importance of public outreach and demonstrate how to fund your program with grant writing and develop novel partnerships. Could implementing these key elements save lives in your community?

**VECTOR CONTROL & ZOONOTIC DISEASES**

**Get Results! Tools for Managing a Public Health Nuisance Program (Sponsored by Orkin)**

The housing crisis and diminished mental health services have resulted in more complaints and public health nuisance inspections at Franklin County Public Health. See how simple triage and scoring tools were used to categorize and prioritize complaints to get results and gain recognition in the community. In this session, you'll be able to evaluate this approach and test these tools as a way for your department to manage public health nuisances with limited funds and staff.

**Integrated Approach to Malaria Prevention in Uganda: Experiences From a Pilot Project**

This pilot project promoted an integrated approach to the prevention of malaria at the household level in two rural communities where malaria is the leading cause of morbidity and mortality. This project conducted a baseline survey on malaria prevention knowledge and practices, trained community health workers, increased awareness of the population of an integrated approach to malaria prevention, and established study demonstration sites. The integrated approach to malaria prevention was well received by the study communities and work continues to assess health benefits and community perceptions of this approach. Available data will be shared with attendees during the session.

**WATER QUALITY**

**Tools and Data for Identifying Areas With a High Potential for Private Well Contamination**

In many areas there are concerns about private well water quality, but little data on levels of contaminants such as nitrate, arsenic, and uranium. We have compiled extensive groundwater quality data from national, state, and local sources and generated maps spanning the U.S. showing where there is the greatest chance of elevated levels of these contaminants. In this session, you will be shown how to access and interpret these maps and data for application in your jurisdiction.

**Attend the Awards Ceremony on July 8 to find out who wins the NEHA Environmental Health Innovation Award.**

In its second year, this award is presented to an individual, team, or organization for an innovative contribution in the form of a new idea, practice, or product that has had a positive impact on improving environmental public health and the quality of life. Change that promotes or improves environmental health protection is the foundation of this award.

# MORE SESSIONS BY TRACK

Acquire comprehensive information from subject matter experts and industry leaders, and learn from your peers as you share.

## **CHILDREN'S EH**

- Lessons Learned About Environmental Health in the World of Child Care
- Beating the Odds: Eliminating Lead Exposure for Kids in the Nation's Capital
- Association Between Risk of Birth Defects and Arsenic Concentrations in Soils of China

## **EMERGENCY PREPAREDNESS & RESPONSE**

- Hurricane Sandy: A Complex Environmental Health Communications Challenge
- Enhancing Planning and Preparedness: Development of an E-Learning Tool for Chemical Incidents
- Public Health Preparedness: Examination of Legal Language Authorizing Responses to Radiological Incidents
- Destructive Wildfires and Devastating Floods: EH's Response and Role in Recovery
- To Tweet or Not To Tweet: Leveraging Social Media for Environmental Health

## **FOOD PROTECTION AND DEFENSE**

- Food Safety Focus Series I: A National Collaborative Effort to Support the FDA National Retail Food Regulatory Program Standards (*Sponsored by Prometric and Skillsoft*)
- Food Safety Focus Series II: Local Experiences With the FDA Retail Food Program Standards (*Sponsored by Prometric and Skillsoft*)
- Food Safety Apps Can Improve Food Safety Standards
- Applying a Behavior Change Model Proven to be Effective in Child Care Settings to Licensed Food Establishments
- Investigation of a Large Foodborne Illness Outbreak in Toronto, Canada

- Southern Nevada Health District THINK RISK Initiative
- FDA's Oral Culture Learner Project: Helping Food Employees Understand the Importance of Food Safety
- The Great Food Truck Race...for Food Safety
- Flip the Fear: How the FDA, ADA, and Lesley University Changed the Face of Public Health and Food Safety in 2013
- Nanotechnology Implications for Food and Food Safety

## **HAZARDOUS MATERIALS AND TOXIC SUBSTANCES**

- Burning to Know: Neighborhood Mercury Exposure From Crematoriums
- Lead Poisoning Outbreak Resulting From Construction and Renovation at an Indoor Firing Range
- Smoke and Ash Deconstructed—Not Just Particles

## **HEALTHY HOMES AND COMMUNITIES**

- Hazard Assessment in Houses and Some Clever Software Tools
- Multi-Agency Approach in the Closure of a Motel
- Fungal Bioburden in Foreclosed Homes Using ERMI<sup>sm</sup> as an Indicator
- The Public Health Challenge of Hoarding
- Pesticide Usage and Pesticide Dust Concentrations in Residences of Asthmatic Children Living in Subsidized Housing in Philadelphia

## **LAND USE DESIGN & PLANNING**

- Developing Policy to Address Near Roadway Pollution Health Hazards
- Annoyance and Perception of Noise in Rural and Urban Areas of France

- Outside-the-Box Advocacy: Organizing Public Health's Engagement in Built Environment Advocacy
- Levels of Heavy Metals in Traffic-Related Particulate Matter Along a Major Motorway in Nigeria
- Keys to Facilitating Healthy Cities Partnership in Indonesia: A Case Study
- Air Quality Assessments Using Satellite Derived High Resolution Aerosol Optical Depth Retrievals

## **LEADERSHIP/MANAGEMENT**

- Building Agency Capacity
- Leadership Development: Key Considerations for Mentoring Millennials
- Characterization of Competencies Required for Successful Environmental Health Work
- American Academy of Sanitarians Presents an Environmental Health Master Class
- Building an Environmental Health Program of Excellence in a Time of Austerity
- Organizational Culture Change: A Local Experience of Going From Fair to Great
- Implications of the Affordable Care Act on Environmental Health

## **ONSITE WASTEWATER**

- Transfer of Property Requirements: Training, Certification, and Politics
- Grey Water and Water Reuse in the Southwest
- Market Impacts of Product Testing, Product Acceptance, and Regulations (NEHA/SORA session)
- Onsite Wastewater Treatment and the Value of Independent Certification
- The Proliferation of Blue-Green Algae: Context, Challenges, and Innovative Solutions
- Realtors and Environmental Health, Partners in a Successful Mandatory Point-of-Sale Program

## Be a voice.

You Spoke, We Listened...

NEHA used your participation in our 2014 Abstracts Blog and your responses to our conference surveys as guidance in choosing sessions and developing the training and education program. THANK YOU for giving us feedback so we can advance the proficiency of the environmental health profession AND help create bottom line improvements for your organization!

### FROM THE BLOG

- The Great Food Truck Race...for Food Safety
- Restroom Infection Control: Chlorhexidine, the Final Frontier
- Arsenic in Iowa's Groundwater—The Unknown Threat: A Pilot Study in Cerro Gordo County
- Triggers for Change in the Safest Place on Earth
- Disaster Management Challenges From Non-Communicable Diseases: Lessons Learned and Questions Going Forward

### FROM CONFERENCE SURVEYS

- Inspection technology and use of apps in EH:
  - » Help! Everyone Wants My Data: A Look at Streamlining Data Collection for Environmental Health Programs
  - » Enhancing Planning and Preparedness: Development of an E-Learning Tool for Chemical Incidents
  - » Focusing Disney Magic on Food Safety
  - » Food Safety Apps Can Improve Food Safety Standards
  - » Using the Lean Program to Improve Efficiency in Environmental Health Services
- The Leadership/Management track will address your concerns related to:
  - » The future of the EH practice
  - » Demonstrating program effectiveness
  - » Value and return on investment for environmental health programs
  - » Building agency capacity under reduced budgets and staffing collaborations/programs
- Hoarding, bed bugs, and rats—we've got them covered in our Vector Control & Zoonotic Diseases and Healthy Homes and Communities tracks!
- Evaluation of the built environment and its link to public health—check out sessions in the Land Use Planning & Design track!

### PATHOGENS AND OUTBREAKS

- Don't Gamble With Norovirus: Prevention, Control, and Containment of a Norovirus Outbreak in a Casino
- Issues and Challenges: Investigation of a Foodborne Outbreak in Jamaica
- Investigation of a Foodborne Illness Outbreak in Toronto, Canada

### RECREATIONAL WATERS

- Chlorine Resistant Pathogen Treatment Strategies for Recreational Water (NEHA/APSP session)
- Gage-Bidwell Law of Purification: Old Errors Corrected and New Relevance Identified (NEHA/APSP session)
- Developing a Drowning Prevention Awareness Program That Works for You (NEHA/APSP session)
- Hot Tub and Spa Inspection Data: The Power to Prevent Illness and Injury
- Pool and Spa Safety Act Program: Implementation and Findings in Seattle and King County

### SCHOOLS/INSTITUTIONS

- Food-Safe Schools: Food Safety Beyond the Cafeteria
- School Indoor Air Quality Improvement: Lessons from Multnomah County, Oregon
- Correcting Corrections: Surviving Jail Inspections and High Risk Inmate Activities

### SUSTAINABILITY/CLIMATE CHANGE

- Climate Change and Sustainability: Navigation of Governance, Energy, and Built Environment Opportunities
- Triggers for Change in the Safest Place on Earth
- International Perspectives on Climate Change and the Role of Environmental Health
- Climate Change Impacts and Options: Case Studies in the Northwest Arctic Borough, Alaska

### TECHNOLOGY AND EH

- Help! Everyone Wants My Data: A Look at Streamlining Data Collection for Environmental Health Programs
- Building Agency Capacity
- Environmental Public Health Tracking: Developing Nationally-Consistent Community Environmental Health Profiles
- Public Health Mythbusters
- Using the Lean Program to Improve Efficiency in Environmental Health Services
- Implementation of GIS for Research on Neural Tube Defects in China
- Pick a Favorite Technology To Help You Improve Inspection-Based Hand Washing

### VECTOR CONTROL & ZOONOTIC DISEASES (SPONSORED BY ORKIN)

- University Integrated Pest Management Program Success With GIS Mapping Software
- Integrated Approach to Malaria Prevention in Uganda: Experiences From a Pilot Project
- Hantavirus in Northern Arizona: Investigation and Response
- Stamping Out Bed Bugs: An Organization and Systems Approach in Action
- New Urban Rat Control Program Development in the Post Recessionary Environment
- Using Heat to Treat for Bed Bugs in a Homeless Shelter
- Get Results! Tools for Managing a Public Health Nuisance Program

### WATER QUALITY

- Tools and Data for Identifying Areas With a High Potential for Private Well Contamination
- Using a Rapid Bacteria Screening Method to Assess *Legionella* Risk
- Containing an Outbreak of Cryptosporidiosis in Galway: The Role of the Environmental Health Service
- An Innovative Response to Preventing Legionellosis Outbreaks
- Arsenic in Iowa's Groundwater—The Unknown Threat: A Pilot Study in Cerro Gordo County



# NEHA 2014 AEC SCHEDULE AT-A-GLANCE

*Schedule is subject to change.*

	SAT // July 5	SUN // July 6	MON // July 7	TUE // July 8	WED // July 9	THU // July 10	FRI // July 11	SAT // July 12	SUN // July 13
EHAC Meeting	EHAC Meeting	NEHA Board of Directors Meeting	Educational Sessions	Exhibition Open • Poster Session • Silent Auction	Town Hall Assembly				
FEH Council Meeting	International Environmental Health Faculty Forum Business Meeting	Pre-Conference Workshops: • Industry-Foodborne Illness Investigation Training and Recall Response Workshop • Model Aquatic Health Code Workshop • NEHASORA Onsite Wastewater Field Trip	International EH—IFEH Special Sessions	Student Research Presentations	CCFS Course	Educational Sessions	Credentials & Certifications • CCFS Exam • CP-FS Course • REHS/RS Course • CPO® Course • HACCP: Managing Risks for Foodservice and Retail Food Operations Course	Credentials & Certifications • CP-FS Course • REHS/RS Course • CPO® Course & Exam • HACCP: Managing Risks for Foodservice and Retail Food Operations Exam	Credentials & Certifications • CP-FS Exam • REHS/RS Course & Exam
			“Thank You Luncheon” for guests staying at the AEC designated hotel for two or more nights	CCFS Course					
	International Environmental Health Faculty Forum & EHAC Joint Meeting	IFEH Regional Meetings AEHAP Annual Meeting	Awards Ceremony & Keynote Address	Networking Luncheon (Sponsored by American Public University)	International EH—IFEH Special Sessions	SORA Educational Sessions	• HACCP Basics for Processors and Manufacturers	• HACCP Basics for Processors and Manufacturers	
	IFEH AGM Meeting	Community Volunteer Event		International EH—IFEH Special Sessions					
		First Time Attendee Workshop	Exhibition • Grand Opening & Party • Poster Session			President’s Banquet			
		Annual UL Event							

AEHAP = Association of Environmental Health Academic Programs

EHAC = National Environmental Health Science & Protection Accreditation Council

IFEH = International Federation of Environmental Health

SORA = State Onsite Regulators Alliance

*Stay at the designated AEC hotel—The Cosmopolitan of Las Vegas—for two or more nights and attend a free “Thank You Luncheon” on Tuesday, July 8. Certain terms and conditions apply. See Web site for details.*

# KEYNOTE SPEAKER

*The National Environmental Health Association is pleased to announce that Mark Keim, MD, with the Centers for Disease Control and Prevention, will address attendees of the 78th Annual Educational Conference (AEC) & Exhibition as the keynote speaker.*

With the expanded international audience at this year's AEC, you'll want to hear Dr. Keim's perspective on emerging and contemporary issues, including the far-reaching health effects of global climate change.

**Register today for the 2014 AEC so you don't miss this opportunity!**



**NSF** *The keynote speaker is sponsored by NSF International.*

***Check out the sessions in the Sustainability/Climate Change Track for more on this topic!***

The National Environmental Health Association is pleased to announce that Mark Keim, MD, Associate Director for Science in the Office for Environmental Health Emergencies, National Center for Environmental Health/Agency for Toxic Substances and Disease Registry at the Centers for Disease Control and Prevention (CDC), will be the keynote speaker for this combined IFEH and NEHA environmental health event.

Dr. Keim will be speaking on emerging and contemporary issues, including the far-reaching health effects of global climate change.

In addition to his current role, Dr. Keim has spent many years working for the CDC in many capacities including Acting Associate Director in the Office of Terrorism Preparedness and Emergency Response, Medical Officer and Team Leader at the International Emergency and Refugee Health Branch, and Acting Associate Director for Science in the Division of Emergency and Environmental Health Services. He is also an adjunct faculty member at the Rollins School of Public Health at Emory University.

Dr. Keim has provided consultation for the management of dozens of disasters involving the health of literally millions of people throughout the world. Dr. Keim is the author of several hundred scientific presentations, 40 journal publications, and 13 book chapters.

Dr. Keim received numerous awards for his work in CDC's emergency operations during the World Trade Center, anthrax letter, and Hurricane Katrina emergencies, as well as for leading the U.S. health sector response after the Indian Ocean tsunami.

He has been a member of the White House Subcommittee for Disaster Reduction since 2006. He served as a review editor for the United Nations Intergovernmental Panel on Climate Change from 2009 to 2011.

# NETWORKING

*Strengthen your business and personal relationships and build a network of colleagues—in the U.S. and across the world—that you can call on at anytime!*

- Before You Arrive: Send meeting requests through the networking features of the **Virtual AEC—Your Meeting Companion**
- Monday: Mingle with peers and give back to the community hosting the AEC by signing up for the **Community Volunteer Event**. Reunite with friends at the always-exciting **UL Event** in the evening!
- Tuesday: Connect with exhibitors at the **Exhibition Grand Opening & Party**
- Wednesday: See exhibitors you missed the day before and chat with colleagues during the **Networking Luncheon**
- Thursday: Collaborate with other professionals at the **Town Hall Assembly**. Reconnect with everyone you have met during the AEC at the **President's Banquet**
- After the AEC: Stay connected to your friends and contacts after leaving the conference through the **AEC and NEHA social media channels**

## Annual UL Event



*A trip to Las Vegas would not be complete without enjoying its world-class entertainment.*

**Monday, July 7, from 6:30–10:30pm**

Join us for the Annual UL Event and get ready for an evening with one of the best entertainers in the industry today. As a successful headliner on the Las Vegas Strip, Terry Fator captures the hearts and funny bones of audiences from around the world with **Terry Fator: The VOICE of Entertainment**. Backed by a live band, Fator wows audiences nightly with singing, comedy, and unparalleled celebrity impressions. The “America’s Got Talent” winner brings to life a hilarious range of characters including Winston, the

impersonating turtle; Emma Taylor, the little girl with the big voice; and Monty Carlo, the lounge singer. Enjoy comedic banter and amazing vocal impressions of musical superstars such as Garth Brooks, Dean Martin, Aretha Franklin, Lady Gaga, and more. **Terry Fator: The VOICE of Entertainment** is a one-of-a-kind experience, only at The Mirage.

*The UL Event is not included in the registration pricing for the AEC. Price is \$65 per ticket for the first 175 tickets that are purchased and \$75 for each ticket thereafter. To register for this event, visit [neha2014aec.org/register](http://neha2014aec.org/register).*

## 4th Annual Community Volunteer Event



Clean the World™



*For more details and to sign up as a volunteer, visit [neha2014aec.org](http://neha2014aec.org).*

### **SORTING SOAPS TO CLEAN THE WORLD**

**Monday, July 7, from 1:00–3:00pm**

The community volunteer event is designed to give back to the AEC host city community and enhance NEHA’s “green” efforts to reduce the footprint of the NEHA 2014 AEC and IFEH 13th World Congress.

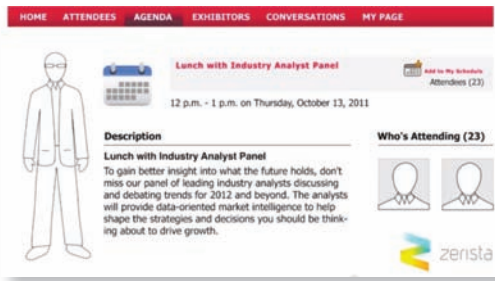
This year’s community volunteer activity helps reclaim and repurpose waste from the hospitality industry and provides for people in need. Clean the World is a non-profit organization that collects and redistributes personal care items and gives them to domestic homeless shelters and impoverished countries suffering from high death rates due to hygiene-related illnesses. Since its inception in 2009, Clean the World

has put over nine million soap bars and two million pounds of bottled amenities back into human use, simultaneously diverting over 600 tons of waste from landfills.

Network with colleagues and contribute to a local and global cause while participating in volunteer activities which may include sorting amenities by content and package type, cleaning and boxing amenities, assembling hygiene kits, taking inventory, or writing educational and inspirational notes to recipients.

When you sign up, please be sure to read and be prepared with required attire and waiver. Join your fellow environmental health colleagues at Clean the World’s Las Vegas Recycling Operations Center and make a difference locally and internationally!

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- **Network and converse:** “Meet” other attendees, speakers, and exhibitors via the chat forums. Request meeting connections, swap digital business cards, or connect digitally with others in your area of specialty or geographic region.
- **Learn:** Attend some of the educational sessions as they occur via live streaming broadcast. Use the chat feature to ask questions, post comments, and communicate with speakers and other attendees. Discover the latest innovative products and services shared by AEC exhibitors. After the conference, you can still access the educational sessions, view presentation slides, and obtain supplemental material through the continuing education resource.

# CONFERENCE REGISTRATION

Registration information is available at [neha2014aec.org](http://neha2014aec.org). For personal assistance, contact Customer Service toll free at 866.956.2258 (303.756.9090 local), extension 0.

	Member	Non-Member*
Full Conference Registration	\$575	\$735
One Day Registration	\$310	\$365
Student/Retired Registration	\$155	\$230

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*This registration pricing is good until May 30, 2014. Registration prices will increase after this date.*



# LAS VEGAS, NEVADA

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Take a walk down the Vegas Strip and try your luck at one of the many casinos that have made the city famous. And with hundreds of different restaurants, the city can cater to every taste and craving.

Las Vegas also plays host to almost any type of live entertainment you can imagine. You can see live comedy, stage shows, and concerts, or take in one of the many

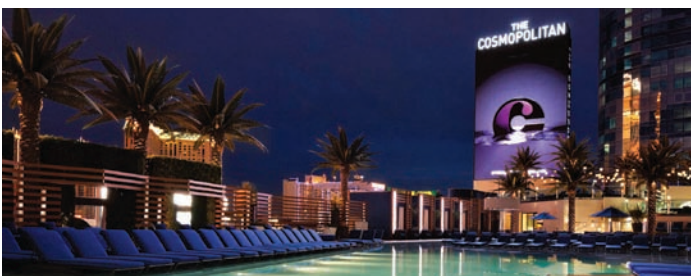
permanent fixtures of the Las Vegas entertainment industry like the Blue Man Group, Cirque du Soleil, or Penn and Teller.

For people looking to relax and unwind, Las Vegas has you covered. Treat yourself to a day at one of the city's many spas and resorts, or get out of the city and spend some time on the golf courses.

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**Managing Editor's Desk***continued from page 74*

available through such communities can be richer and more responsive than what is available through association channels. Even corporations are now creating communities with fanfare and success.

In the wake of these developments, a discernable movement now exists within the association world toward nonmember, community-inclusive business models. It is fascinating to follow this movement and its effort to break free from the dues dependency that the existing association membership model is built upon. It occurs to me that growing numbers of association executives are realizing that membership dues function as artificial barricades to association citizenship for large numbers of people who are otherwise honorable members of the wider community that the association claims to serve. With the emergence of alternative community building tools, it is hardly surprising that we're now seeing heightened interest in more inclusive association business models.

We (environmental health) are a community and to be whole, we (NEHA) need to represent that community. But we also have to be financially sound. It is because of our desire to represent the entire community that in recent years we have undertaken a number of novel programs to try to significantly reduce our dependency on the dues dollar. This plan has been working. Today we derive slightly less than 5% of our total revenue from dues! I know of no dues-based association that can claim such a low percentage. By intention, NEHA is taking the steps that it needs to take to become a much more community-inclusive association.

2. **Associations as information curators.**

For way longer than I've been around, associations have been the keeper of "the information"! They have been content creators and they have charged people for their exclusive content (with "charged" meaning, dues for the member and higher prices for the nonmember).

That comfortable role is changing because the world around us is changing. Associations are no longer the only creators of content for their audiences.

*In a word, it's all  
about "communities"!*

Moreover, much of the content that associations create finds its way into the public domain where it is freely available to anyone. In addition, with many more sources of content now online, enormous amounts of content are now available for free to everyone.

So it is time for associations to say goodbye to their role as primary content providers. However. . . .

The widespread and easy availability of content is not to say that the consumer of this content is better off. In fact, many would argue that content consumers are worse off today because it now takes enormous amounts of time, which no one has in this busy and demanding world, to find that valuable nugget that is sought. This frustrating reality gives rise to a new and important role for associations: that of content curator.

In order to have an attractive value proposition for you—the people we serve—we have to provide products and services that meet your needs. We can do that better by becoming content curators. This means that we must take on several responsibilities. We have to understand your needs and pain points. We must create content that responds to those needs. We must also parse the available content to find that which is of highest value to you, i.e., content that solves your problems. And we must find ways to transform content into meaningful and useful knowledge. Our missions are clearly evolving in the direction of helping you to solve your problems.

To make this transition to content curators, associations are going to have to reexamine the kind of staff we employ as we will increasingly require professionals who can both understand our community and curate information and knowledge for it.

3. **Association management.**

It used to be that associations would fill their CEO and even senior staff positions with professionals from the field of prac-

tice represented by the association. The American Chemical Society would hire a chemist and the National Association of Mechanical Engineers would hire a mechanical engineer to run their associations and so forth. No more.

The association management field is an acclaimed professional field in its own right. The specific skill set necessary to run an association, and especially in these increasingly complicated times, is considerably different than the one necessary to be a successful chemist, mechanical engineer, or even environmental health specialist. As a result, associations of all kinds now routinely turn to association managers to run their organizations.

In part because the association industry has become so complex, in part because the field of association management has matured, and in part because volunteers have limited time to offer, more and more associations now follow what is referred to as "policy governance." In short, the professional staff run the association and manage its operations. Its volunteers govern the association and handle key responsibilities such as policy making, general governance, and strategic direction. The association literature is very clear on this point. The successful association of tomorrow will increasingly be managed by its professional staff.

4. **Associations are going more and more international.**

With sequestration, budget cuts, demographic changes (and lower birth rates), automation (and the loss of jobs), the globalization of the world economy (and production and distribution now occurring outside the U.S.), and so on, many national association leaders are lamenting the fact that their domestic markets have matured and plateaued. As a result, attention is increasingly turning to the international community as sources for growth and expanded influence.

Add to this the fact that some of the world's richest content comes from America. While a two-way value to information exchange most certainly exists, the demand for content from America is high and associations are well positioned to provide such content.

The association of the future will increasingly have an international dimension to it (which has interesting implications for governance structures and organizational cultures). By virtue of our deepening relationship with the International Federation of Environmental Health, our new program on international partnership organizations, and even the advent of our *E-Journal*, which makes getting our journal to professionals in other countries so much easier, NEHA is already building bridges to shorelines in nations far away.

5. **Crowdsourcing will become an important driver for association work and priorities.**

I have lectured until I am blue in the face that the only reality in today's world is speed. Other than maybe a spiritual consideration, I would argue that nothing else matters. *Everything* is going faster and our job is to keep pace. If anything, technology has accentuated this existential fact of our time. If we have any hope of keeping pace, we are increasingly going to have to use tools like crowdsourcing.

Let's start first with an example of work: the time it takes to clear and publish a manuscript. Today, in the average association, more than a year is likely to pass between the time a manuscript is submitted and it is published. A large chunk of that time is devoted to the process of peer review. It is conceivable that with crowdsourcing, we could run a manuscript through a group, and with e-publishing capabilities, have that article available within weeks.

In a similar vein, compelling voices in the association community now argue that strategic planning needs to morph into regular crowdsourcing exercises that have the power to much more quickly provide a read on both the troubles and opportunities facing a profession. It is only in this way that an association can be assured that it is remaining relevant inasmuch as crowdsourcing tracks a community's changing circumstances in real time.

6. **Associations will increasingly consolidate.**

While there are some trends on this list that I really like, others—and this is one of them—I personally don't care for. But my opinion hardly matters! In particular,

I worry that in consolidation, we risk losing the identity of our particular community (as in consolidating environmental health with public health). Nonetheless, the phenomenon of consolidation has been in play in the private sector for years and many are predicting that economies of scale will force many associations to follow suit. The lure that consolidation will financially enable an association to actually provide more to its community will be difficult to resist. We shall see!

7. **Associations will become more involved in public policy.**

Many associations tightly adhere to their educational missions and take on public policy issues at their margins. They do this because very real resource and legal constraints limit their public policy options. Nonetheless, the deteriorating quality of public policy debate demands that professional perspectives be considered, and professional communities are asking for no less. Accordingly, associations are expected to become more deeply involved in this kind of activity.

8. **Associations will be better capitalized.**

I'd say that the vast majority of associations are essentially altruistic and dedicated to their good causes. Finances have always played second fiddle to the cause and mission of these nonprofits. Even in NEHA, the value system has always been to keep margins low and financial accessibility high.

The shockwaves emanating from the Great Recession and its aftermath were strong enough to turn this kind of thinking on its head. Following the pain of layoffs, downsizing, and even closure, associations are now much more frequently adopting financial goals quite independent from their missions. Building reserves is a refrain now heard frequently and loudly in the association community. Associations are also keen these days to have enough capital to afford anything from needed infrastructure to investment opportunities. Some associations have even stepped into the world of creating for-profit subsidiaries where the profits accrue back to the nonprofit mother ship association.

Given the projection of an endless uncertain fiscal environment, watch for

financial issues to necessarily take on a larger role in the affairs of associations for years to come.

9. **The importance of innovation and creativity will become much more important to associations.**

In virtually every book and study that I read that touches on the topic of job creation and business success, over and over again the message boils down to innovation and creativity. (To those concepts, I would add daringness, experimentation, acceptance of failure, and risk tolerance.)

Great business books like *Blue Ocean Strategy*, *The New Geography of Jobs*, and *The Coming Jobs War* all make the case that without a capacity for innovation and creativity, good luck, because that's about all you are going to have going for you!

In a fast moving world where product life cycles are often defined in months (and less), the need for creativity and innovation has never been stronger. Associations are hardly immune to such pressures.

I envision that the successful association of tomorrow will have a capacity for being innovative and even daring as it tests new products, approaches, and services to both remain of value to its communities and safeguard its financial health. NEHA has engaged in some daring adventures in the past couple of years including our Entrepreneurial Zone and our Center for Priority Based Budgeting. Watch for many more such ventures as associations of all stripes push the boundaries of what passes for acceptable programming, because they will have to, to survive.

10. **Associations will become more agents of change.**

We are learning that to attract younger professionals in particular to our associations, we increasingly have to stand for something. And standing for something does not mean discounts on books, access to networks, subscriptions to our journals, or opportunities to hold committee positions. Standing for something means standing for a cause like food safety, the proper regulation of cottage foods, harmonization of regulations between states, building healthy communities through community design, educating policy makers about the health effects of global climate change, etc., etc., etc.



Baby boomers were good at supporting associations because it was what you did as you advanced in your career. Younger professionals—veterans of volunteer community projects through their schooling—are more likely to support an association if they can buy into its cause. Look for associations in the future to have causes that they can be agents of change for.

**11. Associations will become more drivers of collaboration.**

The very nature of an association involves bringing a community of people together on behalf of some purpose. From there, much effort gets expended on consensus building as associations seek to formulate common ground that its community can stand for/on.

Given our consensus-building skill set, it seems apparent that associations have the capability to bring stakeholders together to forge ways forward. Associations can even play such roles outside of their walls when engaged with other associations on behalf

of grander causes. (NEHA today participates in a National Partnership Council for Environmental Health that involves a wide assortment of institutions that have a stake in the environmental health issue. Our collaboration has advanced a number of major concerns to the benefit of environmental health. Watch for more such efforts.)

**12. Associations will develop leaders.**

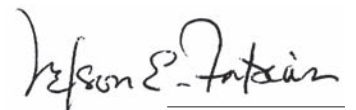
Even today, associations provide a remarkable array of opportunities for members to grow and develop their leadership skills without even realizing it. We rely on volunteers to conduct a wide range of work for us but we fail to see that this experience helps to develop leadership skills in the volunteer.

No oversupply of leaders exists. I imagine that associations will become much better at developing their volunteers ... with intention. As this transformation takes place, we can help our volunteers acquire leadership skills and experiences. As that process gains traction, I also see

that associations can become a source for needed leaders in the wider communities in which we live and work.

One school within the strategic thinking field insists that any discussion of the future include a definition of what success will look like. Having such a vision helps to better understand if that picture is one worth aspiring to. It also provides a clear reference that progress can be measured against.

I sincerely hope that the picture of success that I've drawn for you in this piece conveys that NEHA takes seriously the obligation to keep up with the times and to continually earn both your support and respect. We would never want our "community" to expect less from us. 🐛



[nfabian@neha.org](mailto:nfabian@neha.org)

**NEHA's**

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**Award Program**

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Visit [neha.org/sustainability](http://neha.org/sustainability) to view NEHA's Sustainability Web site and to learn more about the Excellence in Sustainability Award Program and submission process.

Submission deadline is May 1, 2014.

For more information, please contact Jill Schnipke at [jschnipke@neha.org](mailto:jschnipke@neha.org).





# NEHA MEMBERSHIP

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NEHA is also working hard to bring you a membership that fits your particular wants and needs. We are working to evolve the NEHA membership options available to you including a multiyear dues option and the opportunity to receive an electronic version of the Journal of Environmental Health. Updates and information are available at [neha.org](http://neha.org).

## ▶ MANAGING EDITOR'S DESK



Nelson Fabian, MS

I've written a lot in recent years about the future of environmental health. With this column, I want to turn tables and talk about the future of associations.

Within the association world today, thought leaders are spinning out some fascinating story lines having to do with why the association of today can't last and what the association of tomorrow must look like to even exist. These story lines draw from a growing belief that the Internet has irreparably broken the traditional association model in two crucial ways, which I will explain in a moment. Associations that understand this are now rethinking both their identity and their manner of operation. I submit that those association that are merrily carrying on, oblivious to how the world is changing around them, will soon be gone.

To set the stage for the discussion to follow, let me quickly elaborate on how the Internet has proven to be the disruptor that is forcing associations to change.

First, the Internet opens up new and free ways to obtain information, including much of the very information that associations have for years kept locked up behind their membership doors.

Second, the Internet, and more specifically social media, have now given people numerous ways to build communities. If associations aren't communities above and beyond anything else, then I don't know what associations are. But with "groups" now proliferating through various social media channels, associations no longer have a monopoly on the creation and management of communities.

## Twelve Keys to the Successful Association of the Future



*Let me share with you what the NEHA of tomorrow needs to look like in order to justify your support and interest.*

Take away our exclusivity for both information and community and what have you got left? Not much!

Fortunately and thanks to some courageous thinking among a small but growing number of leaders within the association world, the outlines of a very different kind of association business model are now beginning to take shape. Let me share with you here how many of us see associations evolving and what the NEHA of tomorrow needs to look like in order to justify your support and interest.

As NEHA is determined to be around for many more years, I'd welcome any reaction you have to any of the points below. (See <http://neha-org.blogspot.com/>.) Our fundamental challenge is to remain relevant. To learn how associations are meeting that chal-

lenge, we have to pay attention to the association literature and to thought leaders in our industry. But we also have to know exactly what our particular community needs. Hence, your input also and always plays a key role in the reshaping of NEHA.

My commentary below is informed not only by the association literature but also by numerous interactions I've had with a wide variety of association leaders, including one group of some of the smartest people I know. I am referring to colleagues of mine who are the executive directors of many of America's scientific and engineering associations, whom I met with just a couple of months ago, where this very topic was vigorously discussed and debated.

Taking both the literature and the experiences/perspectives of many association leaders into account, it strikes me that the association of tomorrow will feature the following characteristics.

### 1. Associations will migrate from membership models to community models.

In a word, it's all about "communities"! In fact, nothing I say in the following compares in importance and urgency to this single and vital point.

The old association model carved out an exclusive grouping of people (called "members") from a larger community of professionals. The model then had the association focusing its resources on the needs of this subgroup. Given the community building tools now widely available to anyone, larger and broader-based communities are appearing and self-organizing. The interaction and diversity

*continued on page 70*



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