JOURNAL OF

Environmental Health

twelve dollars

Dedicated to the advancement of the environmental health professional

Volume 77, No. 3 October 2014

Prenatal Hot Yoga: Health Implications and Environmental Conditions

Published by the National Environmental Health Association

www.neha.org

UL PUTS SAFETY AT THE TOP OF THE FOOD CHAIN

Full Service Solution Provider for the Food Service Industry

Everclean

For more than a century UL has employed exacting scientific processes and the highest ethical principles to deliver trusted results. Today, we continue to focus on the next generation of food safety challenges and more, helping the food service industry and stakeholders achieve safer living and work environments.

Learn about our many food service and food safety resources below:

FOOD SERVICE EQUIPMENT
UL.COM/APPLIANCES

FOOD SAFETY & BRAND PROTECTION
UL.COM/FOOD

RETAIL FOOD SAFETY TRAINING
ULEDUNEERING.COM/FOODSAFETY

JOURNAL OF

Environmental Health

Dedicated to the advancement of the environmental health professional

Volume 77, No. 3 October 2014

ABOUT THE COVER

In this month's cover feature, "Hot Yoga Establishments in Local Communities Serving Pregnant Women: A Pilot Study on the Health Implications of its Practice and Environmental Conditions," the authors studied participants' knowledge, attitudes, and beliefs about prenatal hot yoga. Public health officials and OB/GYNs should be aware that those who engage in prenatal exercise other than traditional yoga are less likely to be willing to receive safety information. Hot yoga practitioners are more likely to trust individuals who have experience with hot yoga other than their public health official or OB/GYN in regards to prenatal hot yoga advice.

See page 8.

Cover photo © Photodisc/Ryan McVay

ADVERTISERS INDEX

ADVANCEMENT OF THE SCIENCE

ADVANCEMENT OF THE PRACTICE

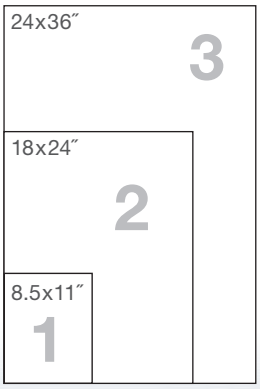
ADVANCEMENT OF THE PRACTITIONER

YOUR ASSOCIATION

Showcase Environmental Health
and All It Encompasses

For many years NEHA's *Journal of Environmental Health* has been adorned by visually-stunning and creative covers portraying a wide variety of environmental health topics. You can now own these amazing cover images in poster size. Use the walls of your department and office to display to visitors, your boss and staff, and the public what environmental health encompasses and your pride in your profession.

For more information and to place your order:
- ➡ Go to neha.org/JEH
- ➡ Contact Kristen Ruby-Cisneros at kruby@neha.org or 303.756.9090, ext. 341



- Three different frame-able sizes*
- Glossy, high-quality prints
- Select covers from 2005 to the present

*Framing available on request for an extra fee.

Special Offer: Get a free 8.5x11″ print of any cover with the order of at least one poster.

don't miss

in the next *Journal of Environmental Health*

- Evaluation of Five Years of Nursing Home Inspection Forms
- Exposure to Electric Power Generator Noise
- Promoting Safe Hygiene Practices in Public Restrooms
- Sanitation in Classroom and Food Preparation Areas in Child-Care Facilities
- Online prepublished article: Evaluation of HACCP System Implementation on the Quality of Mixed Fresh-Cut Salad

Official Publication

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

Journal of Environmental Health
(ISSN 0022-0892)

Kristen Ruby-Cisneros, Content Editor
Elizabeth Donoghue-Armstrong, PhD, Copy Editor
Hughes design|communications, Design/Production
Cognition Studio, Cover Artwork
Soni Fink, Advertising
For advertising call 303.756.9090, ext. 314

Published monthly (except bimonthly in January/February and July/August) by the National Environmental Health Association, 720 S. Colorado Blvd., Suite 1000-N, Denver, CO 80246-1926. Phone: (303) 756-9090; Fax: (303) 691-9490; Internet: www.neha.org. E-mail: kruby@neha.org. Volume 77, Number 3. Subscription rates in U.S.: $135 per year and $250 for two years. International subscription rates: $160 per year and $300 for two years (airmail postage included). Single copies: $12, if available. Reprint and advertising rates available at www.neha.org/JEH. CPM Sales Agreement Number 40045946.

Claims must be filed within 30 days domestic, 90 days foreign,

Full text of this journal is available through Bigchalk.com at www.bigchalk.com and from ProQuest Information and Learning, (800) 521-0600, ext. 3781; (734) 973-7007; or www.proquest.com. The *Journal of Environmental Health* is indexed by Current Awareness in Biological Sciences, EBSCO, and Applied Science & Technology Index. It is abstracted by Wilson Applied Science & Technology Abstracts and EMBASE/Excerpta Medica.

All technical manuscripts submitted for publication are subject to peer review. Contact the content editor for Instructions for Authors, or visit www.neha.org/JEH.

To submit a manuscript, visit http://jeh.msubmit.net. Direct all questions to Kristen Ruby-Cisneros, content editor, kruby@neha.org.

Periodicals postage paid at Denver, Colorado, and additional mailing offices. POSTMASTER: Send address changes to *Journal of Environmental Health*, 720 S. Colorado Blvd., Suite 1000-N, Denver, CO 80246-1926.

Printed on recycled paper.

PRINTED WITH SOY INK

PRESIDENT'S MESSAGE

Carolyn Hester Harvey,
PhD, CIH, RS, DAAS, CHMM

A Joe Beck Story to Tell

Eastern Kentucky University's (EKU's) Environmental Health Science (EHS) program and the entire EHS profession suffered a great loss on August 9, 2014, when our colleague and my good friend Professor Joe Beck passed away. I have decided to do my column on one of Joe's last papers he sent me. Joe was always writing, since that was his second favorite thing to do. His first love was teaching.

Joe used very frequently the quote, "We have got to get our story out" from Nelson Fabian, the former executive director of NEHA, who used it in numerous articles. It is time for all of us in the profession to join in this refrain and realize that we have a story of incredible achievements and successes. Ours is a truly fantastic story that we all need to tell.

Over the last 60 years our success has been obscured by the constant change brought about by new agencies with new missions, such as the U.S. Environmental Protection Agency, Department of Energy, Department of Labor, and the numerous agencies that have arisen at the state and local levels that deal with mirror issues. The importance of our profession can be observed daily from news reports of emerging diseases transmitted from the environment along with the constant demand by the public that we grow to meet our mission.

When we leave our jobs we feel that we have helped solve problems using scientific and engineering principles. In the early years of the EHS profession, neither the pay nor the visibility was high, but the EHS professional left the office each day feeling pride for having made the world a little healthier and safer. In the last 20 years, our society has slowly discovered environmental health's value. It is increasingly recognized that EHS saves more money than it costs. Some people even realize that EHS, through sanitation, makes the difference between a nation being considered developed or undeveloped. Compensation is now very competitive, and good working conditions and recognition are increasing. EHS, however, is not on the mind of a majority of high school graduates looking for a college major.

> *We have got to get our story out!*

Previously, many people got into environmental health for a short time and would leave because of unhappiness with pay; now statistics show most remain in the profession until retirement. Salary scales have gradually moved up until they reflect the complexity of the job and the hours of study necessary to be counted among our profession. It is interesting to realize that the number of credit hours of university science required by our degree is close in number and intensity to a degree in forensic science or one of the premed majors.

I recently googled "environmental health safety entry level jobs" and found 2,985 entry-level environmental health jobs, which did not even include government jobs. A popular Web site provides current salaries for environmental health graduates with a BS degree. The 2011 median pay was $81,500 with 10+ years of experience and an entry-level education bachelor's degree in environmental health and safety. Qualified replacements with an EHS degree entering the workforce number less than 1,000 graduates per year from accredited programs.

How come we do not have hundreds of students at the first-year level waiting to get into environmental health? Well, the answer is our failure to tell the story, especially to people who influence young people. It is essential that we solve this problem if our profession is ever going to function at its true potential. The reality is that literally hundreds of jobs are available currently for a graduate with a BS degree in environmental health. The reality is that many of these jobs are going to be filled by people with often no or very poor preparation. These people then become supervisors who are often afraid to hire people with optimal preparation.

We must get our story out and follow through with students letting them know of the career satisfaction of working in this field. We should be evoking pride in the current working environmental health professionals about the environment that they have helped create. Many of us have entered the field without a BS in environmental health, but it's time for us to promote what we have had a role in creating—an individual with a BS in environmental health.

Those of us who have entered the profession of environmental health without a BS degree in the field should be proud of the fact that we have recognized our educational shortcomings and have reeducated and retrained ourselves on the job. We should be equally proud that we have been a part of the creation of these undergraduate degrees in our

profession. When possible we should always try to hire people better prepared than we have been, but the prime responsibility lies with the academics preparing people for entry into this field. This is the reason EKU's EHS department has created a formula for getting the story out about the incredible opportunities for those who possess a BS in environmental health, particularly now that the pay is truly outstanding for someone with a bachelor's. Most professions require a master's degree to become employed. In environmental health, the bachelor's degree is still the gold standard.

The young people to whom we should be selling the opportunity to work in environmental health are individuals wanting to make a difference; not doing the same thing day after day; having the opportunity to meet people and travel; and having the opportunity to relocate for better paying jobs. Do we need a TV program related to environmental health? No, the real answer is our individual communication with people who influence the next generation's lives. Here is EKU's EHS department's template for getting the story out about this great secret—our profession. Although this template was devised by Joe for EHS programs, EHS professionals can do numerous things to get more young people into the profession. Joe knew that the future of environmental health lies with the next generation.

Action number 1: Talk to anyone you meet about our profession. Talk with passion and the incredible journey through life that is allowed us. EHS professionals can volunteer to talk to science classes one day a year at local schools.

Action number 2: Place your best and most passionate educators, your rock stars in the classroom, for teaching the introductory courses in environmental health. If you are a professional, volunteer to be a guest lecturer or even better an adjunct lecturer.

Realize the presence of a passionate instructor at the front of a room teaching a course can be a very persuasive force. Likewise realize that web courses, unless they include a significant chapter about the profession and its history of achievement, are not likely to attract anyone. Use web-based courses extremely carefully, as it is very difficult to make a personal connection with a student. In addition, our field involves interaction with people, which is something that cannot be evaluated online.

Action number 3: Create an advisory council for your environmental health program using the state and regional leaders in environmental health as advisors. Solicit from them their advice on any changes they would recommend to your curriculum to ensure that your students are the best qualified to meet their workforce demands. Form partnerships with these individuals and their agencies for the promotion of education in environmental health.

Action number 4: Create a diversity task force comprised of minorities both inside and outside of environmental health. Let the task force know about the personal opportunities as well as the outstanding work opportunities. Explain with all sincerity of your belief in a diversified workforce and the opportunities that exist for graduates of diversity. Act upon their recommendations for recruitment of minorities in terms of types of messages and how to effectively communicate the life-changing opportunities.

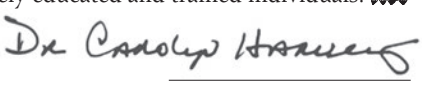
Action number 5: Contact your state's association of school guidance counselors and offer to present about this incredible occupation that has been kept so secret. While presenting to the association, convey the values that are reflected in EHS professionals, especially the ability to go home every night and feel that the world is no worse because of your existence and might even be a great deal better. If possible, schedule a presentation or a booth each year at the counselors' association.

Action number 6: At least once each year, invite science teachers from two-year technical schools, two-year junior colleges, and if possible, high school teachers who deal with the sciences to campus, or better yet go to their school. Bring in successful graduates who can talk about going through the program and what they're currently doing.

Action number 7: Invite any university advisors of undeclared freshman to your department for a morning or afternoon of show and tell.

Action number 8: Consider development of 100- and 200-level courses designed to appeal to undeclared students that discuss environmental health. For example, EKU created a highly successful course for attracting new majors called "Diseases of Leisure" designed to appeal to a wide range of students, particularly those who like the outdoors. Realize that no course should be designed specifically for recruitment but they should all be designed to achieve optimum education and training in those areas.

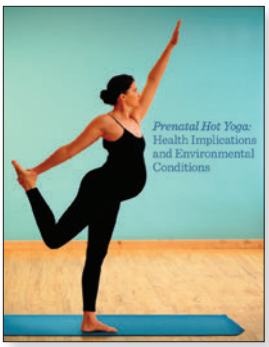
Of course, additional actions can be done to get the word out about this fantastic career that we refer to as environmental health science. As in all good news, the potential dark side to the story is out there if we do not act now. If we fail to get our story out then the powerful forces of supply and demand will take over. Should this happen we can expect to see the job market fracture into many specialties, each requiring its own license, and having no commonality of education and training. The job market is currently attempting to do this due to the shortage of appropriately educated and trained individuals.



carolyn.harvey@eku.edu

Did You Know?

An In Memoriam for Joe Beck will be published in a forthcoming issue of the *Journal* highlighting Joe's memorable life and career. If you would like to share a memory or comment about Joe to be considered for inclusion, please e-mail Kristen Ruby-Cisneros at kruby@neha.org.



Hot Yoga Establishments in Local Communities Serving Pregnant Women: A Pilot Study on the Health Implications of its Practice and Environmental Conditions

Viann N. Nguyen-Feng, MPH
Community and Environmental Health
Old Dominion University

Steven L. Feng, MD
Shilpa Babbar, MD
Department of Obstetrics and Gynecology
Eastern Virginia Medical School

Nicole Calloway Rankins, MPH, MD
Department of Obstetrics and Gynecology
Medical College of Virginia—Virginia Commonwealth University

James D. Blando, MHS, PhD
Community and Environmental Health
Old Dominion University

Abstract **Hot yoga establishments have been increasing in popularity in local communities. Studios may support participation among pregnant women though no clinical studies currently exist that examine prenatal hot yoga effects. The pilot study described in this article aimed to assess the spread of prenatal hot yoga and to provide information on the environmental conditions and practices of those who engage in hot yoga within a local community. A thermal environment meter was used to measure ambient air conditions during three 90-minute hot yoga classes. Mothers who practiced prenatal hot yoga were more likely than non-hot yoga practitioners to have someone aside from an obstetrician/gynecologist discuss prenatal exercise safety with them. Prenatal public health education campaigns need to be refined. Public health officials and obstetricians/gynecologists need to be aware that those who engage in a hot yoga practice are more likely to trust someone other than their health care provider or public health professional regarding safety of this practice.**

Introduction

The practice of yoga consists of eight limbs encompassing physical practice, meditation, breathing, and more. As yoga was popularized and spread west to the Middle East and Europe in the 1800s, the physical benefits of the practice were more closely explored (American Yoga Association, 2006). Today, the *Yoga Journal*, the largest circulation yoga magazine in the U.S., estimates that 6.9% of Americans, or 15.8 million people, practice yoga (*Yoga Journal*, 2008). Many local health departments undoubtedly have these establishments within their jurisdictions. Clinical studies have shown that yoga can mitigate low back pain, improve outcomes in asthma and chronic obstructive pulmonary disease, and improve birth outcomes (Hayes & Chase, 2010). The benefits of yoga extend beyond physical measures, as other studies have also found yoga to decrease stress and anxiety, increase quality of life in the elderly, and be beneficial in patients with eating disorders (Hayes & Chase, 2010).

Fewer studies have been conducted on the health benefits of hot yoga, created by Bikram Choudhury in the early 1970s. In this form of yoga, which Choudhury named after himself, one practices in a room set to 105ºF (Choudhury, 2007). Instead of following Bikram yoga's own sequence of 26 postures, some Western yoga studios have simply transferred the idea of practicing yoga in a hot room. This newfound yoga style is referred to as "hot yoga," the practice of any type or sequence of stationary yoga in a heated room (Fish, 2006). Only a handful of studies on Bikram yoga have been recorded to date (Bikram Yoga, 2014) with the results reflecting the current knowledge of yoga practice. One of the studies noted that short-term practice of Bikram yoga could result in substantial improvements in balance and modest improvements in leg strength as compared to a control group who did not practice any form of yoga. That study did not state whether the accrued benefits were from yoga or specifically from Bikram yoga, but it seems as though the heat did not hinder results when compared to a control group (Hart & Tracy, 2008). Studies comparing and contrasting hot yoga and room-temperature yoga have not yet been conducted.

Comparatively few studies have examined the effects of room-temperature yoga during pregnancy, and no studies to date have examined prenatal hot yoga. The few existing prenatal room-temperature yoga studies have

demonstrated positive effects of the practice. Narendran and co-authors (2005) conducted a prospective study on the effects of prenatal yoga on pregnancy outcomes. That study consisted of an intervention group of 169 pregnant women who were trained to practice yoga one hour daily, and that group was matched to a control group of 166 pregnant women who walked for 30 minutes twice daily. The researchers found that the yoga group had significantly fewer underweight births, less preterm labor, lower rates of intrauterine growth retardation, and lower risk of pregnancy-induced hypertension than the control group. Importantly, the authors found that practicing yoga during pregnancy was not associated with any adverse effects on the mother or baby. That study was confounded in that the women in the yoga group received more attention as they were trained to practice yoga for one week and had their techniques reviewed during each antenatal visit. In addition, most women in the yoga group lived within 15 minutes of the study center (a hospital), while most women in the control group lived farther than 15 minutes travel, raising the possibility of socioeconomic and environmental factors affecting study outcomes.

In a similar randomized control trial with 90 participants, Satyapriya and co-authors (2009) found that pregnant women who received the yoga intervention experienced significantly more stress reduction and reduced sympathetic tone as measured by changes in heart rate as compared to a control group with normal prenatal exercise. The authors similarly found no increase in adverse outcomes in the yoga group. In addition, a number of smaller studies have shown that prenatal yoga is associated with reductions in stress and anxiety as well as improved sleep and maternal comfort during labor (Beddoe, Lee, Weiss, Kennedy, & Yang, 2010; Beddoe, Yang, Kennedy, Weiss, & Lee, 2009; Chuntharapat, Petpichetchian, & Hatthaki, 2008). These studies suggest that increased fitness and stress reduction may be the primary mechanisms behind the positive benefits of prenatal yoga.

Although no published studies currently exist on the effects of hot yoga on pregnancy outcomes, a number of expectant mothers practice hot yoga (Choudhury, 2011; Nguyen, Babbar, Rankins, & Blando, 2012). In the absence of specific research, the American Congress of Obstetricians and Gynecologists (ACOG) provides guidelines for pregnant women with more intense exercise regimens. In particular, ACOG suggests that expectant mothers avoid contact sports and activities that involve extended periods of time in the supine position (ACOG, 2002), which is why prenatal yoga poses are modified to avoid lying on one's back. In addition, hot tubs, spas, and other heat-inducing environments have been associated with adverse birth outcomes, including neural tube defects and spontaneous abortions (Chambers, 2006). No research suggests that prenatal hot yoga has an adverse effect on the mother or baby; however, the research in this area is lacking, both clinically and observationally. Our pilot study aims to make inferences in the field of prenatal hot yoga that may be relevant to public health officials and obstetricians.

Methods

To assess the spread of prenatal hot yoga, Old Dominion University (ODU) distributed knowledge, attitudes, and beliefs (KAB) surveys to hot and non-hot yoga studios (studio participation rate: 43%) and parent-teacher associations (PTAs) (organization participation rate: 45%) in southeastern Virginia. Additionally, a thermal environment meter was used to measure ambient air conditions during three 90-minute hot yoga classes at one studio in southeastern Virginia.

The prenatal hot yoga KAB online self-report surveys were written by ODU researchers, screened by surveying experts at the ODU Social Sciences Research Center, and pilot tested before distribution. The surveys were 14 to 26 questions in length, depending on how respondents answered certain questions. Surveys asked about demographic data, risk and benefit perceptions, pregnancy experiences, general exercise information, and other beliefs. Hot and non-hot yoga studios and PTAs in southeastern Virginia distributed the surveys via e-mail or social media. Females who were reachable through these means were considered as the target population and as representative of the normal population who practices yoga. Females were included regardless of current pregnancy status. Females who had practiced hot yoga at least once were placed in the experimental group while females who had never practiced hot yoga were placed in a control group.

Informal interviews with the studio owner and yoga teachers were conducted in order to assess normal hot yoga studio heating procedures, ventilation, and heat exchange rate. The thermal environment meter was calibrated three days before the air measurements as well as immediately after the measurements. Calibration proved within the acceptable 0.5 tolerance. Measures were taken approximately three feet above ground in the back of the class at equi-distance between the door and the side wall. Yoga students were in near proximity of the meter. Inside wet bulb globe temperature (WBGT), dry globe temperature, and dry bulb temperature readings were recorded approximately every 10 minutes during the three 90-minute class sessions. Each class consisted of 26 identical poses and two breathing exercises in an identical sequence in order to keep the physical exercise effect on ambient air temperature consistent among classes.

Results

Three out of seven (43%) of yoga studios and 9 out of 20 (45%) of PTAs in southeastern Virginia agreed to participate. PTAs and non-hot yoga studios were recruited to be included in the control group. Seventy individuals were in the experimental group and 59 individuals were in the control group who began the online survey. Of those individuals, 53 (76%) in the experimental group and 21 (36%) in the control group completed all permissible questions. In total, 74 respondents were included in the data analysis, with 53 hot yoga practitioners and 21 non-hot yoga practitioners. Survey respondents tended to be white, college-educated females in the upper-30s age range; age was demonstrated to be normally distributed with both a mean and median of 37 years. More than 8 in 10 women reported that their obstetrician/gynecologist (OB/GYN) had asked about their exercise regimen.

Independent samples *t*-tests were conducted in order to analyze differences between means of the continuous variables whereas Chi-square tests were conducted for the categorical variables (Table 1). The demographic characteristics between groups were similar. Of the hot yoga group, 77% identified as white and 55% reported themselves to be a college graduate. Of the non-hot yoga group, 91% identified as white and 43% reported themselves to be a college graduate.

In regards to prenatal health and beliefs, groups were also similar except hot yoga prac-

titioners were statistically significantly ($p < .05$) more likely to currently be pregnant; desire to be pregnant if not currently pregnant; and have someone, not necessarily an OB/GYN, discuss prenatal exercise safety with them. Most notably, 25% of the hot yoga practitioners reported themselves to be currently pregnant as opposed to 5% of the non-hot yoga practitioners.

Non-hot yoga practitioners trusted their OB/GYN as a source of prenatal hot yoga safety knowledge (rating: 9.3/10) more than themselves (rating: 7.1/10). By contrast, hot yoga practitioners trusted themselves (rating: 8.7/10) more than their OB/GYN (rating: 7.7/10). Hot yoga practitioners also ranked OB/GYNs below a friend or acquaintance who had practiced yoga while pregnant (rating: 7.9/10) as a trusted source of health information. Of the sources who discussed prenatal hot yoga safety with respondents, OB/GYNs were listed fourth for prenatal hot yoga practitioners, behind a friend or acquaintance who practices hot yoga, yoga studio employees, and a friend or acquaintance who practiced prenatal hot yoga.

Of the 39 females who had practiced prenatal hot yoga, 87.5% would do so again. Excluding the individual who practiced prenatal hot yoga while unaware of her pregnancy status, this figure rises to 90.5%. An equal distribution occurred of prenatal hot yoga practice prevalence among the three pregnancy trimesters. All respondents who practiced prenatal yoga for one pregnancy and not the other reported benefits of the yoga.

The exercise room dimensions were approximately 8' x 30' x 60', or 14,400 cubic feet. The building was new with no visible molds. For the three yoga classes in which measurements took place, one set the heat manually while the other two used the automatic settings. Overall, the dry bulb, representing actual air temperature, ranged from 102.3ºF to 131.7ºF. The relative humidity ranged from 23% to 50% over the three classes. The WBGT, which is an integrated measure of environmental heat stress that accounts for convective heat, humidity, and radiant heat, ranged from 86ºF to 104ºF (Figure 1).

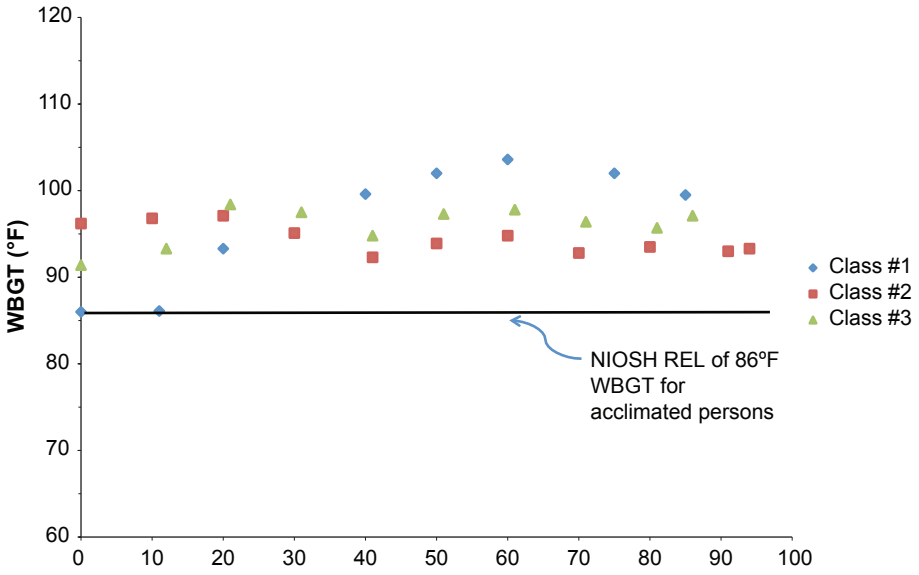
TABLE **1**

Demographics of Hot Yoga and Non-Hot Yoga Practitioner Survey Respondents, Old Dominion University, 2013

Characteristic	Study Group		*p*-Value
	Hot Yoga Practitioner	Non-Hot Yoga Practitioner	
Sample size	53	21	–
Average age (years)	35.6	42.0	.273
White	77%	91%	.137
College graduate	55%	43%	.358
Currently pregnant	25%	5%	.011
Not pregnant, but would like to be	11%	0%	<.001
Obstetrician/gynecologist has asked about exercise	83%	81%	.842
Would practice prenatal hot yoga	77%	10%	<.001
Ever been pregnant	76%	100%	<.001

FIGURE **1**

Wet Bulb Globe Temperature (WBGT) (ºF) Over the Duration of Hot Yoga Class, Old Dominion University, 2013



This figure shows WBGT readings over the course of three 90-minute hot yoga classes at a studio in southeastern Virginia. A horizontal line on the chart signifies the National Institute for Occupational Safety and Health (NIOSH)–recommended exposure level (REL) for acclimated persons.

Discussion

This article provides new, quantitative information on the potential burden of exercising in a heated room and knowledge, attitudes, and beliefs about prenatal hot yoga, which can be used in public and environmental health education. Public health officials and OB/GYNs may need to be aware that those who engage in prenatal exercise other than traditional yoga are less likely to be receptive to receiving safety information. Likewise, because hot yoga practitioners are more likely to trust other individuals who have experience with hot yoga than their public health official or OB/GYN in regards to prenatal hot yoga advice, public health officials and OB/GYNs should redefine their approach

when discussing prenatal exercise with this patient population.

Individuals practicing hot yoga should be aware that the ambient air temperature would most likely change during practice and may be higher than the temperature advertised. In general, occupational health recommendations state that for persons acclimated to high heat exercising at approximately 200 Kcal/hour (National Institute for Occupational Safety and Health, 1986), which is typical of yoga, the maximum recommended WBGT exposure is approximately 86ºF averaged over a one-hour period (Ray, Pathak, & Tomer, 2011). This recommended exposure limit is less for persons who are not acclimated to the hot environment. All of the measured temperatures collected by the researchers were at or above a WGBT of 86ºF, as displayed in Figure 1.

Pregnant individuals or individuals with certain health conditions should discuss this practice with their physician in order to adequately prepare and to maximize safety. Public health officials may wish to engage in an educational campaign to encourage participants to actively discuss this practice with their health care provider. Another method public health departments can implement to maximize safe exercise conditions is to make hot yoga studios aware of the large temperature fluctuations within a class so that they may monitor and adjust the temperature accordingly. Though some studios maintain the thermostat at a certain set degree, others attempt to keep the ambient air temperature to "feel" a certain temperature. As demonstrated in Figure 1 for a studio with a set temperature, as well as a studio that bases their temperature on "feel," it is reasonable to assume that neither method results in temperatures that are carefully controlled. Studios may benefit from careful control of their temperatures by assuring that the WBGT does not exceed recommended heat exposure limits. In this way, participants can gain the benefits of yoga while minimizing their risk of heat-related complications.

Conclusion

This pilot study provides a unique descriptive analysis on prenatal yoga practices in a local community. Relatively few studies on hot yoga have been published. Though Hart and Tracy (2008) compared Bikram yoga against no form of yoga and other researchers (Beddoe et al., 2009, 2010; Chuntharapat et al., 2008; Nareendran et al., 2005; Satyapriya et al., 2009) have studied prenatal room-temperature yoga benefits, no studies have been published comparing prenatal hot yoga to room-temperature yoga.

These findings are subject to several limitations. The survey has a small sample size that makes the results difficult to generalize to the entire yoga population. Many groups did not want to participate, fearing that it may indicate the group's support for prenatal hot yoga, a practice with benefits that have not been scientifically proven. Thus, the study population was merely a convenience sample with a probable response bias. Those with stronger opinions on or experience in prenatal hot yoga may be more likely to respond than those without strong opinions or experiences. This is demonstrated by the stronger response rate from hot yoga practitioners compared to non-hot yoga practitioners. This participation difference skews the results towards the group with a higher response rate, the hot yoga sample. Additionally, the ambient air measurements were also subject to limitations since they were only conducted at one site for only three classes, in which one class was heated manually instead of the using the normal automatic method.

Future clinical studies are needed to make inferences about the safety and potential benefits or risks of prenatal hot yoga. Studies are needed to quantifiably determine if physiological differences exist between practitioners of prenatal hot yoga and other forms of yoga. The physiological differences between practicing hot yoga, practicing room-temperature yoga, and exercising in another form are still unknown and warrant exploration.

Corresponding Author: James D. Blando, Old Dominion University, Community and Environmental Health, 4608 Hampton Blvd., Room 3134, Norfolk, VA 23529.
E-mail: JBlando@odu.edu.

References

American Congress of Obstetricians and Gynecologists. (2002). *Exercise during pregnancy and the postpartum period*. Retrieved from http://www.acog.org/Resources_And_Publications/Committee_Opinions/Committee_on_Obstetric_Practice/Exercise_During_Pregnancy_and_the_Postpartum_Period

American Yoga Association. (2006). *General yoga information*. Retrieved from http://www.americanyogaassociation.org/general.html

Beddoe, A.E., Lee, K.A., Weiss, S.J., Kennedy, H.P., & Yang, C.P. (2010). Effects of mindful yoga on sleep in pregnant women: A pilot study. *Biological Research for Nursing*, *11*(4), 363–370.

Beddoe, A.E., Yang, C.P, Kennedy, H.P., Weiss, S.J., & Lee, K.A. (2009). The effects of mindfulness during pregnancy on maternal psychological and physical distress. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *38*(3), 310–319.

Bikram Yoga. (2014). *Research*. Retrieved from http://bikramyoga.com/BikramYoga/Research.php

Chambers, C.D. (2006). Risks of hyperthermia associated with hot tub or spa use by pregnant women. *Birth Defects Research, 76*(8), 569–573.

Choudhury, B. (2007). *Bikram yoga: The guru behind hot yoga shows the way to radiant health and personal fulfillment*. New York: Harper Collins.

Choudhury, R. (2011, September). *A teacher's guide to Rajashree's pregnancy yoga*. Seminar presented at the Center for Yoga and Health, Stockbridge, MA.

Chuntharapat, S., Petpichetchian, W., & Hatthaki, U. (2008). Yoga during pregnancy: Effects on maternal comfort, labor pain, and

continued on page 12

References *continued from page 11*

birth outcomes. *Complementary therapies in clinical practice*, *14*(2), 105–115.

Fish, A. (2006). The commodification and exchange of knowledge in the case of transnational commercial yoga. *International Journal of Cultural Property*, *13*(2), 189–206.

Hart, C.E., & Tracy, B.L. (2008). Yoga as steadiness training: Effects on motor variability in young adults. *Journal of Strength and Conditioning Research*, *22*(5), 1659–1669.

Hayes, M., & Chase, S. (2010). Prescribing yoga. *Primary Care: Clinics in Office Practice*, *37*(1), 47–53.

Narendran, S., Nagarathan, R., Narendran, V., Gunasheela, S., & Nagendra, H.R. (2005). Efficacy of yoga on pregnancy outcome. *Journal of Alternative and Complementary Medicine*, *11*(2), 237–244.

National Institute for Occupational Safety and Health. (1986). *Occupational exposure to hot environments* (revised criteria 1986). Retrieved from http://www.cdc.gov/niosh/docs/86-113/

Nguyen, V.N., Babbar, S., Rankins, N.C., & Blando, J.D. (2012, October). *Perceptions of prenatal hot yoga.* Poster session presented at the 140th Annual Meeting of the American Public Health Association, San Francisco, CA.

Ray, U., Pathak, A., & Tomer, O. (2011). Hatha yoga practices: Energy expenditure, respiratory changes, and intensity of exercise. *Evidence-Based Complementary and Alternative Medicine*, epub 241294.

Satyapriya, M., Nagendra, H.R., Nagarathan, R., & Padmallatha, V. (2009). Effect of integrated yoga on stress and heart rate variability in pregnant women. *International Journal of Gynaecology and Obstetrics*, *104*(3), 218–222.

Yoga Journal. (2008). Yoga Journal *releases 2008 "Yoga in America" market study* [Press release]. Retrieved from http://www.yogajournal.com/advertise/press_releases/10

Did You Know?

The Centers for Disease Control and Prevention have physical activity guidelines posted for healthy pregnant women at www.cdc.gov/physicalactivity/everyone/guidelines/pregnancy.html.

O-Chlorobenzylidene Malononitrile (CS Riot Control Agent) Exposure in a U.S. Army Basic Combat Training Cohort

MAJ Joseph J. Hout, MSPH, PhD, REHS, CPH
Duvel W. White, PhD, REHS
Alex Stubner, PhD, REHS
Michael Stevens, PhD
Department of Preventive Medicine and Biometrics
Uniformed Services University of the Health Sciences

Joseph J. Knapik, ScD
United States Army Institute of Public Health

Abstract **All U.S. Army soldiers participate in mask confidence training during initial military training and periodically throughout their careers. Training is conducted by dispersing the riot control agent, o-chlorobenzylidene malononitrile (CS), in a relatively air-tight structure where soldiers enter and conduct a series of exercises that culminate with mask removal. The study described here quantified CS concentrations experienced by 6,723 trainees and seven chamber operators during U.S. Army basic combat training at Fort Jackson, South Carolina, from August 1 to September 25, 2012. All 6,723 trainees were potentially exposed to CS concentrations exceeding the American Conference of Governmental Industrial Hygienists threshold limit value-ceiling (TLV-C) (0.39 mg/m^3), 6,589 of which were potentially exposed to concentrations exceeding the value deemed immediately dangerous to life and health (IDLH) (2.0 mg/m^3) by the National Institute for Occupational Safety and Health. All chamber operators were exposed to concentrations exceeding both the TLV-C and the IDLH.**

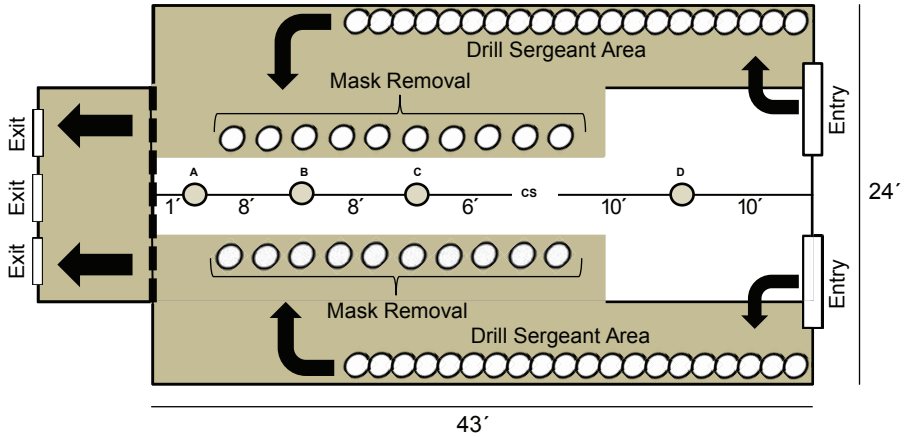
Introduction

O-chlorobenzylidene malononitrile (CS), commonly referred to as "tear gas," is an incapacitating agent used by military and law enforcement communities for training and riot control operations (Hout, Lapuma, Hook, & White, 2010). The incapacitating effects of CS are well documented (Archuleta & Stocum, 1993; Blain, 2003; Punte, Owens, & Gutentag, 1963; Salem et al., 2008; Sivathasan, 2010; Thomas, Smith, Rascona, Louthan, & Gumpert, 2002). The U.S. Army exploits these effects to provide realism to combat training events, to validate the serviceability of chemical protective equipment, and to demonstrate protection afforded by the chemical protective mask when challenged by airborne chemical agents (Department of the Army, 1996, 2012a). All new recruits entering the U.S. Army are exposed to CS during the first month of basic combat training (BCT) while participating in chemical, biological, radiological, and nuclear (CBRN) mask confidence training (MCT). Completion of the mask confidence chamber is a graduation requirement (Department of the Army, 2012b). In addition, all U.S. Army soldiers issued a protective mask must complete MCT on an annual basis (Department of the Army, 2011, 2012a). These two factors make CS a common exposure for many of the nearly 550,000 soldiers serving in the U.S. Army (Department of Defense, 2012).

MCT requires participants to enter an enclosed, CS-rich environment created by thermally dispersing CS capsules (Department of Defense identification code K765) in a relatively air-tight structure (Department of the Army, 2012a). Dispersal is controlled by a chamber operator wearing a qualitatively fit-tested M40 series military protective mask equipped with a C2A1 canister. The M40 is a full-face air purifying respirator (APR) that is specifically designed to protect the eyes, face, and respiratory tract from airborne chemical warfare agents when used in conjunction with the C2A1 canister (Department of the Army, 1994a; U.S. Army Chemical School, 2003). The C2A1 canister consists of a high-efficiency particulate air filter, followed by an activated carbon filter impregnated with copper, zinc, silver, molybdenum, and triethylenediamine, which is designed to remove chemical warfare agents and radioactive fallout particles from air entering the mask (Morrison, 2001). The chamber operator builds an initial CS concentration by thermally dispersing one 650-mg CS capsule on the surface of an empty heated coffee can for every 30 m^3 of chamber volume (Department of the Army, 1982, 1994b; Hout et al., 2010). Once the initial concentration is established, participants enter the chamber wearing the army combat uniform (ACU) (a 50/50 cotton/nylon digital camouflage patterned blouse and trouser that covers the body excluding the hands, wrists, neck and head, worn in conjunction with leather boots) and a qualitatively fit-tested M40 with C2A1 canister (U.S. Army Program Executive Office Soldier, 2012). Trainees conduct a series of physical exercises, break and reseal the air-tight seal between their mask and face, and finally line

FIGURE **1**

Fort Jackson Mask Confidence Chamber



Dark circles A–D represent sampling locations; light circles represent trainees; white represents the area open to sampling; and arrows depict the flow of trainees through the chamber.

up in groups of 10 to completely remove their masks before exiting the chamber. Chamber operators remain inside the chamber for the duration of the exercise, maintaining the CS concentration by dispersing an additional capsule for every 10 soldiers who pass through the chamber (Department of the Army, 1982, 2008, 2012a; Hout, White, Kluchinsky, & Lapuma, 2011). Participants experience an intense burning sensation on exposed skin and after removing the mask, almost immediate lacrimation, coughing, and sometimes vomiting. These events may occur earlier if the mask is defective or improperly fit. Absence of symptoms prior to mask removal develops confidence in the ability of the M40 mask to protect the user from airborne chemical agents (Department of the Army, 1982, 2008).

A 2010 study conducted at the Uniformed Services University of the Health Sciences (USU) demonstrated that low-temperature dispersal of CS capsules in an unoccupied mask confidence chamber and in a temperature-controlled tube furnace resulted in the formation of at least 17 thermal degradation products, some of which were hazardous to human health (Hout et al., 2010). A follow-on study conducted in an unoccupied mask confidence chamber showed CS dispersed in accordance with U.S. Army MCT guidelines resulted in CS concentrations exceeding the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value-ceiling (skin) (TLV-C), the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit-ceiling (REL-C), and the level that NIOSH deems immediately dangerous to life and health (IDLH) (Hout et al., 2011). These studies illustrate the potential for exposures to CS thermal degradation products and high levels of CS in a U.S. Army mask confidence chamber; however, they were not conducted during live MCT and thus did not represent a population exposure.

The current observational study quantified CS exposures in a cohort of U.S. Army BCT trainees (n = 6,723) and chamber operators (n = 7) from August 1, 2012, to September 25, 2012, during BCT at Fort Jackson, South Carolina, and compared them to published exposure guidelines. The study protocol was approved by the U.S. Army Training and Doctrine Command and the USU Office of Research, and was deemed nonhuman subjects research by the USU institutional review board.

Methods

The Fort Jackson mask confidence chamber is a 255-m^3 structure used solely for MCT. The chamber has two entrances and three exits at opposing ends of the structure covered by plastic strip curtains to prevent the escape of aerosolized CS (Figure 1). The floor is concrete, the walls are cinder block, and the ceiling is painted plywood. Chamber operators

Hot plate method of CS dispersion at the Fort Jackson mask confidence chamber.

establish an initial CS concentration by placing an empty 387-g coffee can on the small burner of a 1500-watt dual burner hot plate elevated on a 1.1-m tall table in the center of the chamber (see photo above). The hot plate is set to high (mean = 199°C) and the coffee can is preheated for approximately five minutes. Calculations showed that 8.5 capsules were required to establish the initial CS concentration; however, chamber operators consistently add 10 CS capsules and agitate and mix with a stirring rod until all visible CS is aerosolized (approximately five minutes).

Exposure groups (mean = 50 trainees) enter the chamber through both entrances, line up against the walls, and conduct a series of exercises that include breathing normally, breathing deeply, turning head from side-to-side, moving head up and down, rotating chin, running in place for 60 seconds, pulling mask away from the face, clearing the inside of the mask of airborne contaminants, and resealing the mask. Trainees then line up in groups of 10 at two of the exits, remove their protective masks, recite phrases chosen by the instructors, and exit the chamber (Figure 1). Once all trainees in an exposure group exit, a new exposure group immediately enters. One CS capsule is added for every 10 trainees who exit the chamber in the previous exposure group and the training continues as previously described. A maximum of 34 capsules are used for a military company consisting of four exposure groups.

Chamber Characterization

Initial sampling characterized CS dispersal within the chamber to determine the number and placement of sampling devices. Sampling was restricted to the low-traffic area that traversed the chamber from the entrances to the

TABLE **1**

CS[a] Concentrations and Exposure Durations for Trainees

Company #	Exposure Group 1			Exposure Group 2			Exposure Group 3			Exposure Group 4		
	n	Time (min.)	CS (mg/m^3)	*n*	Time (min.)	CS (mg/m^3)	*n*	Time (min.)	CS (mg/m^3)	*n*	Time (min.)	CS (mg/m^3)
1	55	10.1	**13.0**	53	8.5	**17.2**	56	10.0	**12.7**	54	10.0	**5.3**
2	47	10.0	**7.3**	47	8.7	**7.7**	46	8.0	**8.3**	45	8.0	**7.4**
3	55	9.0	**53.3***	55	8.0	**12.6**	52	7.0	**12.4**	56	8.0	**10.0**
4	55	7.5	**20.4**	56	6.5	**45.1***	54	8.0	**43.3***	55	10.0	**23.3***
5	53	9.0	**5.0**	55	7.5	**5.3**	48	7.0	**5.3**	54	8.5	**5.0**
6	50	9.0	**25.9***	49	9.0	**48.2***	50	10.0	**29.3***	49	10.0	**20.0***
7	45	5.5	**14.9**	48	7.0	**13.1**	50	10.0	**24.0***	44	10.0	**12.5**
8	51	9.0	**3.6**	53	7.0	**7.8**	55	10.5	**11.2**	52	10.5	**6.2**
9	51	6.0	**9.8**	51	7.0	**12.5**	52	6.0	**17.9**	50	5.0	**9.9**
10	51	7.0	**9.0**	51	7.5	**5.4**	57	8.5	**4.7**	55	10.0	**4.1**
11	52	9.0	**19.6**	52	10.0	**34.0***	51	10.5	**55.2***	51	10.0	**7.8**
12	43	10.0	**20.1***	45	10.0	**25.0***	41	9.0	**24.2***	44	10.0	**16.6**
13	53	8.5	**4.2**	51	7.5	**4.5**	56	8.0	**5.3**	56	10.0	**5.3**
14	60	7.5	**3.3**	55	8.0	**2.6**	52	7.0	**3.2**	63	10.5	**2.6**
15	57	7.5	**5.7**	59	6.5	**8.4**	60	10.5	**8.1**	58	10.0	**6.4**
16	67	10.5	**6.2**	68	9.0	**6.0**	67	8.5	**5.7**	No exposure group		
17	48	7.5	**5.2**	46	8.5	**4.4**	49	8.5	**4.0**	47	6.5	**3.5**
18	48	8.0	**3.9**	48	10.0	**4.0**	48	8.5	**3.6**	49	9.5	**4.0**
19	47	7.0	**6.0**	46	7.0	**2.9**	45	8.0	**3.3**	46	10.0	**3.0**
20	40	10.0	*1.7*	41	8.0	**4.4**	39	8.0	**5.1**	45	6.0	**2.8**
21	48	9.0	**18.5**	46	7.0	**10.1**	46	6.5	**7.6**	43	8.0	**7.0**
22	38	8.0	**5.0**	39	7.5	**4.5**	40	6.5	**2.6**	46	8.0	**4.1**
23	48	7.0	**8.8**	47	7.0	**8.0**	44	6.5	**7.3**	48	8.5	**6.6**
24	48	8.0	**3.6**	51	9.0	**11.4**	48	9.0	**7.7**	8	7.0	**3.2**
25	47	10.0	*1.9*	49	10.0	**5.7**	49	10.0	**5.7**	53	8.5	**8.6**
26	51	10.0	**2.7**	49	10.5	**13.1**	45	11.0	**13.9**	49	11.5	**7.5**
27	39	7.5	**6.7**	50	10.5	**6.4**	53	8.0	**6.6**	50	8.0	**7.2**
28	53	9.0	**19.3**	54	11.0	**12.3**	43	8.5	**10.4**	70	15.0	**16.9***
29	45	7.0	**4.1**	44	7.5	**3.8**	57	8.5	**4.9**	58	8.5	**5.6**
30	43	6.5	**2.6**	47	6.0	*1.8*	50	6.0	**4.7**	64	7.5	**5.5**
31	54	8.5	**6.9**	49	9.0	**5.5**	46	9.0	**4.0**	51	11.0	**5.6**
32	59	13.0	**3.6**	61	13.0	**5.6**	65	13.0	**7.7**	No exposure group		
33	46	9.0	**3.3**	47	9.5	**2.2**	49	9.5	**3.1**	50	11.5	**2.9**
34	46	10.0	**7.3**	55	9.5	**7.0**	57	9.0	**6.4**	29	7.0	**5.1**

Note. Values in italics exceeded American Conference of Governmental Industrial Hygienists' threshold limit value-ceiling (0.39 mg/m^3). Values in bold exceeded the National Institute for Occupational Safety and Health's immediately dangerous to life and health value (2.0 mg/m^3).

[a]CS = o-chlorobenzylidene malononitrile.

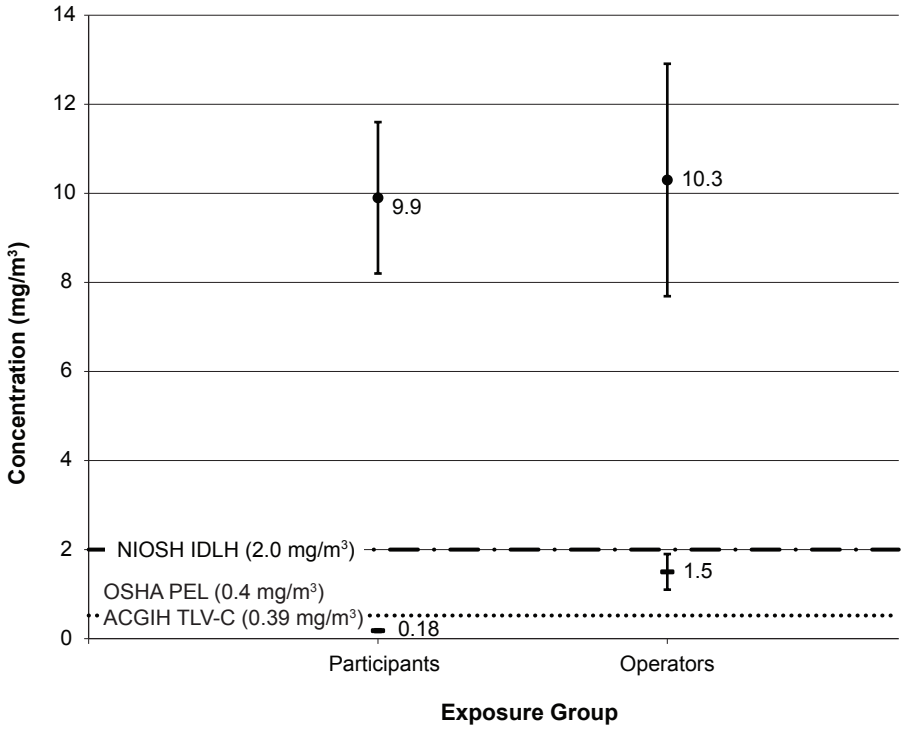
*Exceeded the Occupational Safety and Health Administration permissible exposure limit (0.4 mg/m^3) when averaged over the eight-hour work day.

exits. Sampling locations were selected to minimize training interference, provide representative respiratory exposure locations, and allow access to sampling media for rapid exchange. As shown in Figure 1, four initial sampling locations are based upon these criteria, three in the mask removal (A–C) area and one near the entrance (D).

The Occupational Safety and Health Administration (OSHA)–modified NIOSH physical and chemical analytical method 304 was used to sample for CS (OSHA, 2013a). This method uses an OSHA versatile sampler (OVS) tube in lieu of the NIOSH-required 37-mm polytetrafluorethylene with an in-line Tenax TA sorbent tube (National Institute for Occupational Safety and Health [NIOSH], 1979). The OVS sampler combines a glass filter with a two-sec-

FIGURE **2**

CS Concentration by Exposure Group



● represents mean exposure concentration; — represents mean eight-hour time-weighted averages; error bars represent 95% confidence interval.

CS = o-chlorobenzylidene malononitrile; NIOSH IDLH = National Institute for Occupational Safety and Health immediately dangerous to life and health; OSHA PEL = Occupational Safety and Health Administration permissible exposure limit; ACGIH TLV-C = American Conference of Governmental and Industrial Hygienists threshold limit value-ceiling.

tion sorbent bed (140/70 Tenax) in one tube to capture both the aerosol and vapor phases of CS. Sampling trains consisted of a 1.4-m section of Tygon tubing connected to OVS tube covers with OVS samplers inserted. Sampling trains were then connected to Aircheck XR5000 pumps calibrated to 1.5 L per minute using a BIOS DryCal.

OVS samplers were suspended 1.37 m above the floor on sampling stands at locations A–D to represent human breathing zone exposures. Pumps were sequentially started when an exposure group entered the chamber and sequentially paused after the exposure group exited. OVS tubes were removed, capped, sealed in individual 0.5-L plastic bags, and placed outside the chamber in an ice-filled cooler. A new OVS tube was then placed in each sampling train and sampling continued as previously described until all exposure groups completed training. Post-sampling flow rates were documented following each sampling event. OVS tubes were packed in ice and shipped within 24 hours via overnight mail to a certified laboratory for analysis. Sample size calculation results required 48 samples (12 from each location) to detect a 0.50 mg/m^3 difference between the sampling locations with 80% power at the 95% confidence level.

Exposure Assessment

Once the chamber was characterized, the most appropriate locations for CS sampling were determined for characterizing personnel exposures. Personal monitoring of trainees was not conducted due to potential training disruption. It is acceptable, however, to use area samples taken from a fixed location to represent exposures to multiple workers (OSHA, 2013a). Thus, area-based static sampling provided estimated trainee exposure concentrations. Sampling methodology was consistent with that used during chamber characterization. Thirty-four military companies comprised of a total of 6,723 trainees were involved in the exposure assessment. Thirty-two of the companies had four exposure groups, while two smaller companies had only three exposure groups. A total of 134 area samples were obtained to represent these exposure groups.

Operators remaining inside the chamber for the duration of the exercise wore personal monitors with a sampling train and flow rate consistent with area monitors. The OVS sampler was clipped to the chamber operator's lapel within six inches of the nose; the sampling pump was attached to the operator's belt. The pump was started immediately upon entry into the chamber and was not stopped until the training event was complete and the operator exited the chamber. A total of seven operators were monitored and 33 samples were obtained from these operators during their chamber exposures.

Results

Chamber Characterization

CS concentrations ranged from 0.4 to 53.3 mg/m^3 (mean = 10.4 mg/m^3) for 48 total samples, 12 from each location (Figure 1, A–D). The Shapiro-Wilk test indicated that the data were not normally distributed ($p < .01$) and required nonparametric analysis (Shapiro & Wilk, 1965). CS concentrations at sampling locations A–D were not statistically different when compared using the Kruskal-Wallis one way analysis of variance ($p = .198$) (Kruskal & Wallis, 1952). This is likely the result of mixing created by the constant movement of the trainees and chamber operators. These data suggest that CS is evenly dispersed across the four sampling points and allows one area sample at a fixed location (Figure 1, A–D) to represent chamber concentrations. Location C was selected as the location nearest the center of the mask removal area.

Exposure Assessment

Table 1 shows the 134 area samples used as individual exposure surrogate measures for the 6,723 trainees in our study. Observed CS concentrations were not normally distributed ($p < .01$) and ranged from 1.74 to 55.24 mg/m^3 (mean = 9.9 mg/m^3) with exposure durations and sampling times ranging from 5.0 to 15.0 minutes (mean = 8.7 min.). Eight-hour

time-weighted averages (TWA) ranged from 0.02 to 1.21 mg/m^3 (mean = 0.18 mg/m^3). All area samples (N = 134) exceeded the ACGIH TLV-C (skin) (0.39 mg/m^3), 98% (n = 131) exceeded the IDLH (2.0 mg/m^3), and 11% (n = 15) exceeded the OSHA permissible exposure limit (PEL) (0.4 mg/m^3). All trainees (n = 6,723) in the cohort were potentially exposed to CS concentrations exceeding the ACGIH TLV-C (skin), 6,589 to concentrations exceeding the IDLH, and 770 to concentrations exceeding the OSHA PEL (Figure 2).

The results of the personal monitoring samples collected from the seven different chamber operators (A–G) are displayed in Table 2. One data point was excluded from the analysis because of a pump failure. Personal monitoring samples were not normally distributed (p < .01) and ranged from 2.37 to 35.07 mg/m^3 (mean = 10.3 mg/m^3) with exposure durations ranging from 28.0 to 90.0 minutes (mean = 56.5 min.). All samples exceeded the ACGIH TLV-C (skin) and the IDLH. The eight-hour TWA for the chamber operators ranged from 0.3 to 5.0 mg/m^3 (mean = 1.5 mg/m^3); 32 of 33 samples exceeded the OSHA PEL (Figure 2).

TABLE **2**

CS[a] Concentrations, Exposure Durations, and TWA[b] for Chamber Operators

Company #	Chamber Operator				Company #	Chamber Operator			
	ID	Time (min.)	CS (mg/m^3)	TWA (8 hr.)		ID	Time (min.)	CS (mg/m^3)	TWA (8 hr.)
1	B	70.0	**11.1**	*1.6*	18*	D	57.0	**2.8**	*0.6*
2	C	48.0	**6.8**	*0.7*	19	D	46.0	**10.0**	*1.0*
3	A	54.0	**7.7**	*0.9*	20	E	51.0	**3.6**	*0.4*
4	A	54.0	**32.2**	**3.6**	21	G	Pump failure		
5	C	53.0	**6.5**	*0.7*	22*	D	49.0	**2.4**	*1.1*
6	A	69.0	**35.1**	**5.0**	23*	D	41.0	**10.1**	*1.1*
7	A	28.0	**15.0**	*0.9*	24	E	50.0	**9.9**	*1.0*
8	A	83.0	**9.1**	*1.6*	25*	F	64.0	**12.7**	**2.6**
9	A	83.0	**15.7**	**2.7**	26*	F	71.0	**6.1**	**2.6**
10	A	54.0	**10.3**	*1.2*	27	D	50.0	**10.5**	*1.1*
11	B	90.0	**21.4**	**4.0**	28	F	62.0	**15.1**	*2.0*
12	A	87.0	**19.5**	**3.5**	29	D	50.0	**3.3**	*0.3*
13*	E	52.0	**7.3**	*1.2*	30	D	41.0	**6.0**	*0.5*
14*	E	56.0	**3.1**	*1.2*	31	G	46.0	**5.4**	*0.5*
15	E	60.0	**9.7**	*1.2*	32	F	47.0	**6.1**	*0.6*
16	D	46.0	**11.5**	*1.1*	33	G	55.0	**5.0**	*0.6*
17*	D	50.0	**2.9**	*0.6*	34	D	48.0	**6.7**	*0.7*

Note. Values in italics exceeded American Conference of Governmental Industrial Hygienists' threshold limit value-ceiling (0.39 mg/m^3). Values in bold exceeded the National Institute for Occupational Safety and Health's immediately dangerous to life and health value (2.0 mg/m^3).

[a]CS = o-chlorobenzylidene malononitrile.

[b]TWAs = time-weighted averages.

*Companies 13 and 14, 17 and 18, 22 and 23, and 25 and 26 occurred in the same eight-hour workday, respectively.

Discussion

U.S. Army doctrine dictates the exposure standards set forth by OSHA will be adhered to unless the exposure standards set by ACGIH are more protective; the ACGIH TLV-C, the OSHA PEL, and the NIOSH IDLH are applicable to CS exposures (Department of the Army, 2005). The TLV-C (0.39 mg/m^3) is a value that should not be exceeded during any part of the exposure scenario and was established to minimize CS-induced damage to the respiratory epithelium and protect against symptoms including burning of exposed skin and potential skin sensitization (American Conference of Governmental Industrial Hygienists, 1991, 2010). The OSHA PEL (0.4 mg/m^3) is the average concentration exposure during an eight-hour work period that should not be exceeded during a 40-hour work week and was developed to reduce the risk associated with skin, eye, and respiratory effects (Air Contaminants, 2006; OSHA, 1995, 2013b). The NIOSH IDLH (2.0 mg/m^3) was established to prevent delayed or permanent health effects (including death) associated with exposure and to protect against eye, respiratory, and other effects that could prevent escape from the exposure scenario (NIOSH, 1994).

The primary routes of trainee exposure are inhalation (respiratory tract) and absorption (skin and eyes) (OSHA, 1976). Exposures to the respiratory tract and eyes may have occurred if a mask was defective or improperly sealed; when required to break the seal of the mask; or when required to remove the mask prior to exiting the chamber. Army safety guidelines state, "Unprotected personnel will not be exposed to riot control agents longer than 15 seconds;" however, observed time out of mask for 34 randomly selected participants from different companies ranged from 29 to 122 seconds (mean = 48.9 s) (Department of the Army, 2012c). Skin exposures occur continuously with hands, wrists, necks, and backs of the head fully exposed to airborne CS. ACGIH advises that when a chemical bears a skin notation, measures should be taken to prevent dermal contact because air sampling does not account for exposure contributions via the cutaneous route (ACGIH, 2010). Furthermore, CS penetrates and remains in uniform fabric, presenting potential longer-term exposures. These factors suggest that trainees are potentially exposed to CS at levels greater than those indicated by the air monitoring results presented here.

It is common practice to monitor workers closest to the point of generation (chamber operators) with the assumption of a worst-case exposure scenario (OSHA, 1985). Since the data presented here show chamber operators are overexposed, the potential for similar trainee overexposure is possible and consistent with the area sampling data presented in Table 1. It is important to note, however, that full-period sampling was used to monitor the chamber operators. This sampling method-

ology provides the mean concentration each chamber operator was exposed to during a particular chamber exercise. Changes in concentrations created by addition of CS, doors opening, trainees exiting, and general mixing within the chamber are not individually captured, but averaged together. Consequently, chamber operators may have been exposed to higher CS concentrations than are reported here. Conversely, trainees had much shorter sampling durations that may have captured many of the aforementioned concentration changes. The difference in sampling durations resulted in a disparity in the observed concentration ranges for trainees versus chamber operators; however, the Mann-Whitney U test failed to reveal a statistical difference between the mean trainee CS concentration (mean = 9.9 mg/m^3) and the mean chamber operator CS concentration (mean = 10.3 mg/m^3) at the 95% confidence level (p = .172).

Chamber operators are not required to break the seal or remove their mask; however, the question of respirator efficacy in this environment remains. The M40 is designed to protect the respiratory system from military chemical warfare agents. The Department of the Army and Department of Defense are the approval authorities for respirators to be used for protection against these agents; however, riot control agents are specifically exempt from this definition, leaving NIOSH as the approving authority (Department of the Army, 2013). A quantitatively fit NIOSH-approved full-face APR has an assigned protection factor (APF) of 50 and is capable to protect against airborne concentrations up to the IDLH; however, the M40 is not NIOSH approved and thus does not have an APF. Without an APF, it is difficult to determine whether the M40 provides adequate respiratory protection for concentrations approaching the IDLH level. When IDLH is exceeded, a full-face pressure demand self-contained breathing apparatus or a combination full-face pressure demand supplied air respirator with auxiliary self-contained air supply is required (Bolinger, 2004; Department of the Army and Defense Logistics Agency, 1982; OSHA, 1976; Respiratory Protection, 2006). Routine entry into this type of environment requires approval from either the installation medical authority or the safety and occupational health manager (Department of the Army, 2013). Since chamber operators are exposed to levels exceeding the PEL and IDLH on a routine basis, they should be issued a NIOSH-approved quantitatively fit respirator and be enrolled in a respiratory protection program (Department of the Army, 2007, 2013; Department of the Army and Defense Logistics Agency, 1982; OSHA, 1995; Respiratory Protection, 2006). All chamber operators in our study wore only a qualitatively fit-tested M40 series protective mask and were not enrolled in a respiratory protection program.

Chamber operators were also subjected to the effects associated with dermal exposure to CS. Three of the seven chamber operators wore the mission-oriented protective posture (MOPP) level four ensemble without the chemical protective over boots. MOPP level four features a chemical protective over garment that covers the upper and lower body, chemical protective gloves and over boots, and the M40 series mask with attached hood (Rimpel, Boehm, O'Hern, Dashiell, & Tracy, 2008; U.S. Army Chemical School, 2003). The remaining four chamber operators (and three investigators) wore only the ACU and an M40 protective mask without a hood. Three of four chamber operators and two of three investigators who wore only the ACU and M40 protective mask without the hood developed erythema that persisted for up to 48 hours on the exposed skin on the back of the neck and head. These reactions are consistent with those from prolonged CS skin exposures (Archuleta & Stocum, 1993; Blain, 2003; Shmunes & Taylor, 1973).

Conclusion and Recommendations

Our study is the first to quantify CS exposures in U.S. Army BCT trainees and chamber operators. Both cohorts were potentially exposed to CS levels requiring a greater level of respiratory and skin protection than afforded at the time of our study. All members of the BCT cohort were potentially exposed to CS concentrations exceeding the TLV-C (skin), 98% of which exceeded IDLH. This is consistent with previous unoccupied chamber studies that suggested the U.S. Army MCT procedures produce CS concentrations exceeding guidelines established by ACGIH, NIOSH, and OSHA (Hout et al., 2011).

A work practice control of decreasing the concentration of CS used in the MCT may reduce the potential for overexposure to CS. MCT's primary goal of demonstrating the capability of the protective mask can be accomplished using CS concentrations bounded by the odor threshold (0.004 mg/m^3) and the TLV-C (0.39 mg/m^3) (Department of the Army, 1996; Hout et al., 2010). If concentrations remain within this range, the need for skin and respiratory protection is greatly decreased. Chamber CS concentrations should be evaluated by industrial hygiene personnel at least annually to verify exposure levels (Department of the Army, 2007). Pairing this with administrative controls such as rotating chamber operators and limiting the time trainees are inside the chamber without respiratory protection to 15 seconds should significantly reduce overexposure potential.

If CS concentrations are not reduced, personal protective equipment must be relied upon to reduce exposures. The use of the chemical protective garment ensemble by both the trainees and operators should reduce potential skin exposures. Respiratory exposures may be minimized through proper mask maintenance, quantitative fit testing, and equipping chamber operators with NIOSH-certified masks designed to protect them against levels of CS exceeding IDLH. Chamber operators should also be enrolled in a respiratory protection program.

The results of our study prompted the March 2013 publication of All Army Activities (ALARACT) message 051/2013, which incorporated several of the controls recommended here into future army MCT events. Specifically, it reduced the number of CS capsules required to charge the chamber, reduced the number of capsules used to maintain the CS concentration, and specified a maximum time out of mask of 15 seconds. It also mandated semiannual industrial hygiene assessments of all army mask confidence chambers and periodic wet cleaning of said chambers (U.S. Army Safety Office, 2013).

Ongoing research is being conducted to investigate health effects associated with the CS exposures documented here. Future research is needed to quantify CS exposure levels after implementation of ALARACT 051/2013 to determine if the controls were effective in lowering CS concentrations and to study the effect of these controls on health outcomes.

continued on page 20

continued from page 19

Disclaimer: The views expressed in this article are those of the authors and do not reflect the official policies or positions of the Uniformed Services University of the Health Sciences, Department of the Army, Department of Defense, or the U.S. government.

Acknowledgements: This work was sponsored by the U.S. Army Medical Command, Office of the Surgeon General, Falls Church, Virginia. Laboratory and technical support were provided by the Army Institute of Public Health, Aberdeen Proving Ground, Maryland.

Corresponding Author: MAJ Joseph Hout, Department of Preventive Medicine and Biometrics, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Rd., Bethesda, MD 20814.
E-mail: jhout@usuhs.edu.

References

Air Contaminants (Occupational Safety and Health Administration). 29 CFR 1910.1000 (2006). Retrieved from http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9991&p_table=STANDARDS

American Conference of Governmental Industrial Hygienists. (1991). *Documentation of the threshold limit values and biological exposure indices* (6th ed.). Cincinnati, OH: Author.

American Conference of Governmental Industrial Hygienists. (2010). *TLVs and BEIs*. Cincinnati, OH: Author.

Archuleta, M., & Stocum, W. (1993). *Toxicity evaluation and hazard review for o-chlorobenzylidene malononitrile* (pp. 7–12). Albuquerque, NM: Sandia National Laboratories.

Blain, P.G. (2003). Tear gases and irritant incapacitants. *Toxicological Reviews, 22*(2), 103–110.

Bolinger, N. (2004). *NIOSH respirator decision logic* (Publication No. 2005-100). Cincinnati, OH: National Institute for Occupational Safety and Health. Retrieved from http://www.cdc.gov/niosh/docs/2005-100/pdfs/05-100.pdf

Department of Defense. (2012). *Military personnel statistics*. Retrieved from https://www.dmdc.osd.mil/appj/dwp/reports.do?category=reports&subCat=milActDutReg

Department of the Army. (1982). *Technical manual 43-0001-26-2*. Washington, DC: Author.

Department of the Army. (1994a). *Technical manual 3-4240-339-10, operator's manual for chemical-biological mask: Field M40*. Retrieved from http://chemicaldragon.com/yahoo_site_admin/assets/docs/TM_3-4240-339-10.12645728.pdf

Department of the Army. (1994b). *Training circular 3-8, chemical training*. Retrieved from http://chemicaldragon.com/yahoo_site_admin/assets/docs/TC_3-8.207105519.pdf

Department of the Army. (1996). *Field manual 3-11, flame, riot control agent, and herbicide operations*. Retrieved from http://library.enlisted.info/field-manuals/series-3/FM3-11/TOC.PDF

Department of the Army. (2005). *Department of the army pamphlet 40-11, preventive medicine*. Retrieved from http://www.apd.army.mil/pdffiles/p40_11.pdf

Department of the Army. (2007). *Army regulation 385-10, the army safety program*. Retrieved from http://www.apd.army.mil/pdffiles/r385_10.pdf

Department of the Army. (2008). *Chemical, biological, radiological, and nuclear (CBRN) defense mask confidence training procedures: Training support package 805-B-2040*. Retrieved from http://chemicaldragon.com/yahoo_site_admin/assets/docs/training_support_package_from_chem_school.207105550.doc

Department of the Army. (2011). *Army regulation 350-1, training and leader development*. Retrieved from http://www.apd.army.mil/pdffiles/r350_1.pdf

Department of the Army. (2012a). *Department of the army pamphlet 350-38, standards in training commission*. Retrieved from http://www.apd.army.mil/pdffiles/p350_38.pdf

Department of the Army. (2012b). *Training and doctrine command regulation 350-6, enlisted initial entry training policies and administration*. Retrieved from http://www.tradoc.army.mil/tpubs/regs/tr350-6withCh1.pdf

Department of the Army. (2012c). *Department of the army pamphlet 385-63, range safety*. Retrieved from http://www.apd.army.mil/pdffiles/p385_63.pdf

Department of the Army. (2013). *The army respiratory protection program*. Washington, DC: Author. Retrieved from http://armypubs.army.mil/epubs/pdf/R11_34.pdf

Department of the Army and Defense Logistics Agency. (1982). *Technical bulletin medical 502, occupational and environmental health respiratory protection program*. Retrieved from http://armypubs.army.mil/epubs/pdf/R11_34.pdf

Hout, J., Lapuma, P., Hook, G., & White, D. (2010). Identification of compounds formed during the low temperature heat dispersal of encapsulated o-chlorobenzylidene malononitrile (CS riot control agent). *Journal of Occupational and Environmental Hygiene, 7*(6), 352–357.

Hout, J., White, D., Kluchinsky, T., & Lapuma, P. (2011). Evaluation of CS (o-chlorobenzylidene malononitrile) concentrations during U.S. army mask confidence training. *Journal of Environmental Health, 74*(3), 18–21.

Kruskal, W., & Wallis, A. (1952). Use of ranks in one-criterion variance analysis. *Journal of the American Statistical Association, 47*(260), 583–621.

Morrison, R. (2001). *NBC filter performance* (pp. 1–6). Aberdeen Proving Ground, MD: Edgewood Biological Center.

National Institute for Occupational Safety and Health. (1979). *o-chlorobenzylidene malononitrile (OCBM), physical and chemical analytic method (P&CAM) 304*. Retrieved from http://www.cdc.gov/niosh/npg/pdfs/P&cam304.pdf

National Institute for Occupational Safety and Health. (1994). *Documentation for immediately dangerous to life or health concentrations*

References

(IDLHs). Retrieved from http://www.cdc.gov/niosh/idlh/2698411.html

Occupational Safety and Health Administration. (1976). *Occupational health guideline for o-chlorobenzylidene malononitrile*. Retrieved from http://www.cdc.gov/niosh/docs/81-123/pdfs/0122.pdf

Occupational Safety and Health Administration. (1985). *Occupational safety and health guidance manual for hazardous waste site activities*. Retrieved from https://www.osha.gov/Publications/complinks/OSHG-HazWaste/all-in-one.pdf

Occupational Safety and Health Administration. (1995). *Occupational safety and health guideline for o-chlorobenzylidene malononitrile*. Retrieved from http://www.cdc.gov/niosh/docs/81-123/pdfs/0122-rev.pdf

Occupational Safety and Health Administration. (2013a). *Chemical exposure health data*. Retrieved from http://www.osha.gov/opengov/healthsamples.html

Occupational Safety and Health Administration. (2013b). *o-chlorobenzylidene malononitrile*. Retrieved from http://www.osha.gov/dts/chemicalsampling/data/CH_227100.html

Punte, C.L., Owens, E.J., & Gutentag, P.J. (1963). Exposures to orthochlorobenzylidene malononitrile. Controlled human exposures. *Archives of Environmental Health, 6*(3), 366–374.

Respiratory Protection (Occupational Safety and Health Administration). 29 CFR 1910.134 (2006). Retrieved from http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=standards

Rimpel, L.Y., Boehm, D.E., O'Hern, M.R., Dashiell, T.R., & Tracy, M.F. (2008). Chemical defense equipment. In S.D. Tuorinsky (Ed.), *Medical aspects of chemical warfare* (pp. 559–592). Washington, DC: Borden Institute.

Salem, H., Gutting, B.W., Kluchinsky, T.A., Boardman, C.H., Tuorinsky, S.D., & Hout, J.J. (2008). Riot control agents. In S.D. Tuorinsky (Ed.), *Medical aspects of chemical warfare* (pp. 441–484). Washington, DC: Borden Institute.

Shapiro, S.S., & Wilk, M.B. (1965). An analysis of variance test for normality (complete samples). *Biometrika, 52*(3–4), 591–611.

Shmunes, E., & Taylor, J. (1973). Industrial contact dermatitis: Effect of the riot control agent ortho-chlorobenzylidene malononitrile. *Archives of Dermatology, 107*(2), 212–216.

Sivathasan N. (2010). Educating on CS or "tear gas." *Emergency Medicine Journal, 27*(11), 881–882.

Thomas, R., Smith, P., Rascona, D., Louthan, J., & Gumpert, B. (2002). Acute pulmonary effects from o-chlorobenzylidenemalononitrile "tear gas:" A unique exposure outcome unmasked by strenuous exercise after a military training event. *Military Medicine, 167*(2), 136–139.

U.S. Army Chemical School. (2003). *Field manual 3-11.4, multiservice tactics, techniques, and procedures for nuclear, biological, and chemical (NBC) protection*. Retrieved from http://www.fas.org/irp/doddir/army/fm3-11-4.pdf

U.S. Army Program Executive Office Soldier. (2012). *Army combat uniform*. Retrieved from http://www.peosoldier.army.mil/portfolio/#17

U.S. Army Safety Office. (2013). *ALARACT 051/2013: Safety alert on mask confidence training (MCT) procedures using o-chlorobenzylidene malononitrile (CS) capsules*. Retrieved from https://acc.dau.mil/CommunityBrowser.aspx?id=636485

Sensor Drift and Predicted Calibration Intervals of Handheld Temperature and Relative Humidity Meters Under Residential Field-Use Conditions

James D. Johnston
Brianna M. Magnusson
Department of Health Science
Brigham Young University

Dennis Eggett
Department of Statistics
Brigham Young University

Kyle Mumford
Center for Persons With Disabilities
Utah State University

Scott C. Collingwood
Department of Pediatrics
University of Utah

Scott A. Bernhardt
Department of Biology
Utah State University

Abstract **Handheld temperature and relative humidity (T/RH) meters are commonly used in residential indoor air surveys. Although popular, T/RH meters are prone to sensor drift and consequent loss of accuracy, and thus instrument manufacturers often recommend annual calibration and adjustment. Field-use conditions, however, have been shown to accelerate electronic sensor drift in outdoor applications, resulting in out-of-tolerance measurements in less than one year. In the study described in this article, sensor drift was evaluated under residential field use for 30 handheld T/RH meters to predict needed calibration intervals based on hierarchical linear modeling. Instruments were used in 43 home visits over a 93-day period and were calibrated (without adjustment) 49 times over the study period with a laboratory standard. Analysis of covariance showed significant drift among temperature sensors for all three instrument types ($p < .0001$) and among humidity sensors in two instruments. The authors' study suggests calibration frequency should be based on instrument performance under specific sampling conditions rather than on predetermined time intervals.**

Introduction

Temperature and relative humidity (T/RH) have become increasingly important considerations in residential health surveys. Cold housing, for instance, is associated with increased mortality, circulatory diseases, respiratory problems, and mental ill health (Butler, Williams, Tukuitonga, & Paterson, 2003; Marmot Review Team, 2011), and high indoor temperature is associated with increased mortality, particularly among the elderly (Centers for Disease Control and Prevention [CDC], 2003; Semenza et al., 1996; Yip et al., 2008). Indoor RH above 50%–55% can support house dust mite (HDM) growth, which is associated with the development and exacerbation of asthma (Arlian, Confer, Rapp, Vyszenski-Moher, & Chang, 1998; Ellingson, LeDoux, Vedanthlan, & Weber, 1995; Korsgaard, 1982). Likewise, many fungi produce allergenic spores and can grow on building surfaces above 75% RH (Arundel, Sterling, Biggin, & Sterling, 1986; Block, 1953; Grant, Hunter, Flannigan, & Bravery, 1989). In addition to supporting HDM and mold growth, damp indoor environments are associated with upper respiratory infections, wheezing, and coughing (Arundel et al., 1986; Gunnbjörnsdóttir et al., 2006; Koskinen, Husman, Meklin, & Nevalainen, 1999). Indoor dampness is also linked to mental illness and depression, independent of visible mold growth (Hopton & Hunt, 1996; Hyndman, 1990). Thus, accurate assessment of indoor environmental conditions is essential prior to making recommendations to home or building owners, residents, or housing authorities; or prior to interpreting research findings related to residential health.

Handheld electronic T/RH meters are common instruments for measuring indoor environmental conditions, and continue to be used as the primary instrument for measuring air temperature and RH in many environmental studies (Cho et al., 2006; Grimsley et al., 2012; Martin & Coffey, 2007; Perry et al., 2008; Rabito et al., 2007; Ren, Jankun, Belanger, Bracken, Leaderer, 2001). T/RH meters most often use negative temperature coefficient (NTC) thermistors to measure air temperature and thin-film capacitance-based sensors to measure RH. One significant disadvantage to using T/RH meters, however, is that NTC and capacitance-based sensors are prone to drift and decalibration (Childs, Greenwood, & Long, 2000; Visscher & Kornet, 1994). To ensure accurate measurements, manufacturers often recommend annual sensor calibration. Studies show, however, that annual calibra-

TABLE **1**

Manufacturers' Reported Specifications for Temperature and Relative Humidity Meters

Instrument Specifications	Extech 445580	Fluke 971	General Tools PTH8707
Humidity range (RH)	10% to 90%	5% to 95%	20% to 100%
Humidity accuracy	±5%	±2.5%	±3%
Temperature range (°C)	-10 to 50	-20 to 60	0 to 50
Temperature accuracy (°C)	±1.00	±0.50	±1.00
Cost (U.S. $)	$129.99*	$274.95	$39.99
Yearly calibration	Yes	As needed	Yes
In-house calibration	Yes	No	No
Manufacturer information	extech.com	fluke.com	generaltools.com

*Manufacturer's suggested retail price including instrument with 33% and 75% calibration standards. The cost of the instrument without calibration standards was $69.00.

tion may not be sufficient under outdoor atmospheric monitoring applications, particularly for capacitance-based RH sensors (Freitag et al., 1994; Lake, Noor, Freitag, & McPhaden, 2003; Visscher & Kornet, 1994). Given the propensity for T/RH meter sensors to drift, it is possible that annual calibration may be too infrequent for residential field applications as well. The likelihood of sensor drift and the difficulty of conducting in-house T/RH meter calibration may lead field practitioners to continue using instruments after they have drifted outside of manufacturers' specified tolerances.

Although sensor drift is a recognized concern, little is known about how field-use conditions affect T/RH meter accuracy. Wight (1994) suggested sensor drift may be accelerated under field-use conditions due to harsh handling, extreme environments, and multiple users, and therefore calibration intervals should be based on experience with a given instrument under specific sampling conditions rather than on predetermined time intervals. No studies, however, have looked specifically at T/RH meter sensor drift under residential field-use conditions. Understanding the effect of field use on sensor drift is essential to determining whether the convention of annual calibration is appropriate for T/RH meters. The purpose of our study, therefore, was to assess temperature and RH sensor drift over time in handheld T/RH meters used in home visits, and to use regression models to predict required calibration intervals.

Methods

Instrument Selection

Ten each of three T/RH meter models (Extech 445580, Fluke 971, and General Tools PTH8707) were evaluated in our study (Table 1). U.S. National Institute of Standards and Technology (NIST)–traceable calibration was performed on all Extech and Fluke instruments by the manufacturer prior to data collection. NIST-traceable calibration was not offered by General Tools, and instruments were used as purchased.

A Vaisala HMP 110 T/RH instrument was used as a standard from which to compare T/RH meters. This instrument underwent NIST-traceable calibration prior to data collection. The Vaisala HMP 110 was chosen based on cost, temperature range (-40°C to 80°C), temperature accuracy (±0.2°C between 0°C and 40°C), RH range (0%–100%), and RH accuracy (±1.7% between 0%–90% RH). The Vaisala was theorized to be a suitable comparison instrument due to its use of a platinum resistance temperature detector and long-term RH sensor stability. The Vaisala was postcalibrated with a NIST-traceable standard in July 2012 following data collection. The humidity sensor was found to be slightly out of tolerance (-2.09%) at 75% RH, but was within tolerance at 0%, 12%, and 33% RH. The Vaisala was therefore considered an acceptable standard given that RH never exceeded 36% in our study. The temperature sensor was within tolerance at postcalibration.

Field Visits

To test the effect of field use on instrument performance, nine northern Utah homes were selected to represent homes where residential environmental surveys might be conducted. Homes were chosen from volunteers associated with the Cache County Center of the National Children's Study (NCS). Similar to environmental data collection performed in homes as part of the NCS, field use was simulated by having study personnel transport T/RH meters in a field transport bag to and from each home by personal vehicle. Study personnel were provided with instrument-specific training for each T/RH meter model. Study personnel were also trained in a standard operating procedure for collecting temperature and humidity in homes. Home visits were performed 43 times over a 93-day period (March–June 2012). Our study was approved by Utah State University's institutional review board.

It was hypothesized that physical contact between instruments and other hard objects during transport could cause trauma to temperature and humidity sensors, which may accelerate instrument drift. To test this hypothesis, instruments were randomly assigned identification numbers between 1 and 10 within each model. Instruments that received an even number were assigned to the enhanced packaging group. Instruments in the enhanced packaging group were wrapped in bubble wrap for transport. Instruments that received an odd number were assigned to the standard packaging group. Instruments in the standard packaging group were placed in field bags with no attempt to limit contact with other hard objects during transport. Because only nine homes were in the study, one instrument of each model remained in the lab during each field visit. All 30 instruments were rotated through each of the nine homes to ensure uniformity and consistency in data collection.

T/RH Meter Comparison to Vaisala HMP110

At the completion of home visits, instruments were unpacked in the study center laboratory by two technicians who conducted all packaging and instrument comparisons. Instruments were powered on and placed on a laboratory bench adjacent to the Vaisala and allowed to equilibrate for five minutes.

TABLE **2**

Temperature Differences From Vaisala HMP 110 by Instrument Type and by Analysis of Covariance (ANCOVA) Model

Instrument Type	Number of Instruments	Number of Measurements	Mean Difference From Vaisala*	Standard Deviation of the Mean	95% Confidence Interval	Range of Deviation in °C	ANCOVA Mean Difference	*p*-Value
Overall	30	1470	0.078	0.31	0.062–0.094	-4.4–4.9	–	–
Extech	10	490	-0.002	0.23	-0.022–0.019	-1.8–0.9	-0.02	.66
Fluke	10	490	0.126	0.31	0.099–0.153	-4.4–1.3	0.12	.003
General Tools	10	490	0.108	0.37	0.075–0.141	-2.9–4.9	0.06	.1

*Difference calculated as the (instrument reading-Vaisala reading).

After five minutes, temperature and RH readings were taken and differences between T/RH meters and the Vaisala were calculated and recorded on a standardized data collection form. Data from home visits and laboratory comparisons were then manually put into a spreadsheet. Because only nine homes were used, one instrument of each model remained in the laboratory on any given day of data collection. All instruments were calibrated against the Vaisala following field visits, however, including those that remained in the laboratory.

Statistical Methods

A mixed models repeated measures analysis of covariance (ANCOVA) was used to compare the reliability of T/RH meters. This analysis was used to determine if a change in mean deviation occurred from the Vaisala from beginning to end of data collection. The means of the first and last five days of data collection were compared to determine whether significant drift occurred from the Vaisala from beginning to end of data collection. Following this initial analysis, stage was replaced with day as a continuous variable and a hierarchical linear mixed model (HLM) was performed to quantify the rate of sensor drift over time. This model included an interaction between instrument type and day in order to estimate separate linear slopes for each instrument. Slopes were used to predict the time in days for instrument sensors to drift outside of manufacturers' reported levels of accuracy. All analyses were performed using the mixed procedure in SAS version 9.3.

FIGURE **1**

Temperature Sensor Drift Estimated From Hierarchical Linear Mixed Regression Model

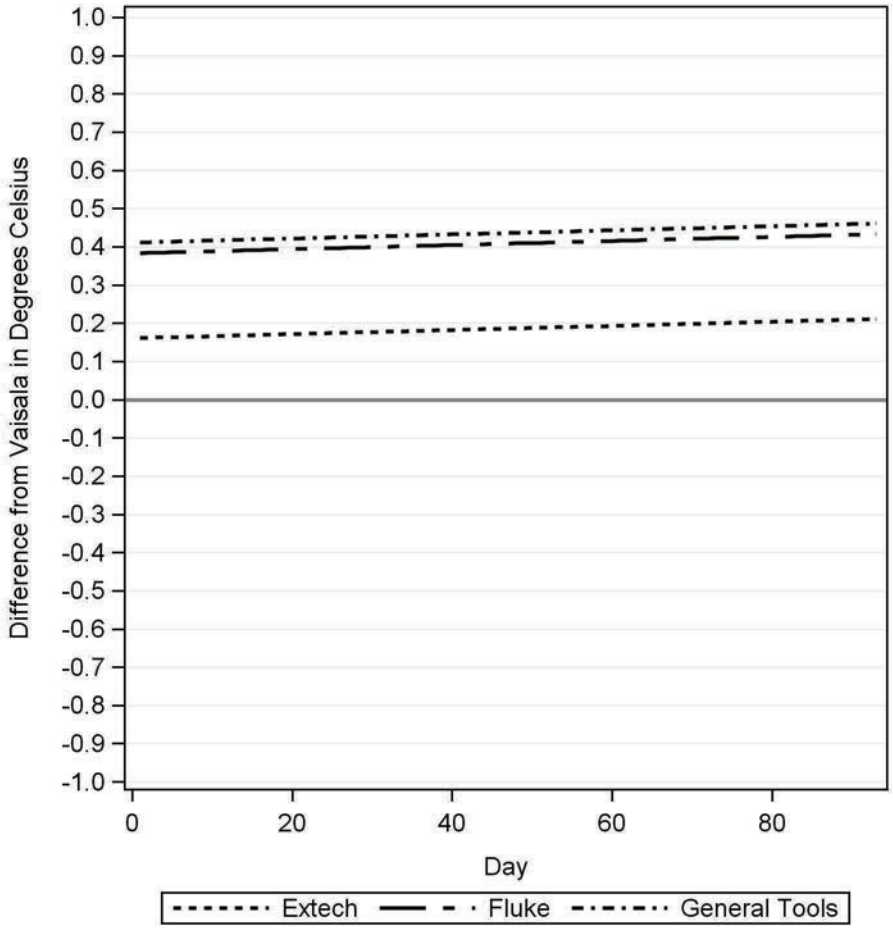


TABLE **3**

Relative Humidity Differences From Vaisala HMP 110 by Instrument Type and by Analysis of Covariance (ANCOVA) Model

Instrument Type	Number of Instruments	Number of Measurements	Mean Difference From the Vaisala*	Standard Deviation of the Mean	95% Confidence Interval	Range of Deviation in °C	ANCOVA Mean Difference	*p*-Value†
Overall	30	278	0.59	1.96	0.49–0.69	-7.01–11.22	–	–
Extech	10	100	1.94	1.01	1.85–2.06	-4.94–11.22	-0.6	.116
Fluke	10	100	-0.76	1.07	-0.86– -0.67	-3.27–6.05	1.03	.008
General Tools	10	78**	0.59	2.47	0.35–0.83	-7.07–5.91	2.96	<.0001

*Difference calculated as the (instrument reading-Vaisala reading).
**22 missing data points due to General Tools instruments' lower limit of detection (20% relative humidity).
†Bonferroni corrected α (0.05/3 = 0.0167).

Results

All 30 T/RH meters completed the study, which included 43 home visits and 49 laboratory comparisons against the Vaisala. T/RH meters traveled an average distance of 1,081.5 km (672 miles) over the course of the study (25.1 km [15.6 miles] round trip per home visit). All home visits and laboratory comparisons were completed over a 93-day period from March to June 2012.

Temperature

A total of 490 laboratory comparisons for temperature were conducted for each instrument type. Ambient lab temperature, as measured by the Vaisala, ranged from 20.8°C to 24.6°C with a mean of 21.8°C. Across all 30 instruments the mean difference from the standard (instrument reading-Vaisala reading) was 0.08°C, with a range of -4.4°C to 4.9°C. Means, standard deviations (*SD*), 95% confidence intervals (*CI*), and range of temperature deviations for each instrument type are provided in Table 2.

Temperature ANCOVA

None of the interactions or the main effect term for packaging were statistically significant in the full model (α = .05), thus these terms were removed using backward elimination. The parsimonious model contained only the terms for stage (beginning vs. end), instrument type, and baseline temperature. The parameter estimate for baseline temperature was -0.3570 (p < .0001). Thus, within the range of temperature encountered in the lab, as the ambient temperature increased, the instrument readings trended closer to the Vaisala reading.

Table 2 provides the final ANCOVA results for the parsimonious model. The nonsignificant instrument type by stage interaction in the full model (p = .63) indicates that no significant difference occurred between the instruments in the change from beginning to ending. Thus all instruments were grouped together and the change from beginning to end was measured by the mean deviation of all instruments. At the beginning of data collection, all instruments were on average 0.23°C higher than the lab standard. By the end of data collection, the mean deviation was -0.12°C lower than the lab standard. The difference in mean deviation from the beginning of data collection was 0.34°C (*SE*-0.07; p < .0001).

HLM Results for Temperature

HLM was used to test linear decline in instrument accuracy over time. The test for the homogeneity of slopes was not significant (F = 1.02; p = .38). Consistent with the ANCOVA results, HLM showed no difference in the slopes of the three instrument types. Thus, the interaction term was removed from the model. Figure 1 shows the regression lines from the HLM model. If we assume constant drift over time from the HLM model, we can calculate the time in days until an instrument requires recalibration. The common slope for the three instruments had a value of 0.000538. As the manufacturers for the instruments we used gave accuracy ranges of 0.50°C (Fluke) and 1.0°C (Extech and General Tools), we used these parameters to estimate the days to calibration. We determined that temperature accuracy would fall out of tolerance with a ±0.50°C range in 929 days or approximately three years and out of compliance with a ±1°C range in 1,859 days or approximately five years.

Relative Humidity

As with temperature, RH comparisons were made against the Vaisala on 49 separate days. One or more of the General Tools instruments failed to display a humidity reading on 15 days during the sampling period, however. This problem occurred on days when ambient RH dropped below the limit of detection (20%). For the General Tools meters, only 417 valid measurements were obtained. Over the course of our study, RH in the lab ranged from 13.19% to 35.87%, with a mean of 23.84%. For the 30 instruments, the mean difference in RH readings as compared to the standard was 0.59%, with a range of -7.01% to 11.22%. Means, standard deviations, 95% *CI*, and range of RH deviations for each instrument type are provided in Table 3.

Relative Humidity ANCOVA

The main effect for packaging (p = .90) and both interaction terms containing packaging (p = .38 and p = .34) were nonsignificant in the full model. Therefore, these terms were

removed using backward elimination. The parameter estimate for baseline humidity was -0.04119, indicating that within the range of RH encountered in the lab, as the relative humidity increased the instrument readings trended closer to the Vaisala readings. This finding was significant (p = .024). The final ANCOVA model included main effect terms for baseline RH, instrument type, stage, and an instrument type by stage interaction.

Table 3 also provides the ANCOVA results for the final model. The interaction was significant (p < .0001), indicating a significant difference among the three instruments from beginning to end. For the Extech instruments, the mean difference from Vaisala was 1.59% in the beginning cluster and 2.18% in the ending cluster, a difference of 0.6%. This change was not significant (p = .11). Among the Fluke instruments, the mean difference from Vaisala in the beginning and end clusters were 0.04% and -0.99%, respectively. The difference in deviation from beginning to end was 1.03% (p = .008). Similarly, for the General Tools instruments, the deviations were 2.62% and -0.34% in the beginning and end clusters, respectively, with a change of 2.96% over time (p < .0001). Using a Bonferroni adjusted alpha for the three tests (α = 0.05/3 = 0.0167), we concluded that a significant change occurred in measurement reliability over the course of our study for the Fluke and General Tools instruments.

Relative Humidity HLM

The test for the homogeneity of slopes in the HLM model was statistically significant (F = 29.71; p < .0001), consistent with our ANCOVA results. Thus, three different slopes were fitted. The HLM slopes for each instrument are shown in Figure 2. Although Fluke and General Tools reported accuracies of ±2.5% and ±3.0% RH, respectively, an accuracy of ±5% of the instrument's reading was used for the purposes of our study and was assumed to be acceptable for most residential indoor air quality assessments. The highest RH observed over the course of the study was approximately 36%. Thus, assuming 36% RH, and using ±5% of the instrument's reading as being out of tolerance (1.8% RH), we estimated the slope and the number of days until calibration would be required for each type of instrument. These results are presented in Table 4.

FIGURE **2**

Humidity Sensor Drift Estimated From Hierarchical Linear Mixed Regression Model

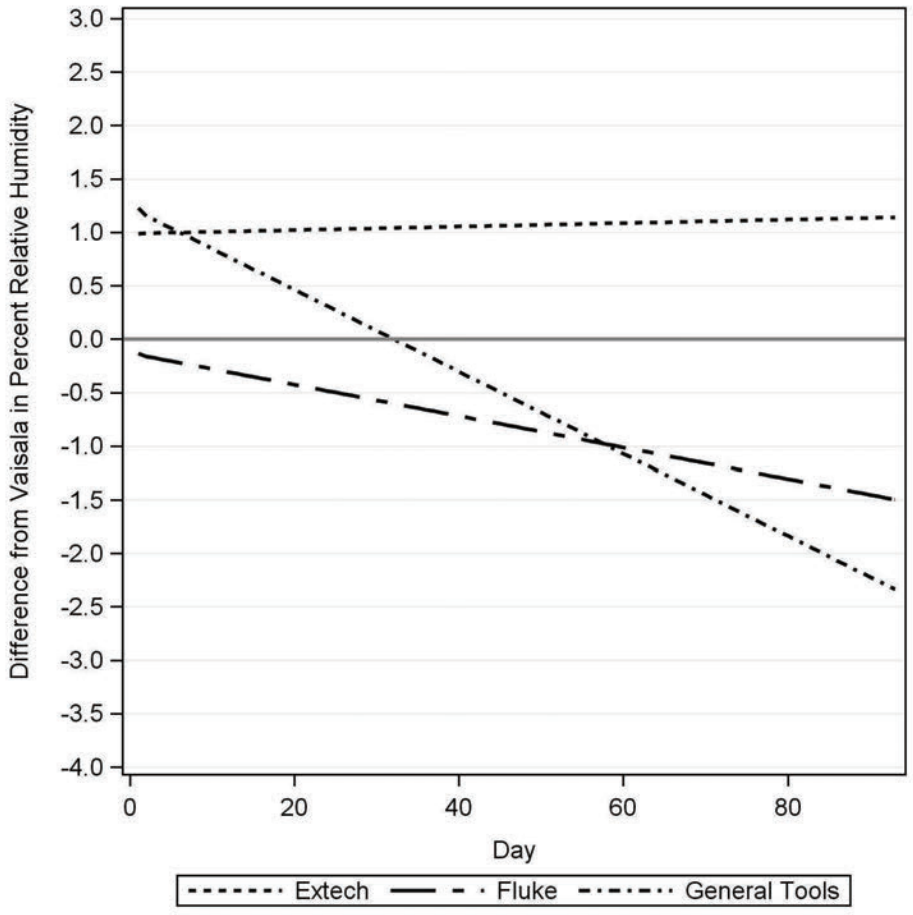


TABLE **4**

Predicted Calibration Intervals for Relative Humidity (RH) Sensors by Instrument Type

Instrument Type	Slope Value	5% Accuracy**
Extech (±5%)*	0.00163	1104 days
Fluke (±2.5%)*	-0.01469	123 days
General Tools (±3%)*	-0.03833	47 days

*Manufacturer's specified accuracy ranges.
**5% of instrument reading at 36% RH (±1.8% RH).

Assuming constant drift over time, we predicted that the Extech instruments would remain in tolerance beyond the conventional annual recalibration interval. The Fluke instruments would remain within ±5% accuracy for approximately four months, and the General Tools instruments would require recalibration at just 47 days.

Discussion

Our study supports previous work showing that field-use may accelerate capacitance-based RH sensor drift (Freitag et al., 1994; Lake et al., 2003; Visscher & Kornet, 1994). Furthermore, capacitance-based RH sensor drift was significant enough for some instruments to warrant calibration intervals of less than one year. Based on these study conditions, calibration intervals of 2, 4, and >12 months are appropriate for General Tools, Fluke, and Extech instruments' RH sensors, respectively. This finding supports Wight's (1994) recommendation to tailor calibration intervals based on instrument performance rather than on predetermined time schedules.

Although calibration intervals tailored to specific instruments and sampling conditions may be ideal, limitations imposed by available equipment and procedures may make frequent calibrations difficult to perform in house for some organizations. Optimally, equipment and procedures for field calibration of T/RH meters should be affordable, easy to perform in a relatively short time period, and designed such that field technicians can adjust instruments to match calibration standards. One method of in-house calibration is to compare instrument temperature readings to a liquid-in-glass precision thermometer. Based on this study, temperature sensors were predicted to stay within manufacturers' specified tolerances for at least three years. In the absence of a method for in-house adjustment, NTC sensor drift could be monitored with a precision thermometer, and reference laboratory calibration intervals could be set based on instrument performance, which according to our findings may be needed only every 2–3 years. High quality liquid-in-glass precision thermometers used as reference instruments should only require one complete calibration in their lifetime, followed by periodic recalibrations in the user's laboratory of only a single temperature, usually 0.0°C (Wise, 1991).

Salt solutions used for T/RH meter calibration may provide an affordable alternative to frequent reference lab calibration for humidity sensors. In cases where dedicated in-house laboratory calibration is available, traceable humidity chamber or other calibration systems may be preferred. If resources are limited, however, salt bath calibration may provide a method for monitoring drift over time to establish calibration intervals.

Our study aimed to identify sources of instrument drift during field use. We hypothesized that trauma to T/RH meter sensors during transport might be a primary contributor. We found no significant difference between instruments packed in bubble wrap and those transported with no protection. Other possible explanations for accelerated drift may be extreme temperatures during vehicle transport or sensor poisoning from contaminants in participant homes. Future studies may consider these and other potential causes of drift.

One limitation of our study was the time allowed for data collection. We found significant sensor drift during field use, but our observations were limited to 93 days. Whether the rate and direction of drift will change over longer periods of time is unknown. Findings are also limited to the instruments under consideration. The wide variation among the three types of instruments assessed in our study suggests that these findings are not generalizable to all T/RH meters. Furthermore, the mean RH over the course of this study was 24%. Thus, these findings may not apply to sensor performance under high ambient RH and future research is needed to evaluate sensor performance over broader RH and temperature ranges.

Conclusion

Our study suggests that RH sensors in handheld T/RH meters may drift outside of manufacturers' specified tolerances in less than one year under field-use conditions. Calibration intervals should be based on instrument performance under a given set of sampling conditions, rather than on predetermined time frames.

Acknowledgements: Support for this project was provided by the National Institutes of Health contract HHSN275200800027C/N01-HD-80027. The authors of this manuscript did not receive any financial support from the commercial manufacturers of the instruments evaluated and believe no conflicts of interest exist. The authors would also like to thank the volunteers who opened their homes for data collection.

Corresponding Author: Scott A. Bernhardt, Department of Biology, Utah State University, UMC5305 Old Main Hill, Logan, UT 84322. E-mail: scott.bernhardt@usu.edu.

References

Arlian, L.G., Confer, P.D., Rapp, C.M., Vyszenski-Moher, D.L., & Chang, J.C.S. (1998). Population dynamics of the house dust mites *Dermatophagoides farina*, *D. pteronyssinus*, and *Euroglyphus maynei* (Arcari: Pyroglyphidea) at specific relative humidities. *Journal of Medical Entomology, 35,* 46–53.

Arundel, A.V., Sterling, E.M., Biggin, J.H., & Sterling, T.D. (1986). Indirect health effects of relative humidity in indoor environments. *Environmental Health Perspectives, 65,* 351–361.

Block, S.S. (1953). Humidity requirements for mold growth. *Applied Microbiology, 1*(6), 287–293.

Butler, S., Williams, M., Tukuitonga, C., & Paterson, J. (2003). Problems with damp and cold housing among Pacific families in New Zealand. *The New Zealand Medical Journal, 116*(1177), U494.

Centers for Disease Control and Prevention. (2003). Heat-related deaths—Chicago, Illinois, 1996–2001, and United States, 1979–1999. *Morbidity and Mortality Weekly Report, 52*(26), 610–613.

Childs, P.R.N., Greenwood, J.R., & Long, C.A. (2000). Review of temperature measurement. *Review of Scientific Instruments, 71*(8), 2959–2978.

Cho, S.-H., Reponen, T., LeMasters, G., Levin, L., Huang, J., Meklin, T., Ryan, P., Villareal, M., & Bernstein, D. (2006). Mold damage

continued on page 28

References *continued from page 27*

in homes and wheezing in infants. *Annals Of Allergy, Asthma, & Immunology, 97*(4), 539–545.

Ellingson, A.R., LeDoux, R.A., Vedanthlan, P.K., & Weber, R.W. (1995). The prevalence of *Dermatophagoides* mite allergen in Colorado homes utilizing central evaporative coolers. *Journal of Allergy and Clinical Immunology, 96*(4), 473–479.

Freitag, H.P., Feng, Y., Mangum, L.J., McPhaden, M.J., Neander, J., & Stratton, L.D. (1994). *Calibration procedures and instrumental accuracy estimates of TAO temperature, relative humidity and radiation measurements*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Pacific Marine Environmental Laboratory. Retrieved from http://docs.lib.noaa.gov/noaa_documents/OAR/PMEL/TM_ERL_PMEL/TM_ERL_PMEL_104.pdf

Grant, C., Hunter, C.A., Flannigan, B., & Bravery, A.F. (1989). The moisture requirements of moulds isolated from domestic dwellings. *International Biodeterioration, 25*(4), 259–284.

Grimsley, L.F., Chulada, P.C., Kennedy, S., White, L., Wildfire, J., Cohn, R.D., Mitchell, H., Thornton, E., El-Dahr, J., Mvula, M.M., Sterling, Y., Martin, W.J., Stephens, K.U., & Lichtveld, M. (2012). Indoor environmental exposures for children with asthma enrolled in the HEAL study, post-Katrina New Orleans. *Environmental Health Perspectives, 120*(11), 1600–1606.

Gunnbjörnsdóttir, M.I., Franklin, K.A., Norbäck, D., Björnsson, E., Gislason, D., Lindberg, E., Svanes, C., Omenass, E., Norrman, E., Joqi, R., Jensen, E.J., Dahlman-Hoglund, A., & Janson, C. (2006). Prevalence and incidence of respiratory symptoms in relation to indoor dampness: The RHINE study. *Thorax, 61*(3), 221–225.

Hopton, J.L., & Hunt, S.M. (1996). Housing conditions and mental health in a disadvantaged area in Scotland. *Journal of Epidemiology and Community Health, 50*(1), 56–61.

Hyndman, S.J. (1990). Housing dampness and health amongst British Bengalis in East London. *Social Science and Medicine, 30*(1), 131–141.

Korsgaard, J. (1982). Preventive measures in house-dust allergy. *American Review of Respiratory Diseases, 125*(1), 80–84.

Koskinen, O.M., Husman, T.M., Meklin, T.M., & Nevalainen, A.I. (1999). The relationship between moisture or mould observations in houses and the state of health of their occupants. *European Respiratory Journal, 14*(6), 1363–1367.

Lake, B.J., Noor, S.M., Freitag, H.P., & McPhaden, M.J. (2003). *Calibration procedures and instrumental accuracy estimates of ATLAS air temperature and relative humidity measurements*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Oceanic and Atmospheric Research Laboratories, Pacific Marine Environmental Laboratory. Retrieved from http://www.pmel.noaa.gov/pubs/PDF/lake2569/lake2569.pdf

Marmot Review Team. (2011). *The health impacts of cold homes and fuel poverty*. Retrieved from http://www.instituteofhealthequity.org/projects/the-health-impacts-of-cold-homes-and-fuel-poverty

Martin, S.B., & Coffey, C.C. (2007). An indoor environmental quality investigation of the Fayette County (Pennsylvania) courthouse. *Indoor and Built Environment, 16*(5), 456–464.

Perry, T.T., Vargas, P.A., Bufford, J., Field, C., Flick, M., Simpson, P.M., Hamilton, R.G., & Jones, S.M. (2008). Classroom aeroallergen exposure in Arkansas head start centers. *Annals Of Allergy, Asthma & Immunology, 100*(4), 358–363.

Rabito, F.A., Iqbal, S., Holt, E., Grimsley, L.F., Islam, T.M., & Scott, S.K. (2007). Prevalence of indoor allergen exposures among New Orleans children with asthma. *Journal of Urban Health, 84*(6), 782–792.

Ren, P., Jankun, T.M., Belanger, K., Bracken, M.B., & Leaderer, B.P. (2001). The relation between fungal propagules in indoor air and home characteristics. *Allergy, 56*(5), 419–424.

Semenza, J.C., Rubin, C.H., Falter, K.H., Selanikio, J.D., Flanders, W.D., Howe, H.L., & Wilhelm, J.L. (1996). Heat-related deaths during the July 1995 heat wave in Chicago. *The New England Journal Of Medicine, 335*(2), 84–90.

Visscher, G.J.W., & Kornet, J.G. (1994). Long-term tests of capacitive humidity sensors. *Measurement Science and Technology, 5*(10), 1294–1302.

Wight, G.D. (1994). *Fundamentals of air sampling*. Boca Raton, FL: Lewis Publishers.

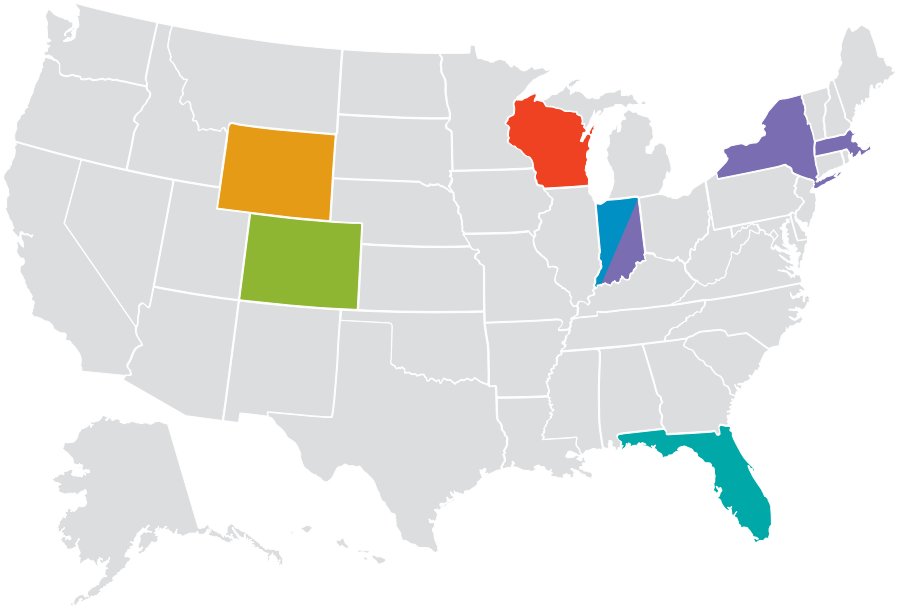
Wise, J.A. (1991). *A procedure for the effective recalibration of liquid-in-glass thermometers*. U.S. Department of Commerce, National Institute of Standards and Technology, Process Measurements Division. Retrieved from http://www.nist.gov/calibrations/upload/sp819.pdf

Yip, F.Y., Flanders, W.D., Wolkin, A., Engelthaler, D., Humble, W., Neri A., Lewis, L., Backer, L., & Rubin, C. (2008). The impact of excess heat events in Maricopa County, Arizona: 2000–2005. *International Journal Of Biometeorology, 52*(8), 765–772.

Did You Know?

Comments on the U.S. Environmental Protection Agency's Clean Power Plan Proposed Rule are due by October 16, 2014. More information about the public hearings held and how to submit comments can be found at www2.epa.gov/carbon-pollution-standards/how-comment-clean-power-plan-proposed-rule.

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 and to offer an avenue for story sharing and community building. It will be published in every other issue of the *Journal*. Do you have a story to share? Please contact Terry Osner at tosner@neha.org.**

COLORADO

Repellant the More Toxic Option

Spraying store-bought mosquito repellent on skin exposes humans to more toxins than community-wide spraying of permethrin-based insecticide, according to the Larimer County Department of Health and Environment. In a recent letter Dr. Adrienne LeBailly sent to the Fort Collins City Council, the department's director outlined the difference between toxicity levels of spray used in some Fort Collins communities and those of store-bought repellents. U.S. Environmental Protection Agency standards indicate that humans are exposed to higher levels of toxins when they slather themselves in bug repellent, LeBailly said.

Concerned about the high levels of West Nile virus–carrying *Culex* mosquitoes in southeast Fort Collins, the health department decided in August to spray the area against the mosquitoes—a move that overstepped the city of Fort Collins' decision to wait to spray until at least two people become infected with the virus in Larimer County.

Regardless of the difference between exposure risks, LeBailly thinks that both community and personal spraying should be used. "I believe both the use of repellents and community spraying are safe, and are very important measures to take in situations where the risk to people's health is very high," she wrote.

Source: www.coloradoan.com/story/news/local/2014/08/14/health-officials-spraying-less-toxic-repellent/14087265/.

FLORIDA

Danger Lurking in the Water

Florida health officials are warning beachgoers about a seawater bacterium that can invade cuts and scrapes and cause flesh-eating disease. *Vibrio vulnificus* thrives in warm saltwater, according to the Centers for Disease Control and Prevention (CDC). If ingested, it can cause stomach pain, vomiting, and diarrhea. But it can also infect open wounds and lead to "skin breakdown and ulceration," according to CDC.

"Since it is naturally found in warm marine waters, people with open wounds can be exposed to *Vibrio vulnificus* through direct contact with seawater," the Florida Department of Health said in a statement. The infection can also be transmitted through eating or handling contaminated oysters and other shellfish, according to the CDC.

As of the end of July, at least 11 Floridians have contracted *Vibrio vulnificus*, and two have died. In 2013, 41 people were infected and 11 died. The proportion of skin and gastrointestinal infections in Florida is unclear, but a CDC spokesman said the ratio tends to be about 1-to-1.

Most people who contract a *Vibrio vulnificus* infection recover with the help of antibiotics, but severe skin infections may require surgery and amputation, according to CDC. People with weakened immune systems are also at risk for blood infections, which are fatal about 50% of the time.

Source: www.abcnews.go.com/Health/warm-water-sparks-flesh-eating-disease-warning-florida/story?id=24755485.

INDIANA

New Meth Menace—Home Resales

When Chris and Jenny Nugent found their dream home on a secluded 2 1/2 acres west of Indianapolis, they tested the water and checked for termites, lead, and radon. They did not test for methamphetamine (meth). The family began getting sick. Jenny Nugent said they experienced shortness of breath, wheezing, and headaches. The girls started vomiting with alarming frequency, she said, missing an average of one day of school each week.

She purchased a $50 meth test kit on the Internet. The first test showed meth levels three times over the legal safe limit. Subsequent tests in different parts of the home showed levels as high as 18 times the legal safe limit. "The first one came in, and we were just, 'We've got to get out here. This is insane,'" Chris Nugent said. So the Nugents left almost everything behind and moved, first to a hotel and then to an apartment a few miles away.

They didn't have much of a choice. Cooking meth produces an invisible toxic gas that gets into ductwork and can penetrate drywall, appliances, carpets, furniture, toys, and clothes. No hard figures are available on how many homes are contaminated with meth, but the advocacy Web site Meth Lab Homes estimates there are 2.5 million American homes contaminated with meth. The Drug Enforcement Agency has a national map of clandestine meth lab seizures in each state since 2012.

Source: http://america.aljazeera.com/watch/shows/america-tonight/articles/2014/7/14/the-test-homebuyersalmostneverdobutshould.html.

INDIANA, NEW YORK, AND MASSACHUSETTS

Google for Gas

Google has been using Google Street View cars to map routes, houses, and commercial buildings for many years. Now, the Environmental Defense Fund (EDF) has put these cars to a new use: mapping natural gas leaks.

The EDF will issue interactive maps that will pinpoint the size and location of thousands of natural gas leaks from distribution pipes that lie below Boston, Indianapolis, and New York's Staten Island. For example, Indianapolis, which has installed plastic pipe, has very few leaks, but in Boston, where natural gas travels through cast-iron pipes dating back as far as the late 1800s and steel pipe installed in an era before rust protection, there are nearly 3,000 leaks. Staten Island falls in between.

The study is one of a series of 16 that the EDF is conducting to figure out how much natural gas is leaking along the supply chain, from shale gas wells drilled with hydraulic fracturing to processing plants, pipelines, commercial vehicles, and homes. The results are critical because natural gas is a potent greenhouse gas, with about 120 times the effect of carbon dioxide during a 20-year period. "This creates a new method that utilities and regulators can use to do a more efficient job at repair and replacement," said Mark Brownstein, an associate vice president and lawyer at the EDF.

Source: http://grist.org/news/now-you-can-google-street-view-gas-pipelineleaks/?utm_source=syndication&utm_medium=rss&utm_campaign=feed_postsubtype_news.

WISCONSIN

Lyme Disease Is a Drag

In Eau Claire County, Wisconsin, Lyme disease is the second most reported illness and the health department is literally dragging and testing for answers. Phil Schumacher with the Eau Claire City-County Health Department explains the "tick drag" program, "It's just as basic as it gets. Ticks feel the movement of the cloth and then we collect them off. If there were any ticks on this cloth we use forceps to take them off the cloth, put them in a bottle of ethanol, and take them back to the lab for DNA testing."

The Eau Claire City-County Health Department is trying to get a handle on why Lyme disease is reported in at least 200 people per year in the county. Environmental Health Director Shane Sanderson says, "Some people even will be diagnosed with arthritis or diseases that present similarly. Past studies have come up with anywhere from 25%–35% of black legged or deer ticks coming back positive for *Borrelia*, which is the bacteria that causes Lyme disease. Whereas other parts in the state and especially other parts in the country will come back with 0%–2% *Borrelia*."

He adds, "Lyme disease does kill people and it does shorten people's lives. We need to show the community that, hey, we're doing something to either reduce exposure or increase resilience against it."

Source: www.wqow.com/story/26027775/2014/07/15/state-grant-has-health-department-hunting-and-testing-ticks-in-eau-claire-county.

WYOMING

Keeping CO_2 Away

If you are a coal-fired plant operator, how do you keep generated CO_2 out of the atmosphere? Last year, the U.S. Environmental Protection Agency released a draft of the rules that effectively require new coal-fired plants to capture and store a portion of the CO_2 they produce. Capturing the CO_2 is one thing; storing vast amounts of it is another issue.

Sponsored by the Office of Fossil Energy's National Energy Technology Laboratory, a project team led by the University of Wyoming's Carbon Management Institute gathered geologic, hydrologic, and geochemical data from a 12,810-foot-deep stratigraphic test well drilled to evaluate the area's potential as a long-term, high-volume carbon storage site. The Rock Springs Uplift, a geologic feature in southwestern Wyoming, was found to have the sought-after combination of ideal geological characteristics for carbon storage and proximity to some of Wyoming's largest sources of anthropogenic CO_2 emissions.

The Rock Springs Uplift could potentially store 14–17 billion metric tons of CO_2, according to results from a Department of Energy–sponsored study. This is equal to 250–300 years worth of CO_2 emissions produced by Wyoming's coal-fired power plants and other large regional anthropogenic CO_2 sources at current emission levels. Additionally, the researchers discovered that the deep saline waters of the Rock Springs Uplift contain high, commercially viable concentrations of lithium, used in batteries and other electronics applications.

Source: www.environmentalleader.com/2014/06/04/wyoming-site-could-store-up-to-300-years-worth-co2-doe-says/.

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES BRANCH

LCDR Danielle Shirk Mills, MPH, REHS

Building Environmental Public Health Framework for Chemical Emergencies

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.

Danielle Shirk Mills is an environmental health officer and emergency coordinator in the Office of Environmental Health Emergencies in CDC's National Center for Environmental Health.

More than 80,000 potentially toxic substances are currently produced, stored, or moved for manufacturing, agriculture, and service industries in an estimated 4.5 million facilities in the U.S. The National Response Center recorded 32,551 chemical incidents in 2012 (National Response Center, 2013). The World Health Organization (WHO) defines a chemical incident as the uncontrolled release of a toxic substance resulting in (potential) harm to public health and the environment (WHO, 2009). Health effects from chemical incidents range from exacerbation of preexisting conditions to acute or chronic effects that affect different systems, depending on the chemical and route of exposure. Accidental releases of chemicals can occur in occupational or nonoccupational settings. An act of terrorism involving an intentional release of toxic industrial chemicals or military chemical weapons likely would also cause chemical exposures. Responding to those emergencies includes addressing the potential health effects of the affected public.

Local, state, and federal public health systems increasingly have become involved in preparedness efforts for chemical incident responses, but efforts have been conducted independently and without a clear consensus or understanding of the public health system's role in such incidents (LaTourrette, Davis, Howell, Sama, & Dausey, 2009). Most emergency preparedness and response planning for chemical incidents focuses on public safety and emergency management roles. Public health departments, however, also have important roles in chemical incident response. These include investigating, tracking, and following up on health effects in exposed persons, as well as issuing guidance about population protective measures and communicating health risks.

A release of chlorine gas caused by an early morning train collision in Graniteville, South Carolina, in 2005 serves as an example that quick involvement of health partners may reduce exposures. Local emergency managers initially issued a shelter-in-place order for a one-mile radius around the collision site until 4:30 p.m. After joint investigations by responders, emergency managers, and local public health officials and a noon declaration of emergency by the state, a mandatory evacuation was issued for the one-mile radius (Centers for Disease Control and Prevention [CDC], 2005). A rapid epidemiology assessment determined that of the 511 persons examined in emergency departments after exposure to chlorine gas, 69 were hospitalized and another 18 were treated at area physician offices (CDC, 2005).

Chemical incident management spans the phases of preparation, response, recovery, and mitigation. Every phase has two core public health functions: risk assessment and communication (WHO, 2009). Risk assessment involves hazard (or potential hazard) identification, dose-response assessment, and risk characterization. During the preparedness and prevention phases of a chemical incident, public health personnel analyze potential exposures to

determine the associated health issues. During the response and recovery phases, the role of public health personnel is to monitor who is being exposed and how exposure is occurring. During incident response, crisis communication conveys actual risk and appropriate risk-reduction measures. Public health employees analyze resiliency of communities to exposures during the mitigation and preparation phases. This resiliency includes the work of local emergency planning committees to ensure safety and control measures to prevent or contain spills and safeguards that limit the availability or quantities of various chemicals. During preparedness and mitigation activities, risk communication pertains to possible incident scenarios and potential protective measures before an incident occurs.

Ensuring preparedness for chemical incidents is a significant challenge; chemicals can be contained in fixed facilities, in transit, or released by human-caused or natural disasters, with each potential scenario requiring unique preparation. Unclear coordination among the planning and response partners also can cause challenges in chemical incident preparedness. Resolving these issues before an emergency avoids ambiguity about the roles of key players during a response. Chemical incidents may present special circumstances (such as unfamiliar health hazards, special medical treatment and supply needs, and environmental health concerns); thus, coordination among organizations that do not normally operate under these conditions likely would enhance preparedness.

Depending on the size of a chemical release, a mix of federal, state, and local agencies can respond. In general terms, the first consideration for a response to a chemical incident is to ensure that the response involves the right partners. This includes first responders and the traditional emergency management community as well as public and environmental health partners, who should be engaged early in the response. Another important consideration is ensuring accurate and complete knowledge of partner agency capabilities; a response is not the best time to discover that critical capabilities are not available. Effective communication between responders before an incident will build these partner relationships. Finally, preparedness means having a plan for chemical identification, response, and evacuation; practicing that plan; and continuously improving that plan in partnership with all potential responders. Training and practicing with other response partners allows agencies to be familiar with the capabilities of those partners. With information available to characterize the risks and vulnerabilities of a particular community, environmental public health employees can prepare pre-scripted messaging before an incident to help reduce confusion during a response. Environmental public health practitioners can participate in training exercises about potential chemical hazards in their communities to expand their knowledge base, build relationships, and learn about the functions of other partners. Chemical preparedness cannot happen in a vacuum.

Corresponding Author: LCDR Danielle Shirk Mills, Office of Environmental Health Emergencies, National Center for Environmental Health, CDC, 4770 Buford Highway, MS F-09, Chamblee, GA 30341. E-mail: dmills@cdc.gov.

Resources for Environmental Public Health Response To Chemical Incidents

- CDC Emergency Preparedness and Response Training for Chemical Emergencies
  www.bt.cdc.gov/chemical/training.asp
- CDC Emergency Preparedness and Response Surveillance for Chemical Emergencies
  www.bt.cdc.gov/chemical/surveillance.asp
- CDC Environmental Health Training in Emergency Response
  www.cdc.gov/nceh/ehs/eLearn/EHTER.htm
- Chemical Agents: Facts About Sheltering in Place
  www.bt.cdc.gov/planning/shelteringfacts.asp
- CDC Emergency Preparedness and Response Chemical Emergencies
  http://emergency.cdc.gov/chemical/
- Community Emergency Response Teams
  www.fema.gov/community-emergency-response-teams

References

Centers for Disease Control and Prevention. (2005). Public health consequences from hazardous substances acutely released during rail transit—South Carolina, 2005; selected states, 1999—2004. *Morbidity and Mortality Weekly Report, 54*(03), 64–67.

LaTourrette, T., Davis, L.E., Howell, D.R., Sama, P.R., & Dausey, D.J. (2009). *Public health preparedness and response to chemical and radiological incidents: Functions, practices, and areas for future work*. Santa Monica, CA: RAND Corporation.

National Response Center. (2013). *National Response Center statistics by incident type 2000–2012*. Retrieved from http://www.nrc.uscg.mil/Default.aspx

World Health Organization. (2009). *Manual for the public health management of chemical incidents*. Retrieved from http://whqlibdoc.who.int/publications/2009/9789241598149_eng.pdf

Did You Know?

An online version of CDC's Environmental Health Training in Emergency Response can be found on NEHA's e-Learning site at http://nehacert.org/moodle/course/category.php?id=42.

DIRECT FROM CDC ENVIRONMENTAL PUBLIC HEALTH TRACKING NETWORK

Youlanda R. Outin

CDC's National Environmental Public Health Tracking Network Adds Pesticide Exposure and Prospective Climate Data

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.

Youlanda Outin is a health communications specialist in CDC's Environmental Health Tracking Branch and has been with CDC for 20 years. She has extensive experience in health communications.

The Centers for Disease Control and Prevention's (CDC's) National Environmental Public Health Tracking Network (Tracking Network) expands content and functionality every year. This year, two new datasets were added: pesticide exposure and 70 years of prospective climate data. These represent two important environmental public health concerns. In 2012, pesticides were the 10th leading cause of poisoning exposure reported to poison control centers in the U.S. (Mowry, Spyker, Cantilena, Bailey, & Ford, 2013). Understanding how and where pesticide exposures are happening can inform public health interventions and public education on the dangers of using these chemicals inappropriately. Extreme heat events, or heat waves, are one of the leading causes of weather-related deaths in the U.S. Climate experts are particularly confident that climate change will bring increasingly frequent and severe heat waves and extreme weather events, as well as a rise in sea levels. These changes have the potential to affect human health in several direct and indirect ways, some of them severe.

The pesticide exposure data now available on the Tracking Network come from poison control centers in the U.S. The American Association of Poison Control Centers (AAPCC) works with the nation's poison control centers to monitor poisonings and their sources. These sources include chemicals found in household products, the workplace, at home, and in the environment, as well as poisonings from foods, beverages, drugs and medicines, and animal and insect bites. Poison control centers offer a free, confidential 24-hour telephone line where people can get medical advice on poisonings.

The pesticide exposures data available in the Tracking Network provide information for all 50 states about the rate and number of reported exposures to different kinds of pesticides and the illnesses related to the exposures.

The *Reported Pesticide Exposures* indicator shows the number and rate (number of cases per 100,000) of exposures to different types of pesticides by state and by year reported to poison control centers. Pesticides are categorized according to their functional class: disinfectants, fumigants, fungicides, herbicides, insecticides, repellents, and rodenticides. Data can be used to identify trends and patterns of reported pesticide exposures over time and in different geographic regions. The advanced options allow you to explore patterns related to the presence and severity of health outcomes from the reported exposure, type of pesticides involved with reported exposures, and where people are exposed to pesticides. In addition, you can select advanced options for the data that provide critical information on the location where people are exposed, such as home or at work; and the reason for the exposure, such as unintentional exposure from air or soil, improper or incorrect use of a pesticide, and work-related activities.

The *Pesticide-Related Illness* indicator shows the rate and number of illnesses that resulted from the reported pesticide exposure and the severity of the health effects. The health effects range from minor effect to death. The health effects data groupings are defined by the AAPCC (Intergovernmental Panel on Climate Change [IPCC], 2013). This indicator has the same advanced viewing options as *Reported Pesticide Exposures*.

70 Years of Extreme Heat Predictions

When temperatures rise in the summer time, extremely hot weather can cause sickness or even death. Extreme heat can also make some types of air pollution worse in the summer, and air pollution can affect your health. Higher temperatures and heat waves also increase demand for electricity. Planning for electricity demand and power outages is an important component of public health preparedness. Having modeled data to project heat patterns could help inform climate adaptation strategies.

In addition to 40 years of historical temperature data, the Tracking Network now has modeled data projecting temperature patterns for the next 70 years. These new data show the estimated number of days and nights of projected extreme heat, available as rolling 30-year averages, through the year 2084. Overall, the data show an increase in the projected number of days and nights of extreme heat over the next seven decades. This is consistent with the Intergovernmental Panel on Climate Change (IPCC), which projects with "virtual certainty" (99%–100%) that climate change will cause more frequent, more intense, and longer heat waves (IPCC, 2013).

These new heat projection data were originally published as part of the recently released National Climate Assessment (Melillo, Richmond, & Yohe, 2014). CDC's Climate and Health Program transformed the data to county level and made them available on the Tracking Network. These county-level data estimates can be used to understand trends in heat over time and focus preparedness plans to lessen the health effects of extreme heat. The new calculations were made from 1/8th-degree-contiguous U.S. Daily Downscaled Climate Projections dataset by Katharine Hayhoe (2013). Extreme heat days were identified for each combination of the following parameters (1) absolute (e.g., 90°F, 95°F, 100°F) or relative (e.g., 90th, 98th, 99th percentile values) threshold and (2) a high- or low-emissions scenario. Extreme heat nights were also identified for each combination of the following parameters (1) absolute (e.g., 65°F, 75°F, 85°F) or relative (e.g., 98th percentile values) threshold and (2) a high- or low-emissions scenario.

The Tracking Network, in collaboration with other CDC programs, provides data and tools that you can use to see how extreme heat may affect your health. The Tracking Network also contains data on historical heat-related deaths and illnesses from 23 states and provides information to help you protect yourself from heat-related deaths or illnesses. You can use the Tracking Network to see if heat-related deaths and illnesses are rising or declining in your state or county.

Heat-related health and climate data can be used to

- identify populations and areas with high risk for heat-associated death,
- gain a better understanding of trends in heat-related deaths over time,
- plan interventions for those at risk, and
- plan preparedness activities to mitigate the effects of extreme heat.

Visit the Tracking Network Today

These two new datasets and the others available on the Tracking Network have very practical applications for city, county, and state environmental health professionals. You can view these data in maps, charts, and tables for easy analysis. In the mapping section, there are a variety of tools you can use to view the data including county maps, animated timeline maps to show multiple years of data, and the ability to view complementary data such as sociodemographic county characteristics.

The New York City Tracking Program used poison control center data from its city's system to pursue restricting bug bombs to the public after evidence showed that they were causing injuries and illness from inappropriate use (Centers for Disease Control and Prevention, 2008). The Minnesota Tracking Program analyzed data on heat-related illnesses and deaths. The results were used to develop and update maps showing areas with at-risk populations who may need support to prepare for heat waves and used to inform health professionals about groups most at risk during extreme heat events. On the Tracking Network, you can find more stories and examples of how other health departments are using the data available at www.cdc.gov/ephtracking.

Acknowledgements: The author would like to thank Erik Hummelman, Eric Lahr, and Michele Monti for contributing to this article.

Corresponding Author: Youlanda R. Outin, Health Communications Specialist, Environmental Health Tracking Branch, National Center for Environmental Health, CDC, 4770 Buford Highway, MS F-60, Atlanta, GA 30341. E-mail: youtin@cdc.gov.

References on page 36

continued from page 35

References

Centers for Disease Control and Prevention. (2008). Illnesses and injuries related to total release foggers—eight states, 2001–2006. *Morbidity and Mortality Weekly Report, 57*(41), 1125–1129.

Hayhoe, K. (2013). *Development and dissemination of a high-resolution national climate change dataset*. Retrieved from http://cida.usgs.gov/thredds/fileServer/dcp/files/Hayhoe_USGS_downscaled_database_final_report.pdf

Intergovernmental Panel on Climate Change. (2013). *Climate change 2013: The physical science basis. Contribution of working group I to the fifth assessment report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press.

Melillo, J.M., Richmond, T.C., & Yohe, G.W. (Eds.). (2014). *Climate change impacts in the United States: The third national climate assessment*. Washington, DC: U.S. Global Change Research Program. Retrieved from http://nca2014.globalchange.gov/

Mowry, J., Spyker, D.A., Cantilena, L.R., Jr., Bailey, J.E., & Ford, M. (2013). *2012 annual report of the American Association of Poison Control Centers' national poison data system (NPDS): 30th annual report*. Retrieved from https://aapcc.s3.amazonaws.com/pdfs/annual_reports/2012_NPDS_Annual_Report.pdf

Did You Know?

A new report from the White House's Council of Economic Advisors states that delaying action on climate change by 10 years will cause the costs of such policies to rise by as much as 40%, which will offset any short-term savings.

Source: Time Magazine, http://time.com/3049465/report-not-acting-on-climate-change-could-have-serious-economic-impact/.

neha.org

- Journal of Environmental Health
- e-Learning
- **R&D Programs**
- NEHA in Action
- Credentials
- Continuing Education
- NEHA Food Safety Training
- Awards & Sabbaticals
- Endowment Fund
- Scholarships
- Position Papers
- Affiliated Organizations
- Links
- Students Section

Information and opportunities abound behind the research and development (R&D) button on NEHA's homepage. Visit neha.org/research to obtain the latest on the following NEHA federally funded programs, many of which include free or low-cost training and educational opportunities:

- Biology and Control of Vectors and Public Health Pests Program
- Environmental Public Health Tracking Program
- Epi-Ready Team Training Program
- Food-Safe Schools Program
- Industry-Foodborne Illness Investigation Training and Recall Response (I-FIIT-RR) Program
- Land Use Planning and Design Program
- Onsite Wastewater Treatment Systems Program
- Radon/Indoor Air Quality Program
- Workforce Development Program

DEMYSTIFYING THE FUTURE

Thomas Frey

"Situational Futuring" and 44 Mind-Stretching Scenarios to Learn How to Use It: The First 22

Editor's Note: Significant and fast-paced change is occurring across society in general and our profession in particular. 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 is a powerful visionary who is revolutionizing our thinking about the future.

Recently I got into a discussion with a friend about the concept of self-contained water. If you think in terms of picking up a bottle of water, only without the bottle, you get the picture.

Rocks are self-contained, baseballs are self-contained, so why can't we devise some way to make water self-contained? Yes, we have ice, but I'm referring to a more usable form of water.

As an example, if water itself could be used to form a somewhat hardened skin around a small quantity of water, we could create 100% consumable water with zero waste.

An industrial design team in London has come the closest with something called "Ooho," (www.impactlab.net/2014/04/01/ooho-an-edible-water-bottle-that-could-save-the-planet/) a blob-like water container made out of an edible algae membrane. While it still involves using something other than water, it does give us clues on how to make a container out of what we're trying to contain, in this case water.

As we imagine our way through this design problem, many more questions come to light. Should it be flexible like a plastic bag or a bit more ridged like a typical water bottle? What is the ideal shape? Should it be a cube for easy stacking, have a handle for easy holding, or spherical just because it looks cool?

Even a container made of water will get dirty, so how do we clean the dirt from the side of a solid water container? More water?

More importantly, what is the optimal size for a self-contained water container? Should it be cup-sized, quart-sized, gallon-sized, or larger? Or maybe marble-sized or pea-sized water pellets would work best.

Should the water be "eaten" like tiny liquid snacks that could be popped into your mouth at any time? Perhaps we would want flavored water like cherry water, tea water, coffee water, or chocolate water.

Maybe we don't actually eat or drink the container. Once the inside water is gone, it may be possible to just discard the bottle onto a lawn or flowerbed, as a form of enviro-littering, and wait for it to reliquefy, sending a few drops of moisture to the thirsty plants below.

How would we fabricate the container part of water? Would it somehow be molded, pressed, 3D printed, or simply sprayed onto a form?

The process I've just described is what I call "situational futuring," where we begin to explore the implications of some future technology. Here's how this can be used as an effective futuring tool.

Situational Futuring

Much like dropping a rock into still water and watching the ripples form in every direction, situational futuring begins with a central idea, which grows into a series of rippling thoughts, issues, and questions expanding in every direction.

Unlike the study of macro or megatrends, situational futuring is a micro-futuring process that begins with a single invention, tiny idea, or what-if condition and expands from there.

The process begins with an initial scenario and asks some of the standard who-what-when-where-how-and-why questions. Probing deeper, questions formulated around things like timing, monetary implications, disruptive effects, symbiotic partners, who-wins-who-loses, wild cards, policy changes, and strange bedfellows will help expand your thinking even further.

This works particularly well in a brainstorming environment where thoughts and ideas can be quickly sketched out, described, or clarified so more can be added.

Inside these moments of microfuturing is where the real treasures live. Companies wishing to expand their product line, service agencies seeking to streamline their processes, or design engineers wishing to gain a new perspective will all find this to be a valuable tool.

44 Examples of Situational Futuring: The First 22

It all starts with the initial idea, so here are some examples of starting points designed to begin the conversational thread of situational futuring.

1. **3D Ice Printers:** A 3D printer designed to work exclusively with ice could be used to make ice sculptures, ice containers, ice cubes with your favorite liquor inside, ice logos for companies, and much more.
2. **Water Harvesting Irrigation Spikes:** Will it someday be possible to add atmospheric water harvesting ground-spikes next to every plant or tree in our garden? These devices will pull water from the air to irrigate nearby plants.
3. **Quantified-Self Skills Analysis:** As employers lose confidence in traditional transcripts and college degrees as a predictor of success, they will turn towards more sophisticated attribute-matching systems for sorting through the ultragranular quantifiable-self and finding the closest fit. People who don't make the shortlist for a job opening will be given an autogenerated overview of their skill deficiencies and ways to improve upon them.
4. **Real-Time Health Care Monitors:** Rather than doing the snapshot-in-time testing that doctors do today, analyses will increasing be made in real-time through sensor networks that pull data over an extended period of time from our skin, organs, and even our brain as these tools evolve into hyperanalytical portals into our own metabolism.
5. **Wireless Power:** Will having users linked to wireless power networks in the future be similar to linking to Wi-Fi networks today?
6. **Swarmbots:** Groups of flying drones that move like flocks of birds, schools of fish, or swarms of bees have become known as swarmbots. How long will it be before we see the newspaper headline that reads, "10,000 tiny flying swarmbots perform flawlessly together?"
7. **Cure for Aging:** Life expectancy is getting longer, but the usefulness of the human body has traditionally maxed out somewhere around 120. Will it someday be possible to find a cure for aging?
8. **Driverless Cars:** How long will it be before we see the first highway in the U.S. to be designated as a "driverless-cars only" highway?
9. **Space Colonies:** In what year will an election occur for the first president of the moon?
10. **Billion-Cam Video Project:** What kind of business will be needed to connect one billion live video cameras to the Internet? What can a billion-cam network do that a million-cam network can't?
11. **Centralized Law Project:** Very few countries have their laws posted in a central repository. In the U.S. the laws, rules, and regulations are so numerous and obscure that few people know what laws are governing them at any given moment. How would that change if all laws were required to be posted on one central Web site?
12. **Dream Recorder:** It's easy to forget our dreams, even before we wake up. Is it possible to create a "hit-play-to-record" device that would allow us to visually or mentally archive our dreams?
13. **Reviving the Extinct Species:** Should extinct species be brought back to life? If so, where would they live, and who would manage their existence?
14. **Self-Cleaning House:** This long-time dream of housewives is finally within reach as smart home technology, combined with the Internet of Things, begins to invade our lives. What are the current missing pieces and what technology could be used to fill the gaps?
15. **Animal Communicator:** With early-stage natural language translators already in existence for humans, the next step will be a technology that bridges the communication gap between humans and animals. Will this ever be possible and how would this affect our human-animal relationships?
16. **Global Elections:** When will we see the first global election with over 500 million people voting from at least 50 different countries? Will they be voting for a person, or voting on an issue? If it's a person, what position will that person be running for? And, if it's an issue, what issue will be so compelling that everyone wants to vote on it?
17. **Human Cloning:** Science fiction movies often show cloned bodies grown over a long period of time. But 3D printing of replacement bodies will likely be a quicker option. How long will it be before someone 3D prints their own replacement body, and what are the implications of this kind of technology?
18. **Space-Based Power Stations:** The Japan Aerospace Exploration Agency recently announced its 25-year plan to build the world's first one-gigawatt power plant in space. Is it possible that another country will build one before Japan, and what effect will this have on today's power industry?
19. **Your Future Self:** How much, and in what ways, should you invest in the person you will become 5–10 years from now? What are some different ways for you to quantify the return on your investment?
20. **Future Countries:** One hundred years from now, will we have more countries in the world or fewer? Will it someday be possible to create micronation states, and how could they be leveraged to influence global thinking?
21. **The Age of the Dismantler:** Every industry will eventually end, and this requires talented people who know how to scale things back and dismantle things in an orderly fashion. How long will it be before we begin a full-scale effort to dismantle the national power grid?
22. **Controlling Weather:** Weather control technology is still in its infancy. In what year will we see the first hurricane stopped by human intervention and what is the technology that will be used?

Next month's column will contain the second 22 situational futuring examples and some final thoughts.

Interested in sharing your thoughts? Go to www.FuturistSpeaker.com.

Corresponding Author: Thomas Frey, Senior Futurist and Executive Director, DaVinci Institute®, 511 East South Boulder Road, Louisville, CO 80027.
E-mail: dr2tom@davinciinstitute.com.

CAREER **OPPORTUNITIES**

Food Safety Inspector

UL Everclean Services is the leader in the restaurant inspections market. We offer opportunities throughout the country. We currently have openings for professionals to conduct Q.A. audits of restaurants.

U.S. Listings
Alaska
Baltimore, MD
Billings, MT
Birmingham, AL
Bismarck, ND
Boise, ID
Buffalo, NY
Butte, MT
Chattanooga, TN
Cleveland, OH
El Paso, TX
Grand Junction, CO
Hartford, CT
Houston, TX
Indianapolis, IN
Jackson, MS
Little Rock, AR
McAllen, TX
Minneapolis, MN
New Orleans, LA
Oklahoma City, OK
Owatonna, MN
Pittsburgh, PA
Pocatello, ID
Princeton, WV
Puerto Rico
Roanoke, VA
Rochester, NY
Sacramento, CA
San Jose, CA
Shreveport, LA
Spearfish, SD
St. Louis, MO
St. Paul, MN
Washington, DC

Canada Listings
Edmonton, AB
Kamloops, BC
Mississauga, ON
Ontario
Ottawa, ON

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.

Find a Job | Fill a Job

Where the "best of the best" consult...

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

NEHA SABBATICAL EXCHANGE PROGRAM TO ENGLAND OR CANADA

NEHA offers wide-ranging opportunities for professional growth and the exchange of valuable information on the international level through its longtime Sabbatical Exchange Program.

The sabbatical may be taken in England, in cooperation with the Chartered Institute of Environmental Health, or in Canada, in cooperation with the Canadian Institute of Public Health Inspectors. The sabbatical can be from two to four weeks, as determined by the recipient. If selected, the sabbatical ambassador receives up to **$4,000** as a stipend, depending on the length of the sabbatical, and up to $1,000 for roundtrip transportation.

The application deadline is March 2, 2015.

Winners will be announced at the NEHA 2015 Annual Educational Conference (AEC) & Exhibition in Orlando, Florida, in July 2015. Recipients will complete the sabbatical between August 1, 2015, and June 1, 2016. The sabbatical ambassador will give a required report of their experience at the 2016 AEC in San Antonio, Texas.

For more information, contact Terry Osner at tosner@neha.org.

To access the online application, visit www.neha.org/about/awardinfo.html.

Standards • Audits • Testing • Certification • Code Compliance • Webinars • Regulatory Support

NSF International • 1-800-NSF-MARK • www.nsf.org/regulatory

EH CALENDAR

UPCOMING NEHA CONFERENCE

July 13–15, 2015: NEHA's 79th Annual Educational Conference & Exhibition, Renaissance Orlando at SeaWorld, Orlando, FL.

NEHA AFFILIATE AND REGIONAL LISTINGS

Alaska

October 7–10, 2014: Annual Educational Conference, hosted by the Alaska Environmental Health Association, BP Energy Center, Anchorage, AK. For more information, visit https://sites.google.com/site/aehatest/.

Illinois

October 2–3, 2014: Annual Educational Conference, hosted by the Illinois Environmental Health Association, East Peoria, IL. For more information, visit http://iehaonline.org.

Iowa

October 14–15, 2014: Fall Conference, hosted by the Iowa Environmental Health Association, Marshalltown, IA. For more information, visit www.ieha.net.

Minnesota

October 2, 2014: Fall Conference, hosted by the Minnesota Environmental Health Association, Spicer, MN. For more information, visit www.mehaonline.org/events.

Missouri

October 1–3, 2014: Annual Education Conference, hosted by the Missouri Environmental Health Association, Lake Ozark, MO. For more information, visit www.mmfeha.org.

Montana

September 30–October 1, 2014: 2014 MEHA/MPHA Fall Conference: Innovate, Inspire, Integrate—Creating a Healthy Environment, hosted by the Montana Environmental Health and Public Health Associations, Missoula, MT. For more information, visit www.mehaweb.org.

Nebraska

October 22, 2014: Fall Educational Conference, hosted by the Nebraska Environmental Health Association, Ashland, NE. For more information, visit www.nebraskaneha.com.

Nevada

October 21–23, 2014: 2014 "Partnerships" Joint Education Conference, hosted by the Nevada Environmental Health Association and the Nevada Food Safety Task Force, Las Vegas, NV. For more information, visit www.nveha.org.

North Dakota

October 21–23, 2014: Fall Education Conference, hosted by the North Dakota Environmental Health Association, Bismarck, ND. For more information, visit http://ndeha.org/wp/conferences.

Texas

October 6–10, 2014: 59th Annual Education Conference, hosted by the Texas Environmental Health Association, Austin, TX. For more information, visit www.myteha.org.

December 3–5, 2014: Annual Educational Conference, hosted by the South Texas Chapter of the Texas Environmental Health Association, South Padre Island, TX. For more information, visit www.facebook.com/TEHASTC.

Virginia

October 17, 2014: Fall Educational Session, sponsored by the Virginia Environmental Health Association, Henrico, VA. For more information, visit www.virginiaeha.org.

TOPICAL LISTINGS

Food Safety

December 4–5, 2014: Consumer Food Safety Education Conference, hosted by the Partnership for Food Safety Education, Arlington, VA. For more information, visit www.teamfoodsafety.org/2014.

Recreational Waters

October 8–10, 2014: World Aquatic Health Conference, hosted by the National Swimming Pool Foundation, Portland, OR. For more information, visit www.thewahc.org.

Did You Know?

October is the U.S. Environmental Protection Agency's Children's Health Month. You can find valuable information about protecting children's health at www2.epa.gov/children.

JEH QUIZ

FEATURED ARTICLE QUIZ #2

Hot Yoga Establishments in Local Communities Serving Pregnant Women: A Pilot Study on the Health Implications of its Practice and Environmental Conditions

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 (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 October 1, 2014 (first day of issue).
5. Check your continuing education account online at 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

→ Quiz deadline: January 1, 2015

1. *Yoga Today* estimates that __ Americans practice yoga.
   a. 3 million
   b. 6.9 million
   c. 15.8 million
   d 21.1 million

2. Clinical studies have shown that yoga can
   a. improve outcomes in asthma.
   b. mitigate low back pain.
   c. improve birth outcomes.
   d. improve outcomes in chronic obstructive pulmonary disease.
   e. all of the above.

3. Hot yoga was created by Bikram Choudhury in the early __ .
   a. 1950s
   b. 1960s
   c. 1970s
   d. 1980s

4. Other studies have found that yoga can also
   a. decrease stress and anxiety.
   b. be beneficial in individuals with eating disorders.
   c. increase quality of life in the elderly.
   d. all of the above.
   e. a and c.

5. Narendran and co-authors (2005) conducted a study that found that pregnant women practicing yoga had significantly fewer underweight births and lower risk of pregnancy-induced hypertension compared to a control group of pregnant women who did not practice yoga.
   a. True.
   b. False.

6. For this study, temperature readings were recorded approximately every __ minutes during three 90-minute hot yoga class sessions.
   a. 5
   b. 10
   c. 12
   d. 15

7. __ and __ of the surveyed females were currently pregnant in the hot yoga and non-hot yoga practitioner groups, respectively.
   a. Twenty-five percent; 5%
   b. Five percent; 25%
   c. Eleven percent; 0%
   d. Eleven percent; 5%

8. Obstetricians/gynecologists (OB/GYNs) were listed as the __ source for those practicing prenatal hot yoga to discuss prenatal hot yoga safety.
   a. first
   b. second
   c. third
   d. fourth

9. Hot yoga practitioners trusted themselves __ their OB/GYN as a source of prenatal hot yoga safety knowledge.
   a. less than
   b. the same as
   c. more than

10. The maximum recommended wet bulb globe temperature exposure for persons acclimated to high heat exercising is approximately __ averaged over a one-hour period.
    a. 76°F
    b. 86°F
    c. 92°F
    d. 96°F

11. All of the measured temperatures collected for this study were at or above the recommended wet bulb globe temperature.
    a. True.
    b. False.

12. The survey sample size was not a limitation of this study.
    a. True.
    b. False.

JEH Quiz #6 Answers

May 2014

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

Thank You

for Supporting the NEHA/AAS Scholarship Fund

American Public University
Manassas, VA
Vickie L. Church
San Diego, CA
Bruce Clabaugh, RS
Greenwood Village, CO
Amer El-Ahraf
Huntington Beach, CA
Dion L. Lerman
Philadelphia, PA
Gloria T. Mackie
Pueblo, CO
COL Wendell A. Moore
Davidsonville, MD
George A. Morris, RS
Dousman, WI
Richard L. Roberts, MPH
Grover Beach, CA
Welford C. Roberts, PhD, RS, REHS, DAAS
South Riding, VA
B. Robert Rothenhoefer, RS, REHS, CP-FS
Falls Church, VA
Walter P. Saraniecki, MS, LDN, LEHP, REHS/RS
La Grange, IL
James M. Speckhart, MS
Norfolk, VA
Ned Therien
Olympia, WA
Clayton Tolson
Baltimore, MD
Dale H. Truesdell
Yakima, WA
Lisa A. Windross
Port Saint Lucie, FL

Did You Know?

The World Health Organization (WHO) advocates banning e-cigarettes in public and work spaces. In addition to citing health concerns over toxins and nicotine in the vapor itself, WHO has also expressed concern that increased visibility and acceptability of e-cigarette use could lead to more children smoking. WHO has suggested that countries should place stricter regulations on the use, sale, and advertising of e-cigarettes to combat these concerns.

Source: BBC, www.bbc.com/news/health-28937610.

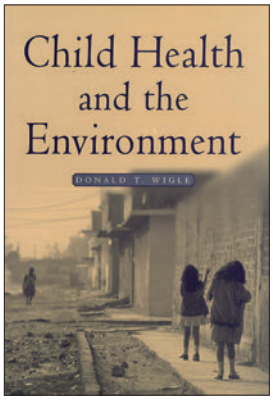
RESOURCE CORNER

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!

NEHA BOOKSTORE
www.neha.org/store

Child Health and the Environment

Donald T. Wigle (2003)

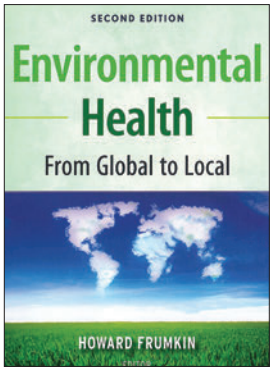


This textbook focuses on environmental threats to child health. It will interest professionals and graduate students in public health, pediatrics, environmental health, epidemiology, and toxicology. It provides overviews of key children's environmental health issues, addresses the health effects of different environmental contaminants, and summarizes associations between environmental exposures and child health outcomes. It also calls for an improved science base to guide public health decisions and protect child health.

396 pages / Hardback / Catalog #759
Member: $59 / Nonmember: $64

Environmental Health: From Global to Local (Second Edition)

Edited by Howard Frumkin (2010)

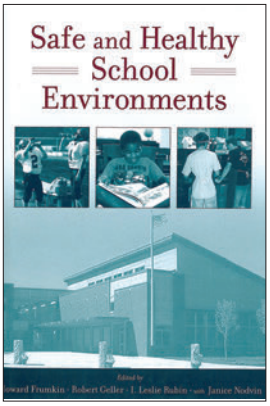


This comprehensive introductory text offers an overview of the methodology and paradigms of this burgeoning field, ranging from ecology to epidemiology, from toxicology to environmental psychology, and from genetics to ethics. Expert contributors discuss the major issues in contemporary environmental health: air, water, food safety, occupational health, radiation, chemical and physical hazards, vector control, and injuries. Also emphasizing a wide variety of issues of global interest, the thoroughly revised second edition contains updated information on such timely topics as toxicology, exposure assessment, climate change, population pressure, developing nations and urbanization, energy production, building and community design, solid and hazardous waste, and disaster preparedness.

1,221 pages / Hardback / Catalog #409
Member: $89 / Nonmember: $94

Safe and Healthy School Environments

Edited by Howard Frumkin, Robert J. Geller, I. Leslie Rubin, and Janice Nodvin (2006)

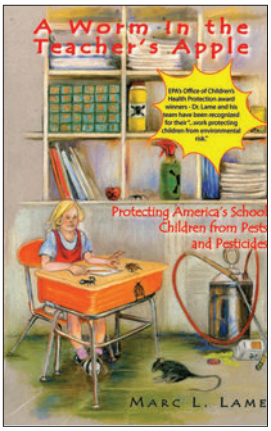


Millions of children and adults across the nation spend their days in school buildings, and they need safe, healthy environments to thrive, learn, and succeed. This book explores the school environment using the methods and perspectives of environmental health science. Though environmental health has long been understood to be an important factor in workplaces, homes, and communities, this is the first book to address the same basic concerns in schools. Each section of this book addresses a different environmental health concern facing schools today. The entire book is evidence-based, readable, generously illustrated, and practical—an indispensable resource for parents, school staff, administrators, government officials, and health professionals.

480 pages / Hardback / Catalog #631
Member: $49 / Nonmember: $54

A Worm in the Teacher's Apple: Protecting America's School Children From Pests and Pesticides

Marc L. Lame (2005)



A substantial movement exists to create safer learning environments in our nation's schools—not just in terms of violent acts, but in terms of environmental quality. Many school districts across the nation, however, are not implementing cost-effective pest management programs so as to minimize the problem of pests and pesticides. This book provides solutions to creating a safer learning environment in terms of pest control in a way that not only provides scientific information, but also deals with people management and communication problems.

238 pages / Paperback / Catalog #1100
Member: $17 / Nonmember: $19

Students Don't Miss This Opportunity!

Applications for the 2015 National Environmental Health Association/American Academy of Sanitarians (NEHA/AAS) Scholarship Program are now available. Last year, $4,000 was awarded to two students who demonstrated the highest levels of achievement in their respective environmental public health degree programs. If you would like an application or information about the NEHA/AAS Scholarship, do one of the following before the deadline:

Visit

www.neha.org/scholarship/scholarship.html.

Application and qualification information is available to download from NEHA's scholarship Web page.

Contact

Cindy Dimmitt
with a request for
an application and information.
E-mail: cdimmitt@neha.org
Phone: 303.756.9090, ext. 300
Write: NEHA/AAS Scholarship
720 S. Colorado Blvd.,
Ste.1000-N
Denver, CO 80246-1926

Deadline: February 1, 2015

Did You Know?

The U.S. Environmental Protection Agency's Clean Power Plan marks the first time the government has set hard limits on the amount of carbon pollution that power plants can put in the air. Previously, power plants only had limits on amounts of arsenic, lead, and mercury pollution.

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

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

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.*

Bette J. Packer
Ham Lake, MN

Peter M. Schmitt
Shakopee, MN

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.*

James J. Balsamo, Jr., MS, MPH, MHA, RS, CP-FS
Metairie, LA

George A. Morris, RS
Dousman, WI

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:

- ❍ Delegate Club ($25)
- ❍ Honorary Members Club ($100)
- ❍ 21st Century Club ($500)
- ❍ Sustaining Members Club ($1,000)
- ❍ Affiliates Club ($2,500)
- ❍ Executive Club ($5,000)
- ❍ President's Club ($10,000)
- ❍ Endowment Trustee Society ($25,000)
- ❍ Visionary Society ($50,000)
- ❍ Futurists Society ($100,000)
- ❍ **You have my permission to disclose the fact and amount (by category) of my contribution and pledge.**

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. 1410JEHEND

SPECIAL NEHA MEMBERS

Sustaining Members

Advanced Drainage Systems
www.ads-pipe.com

Advanced Fresh Concepts Corp.
www.afcsushi.com

AIB International
www.aibonline.org

Albuquerque Environmental Health Department
www.cabq.gov/environmentalhealth

Allegheny County Health Department
www.county.allegheny.pa.us

American Academy of Sanitarians (AAS)
Gary P. Noonan
www.sanitarians.org

American Chemistry Council
www.americanchemistry.com

Anua
www.anua-us.com

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

Association of Environmental Health Academic Programs
www.aehap.org

ATSDR/DCHI
www.atsdr.cdc.gov/hac

Camelot International Health Organization
www.camelot.gr

CDP, Inc.
www.cdpehs.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

City of Milwaukee Health Department, Consumer Environmental Health
http://city.milwaukee.gov/Health

Coconino County Public Health
www.coconino.az.gov

Colorado Department of Public Health and Environment, Division of Environmental Health, Delegated Programs Unit
Therese Pilonetti
therese.pilonetti@state.co.us

Decade Software Company, LLC
Darryl Booth
www.decadesoftware.com

DEH Child Care
www.denvergov.org/DEH

DeltaTrak, Inc.
Vallierie Cureton
www.deltatrak.com

Digital Health Department, Inc.
www.dhdinspections.com

Diversey, Inc.
Steve Hails
www.diversey.com

DuPage County Health Department
www.dupagehealth.org

Eastern Idaho Public Health District
www.phd7.idaho.gov

Ecobeco
www.ecobeco.com

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

EcoSure
charlesa.arnold@ecolab.com

Elite Food Safety Training
www.elitefoodsafety.com

English Sewage Disposal, Inc.
(756) 358-4771

Erie County Department of Health
www.erie.gov/health

Florida Department of Health
www.doh.state.fl.us

Gila River Indian Community, Environmental Health Services
www.gilariver.org

GLO GERM/Food Safety First
Joe D. Kingsley
www.glogerm.com

HealthSpace USA Inc.
Joseph Willmott
www.healthspace.com

Industrial Test Systems, Inc.
www.sensafe.com

Inspect2Go
www.inspect2go.com

InspekPro LLC
www.inspekpro.com

Jefferson County Health Department (Missouri)
Joe Hainline
www.jeffcohealth.org

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

Kansas Department of Health & Environmental
jrhoads@kdheks.gov

LaMotte Company
www.lamotte.com

Linn County Public Health
health@linncounty.org

Maricopa County Environmental Services
jkolman@mail.maricopa.gov

Mars Air Doors
www.marsair.com

Merced County Public Health, Division of Environmental Health
rrowe@co.merced.ca.us

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

Neogen Corporation
www.neogen.com

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
Zia Siddiqi
www.orkincommercial.com

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

PerkinElmer, Inc.
www.perkinelmer.com

Polk County Public Works
www.polkcountyiowa.gov/publicworks

Presby Environmental, Inc.
www.presbyenvironmental.com

Prometric
www.prometric.com

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

Remco Products
www.remcoproducts.com

Sacramento County Environmental Management Department
www.emd.saccounty.net

San Jamar
www.sanjamar.com

Seattle & King County Public Health
Michelle Pederson
michelle.pederson@kingcounty.gov

Shat-R-Shield Inc.
Anita Yost
www.shat-r-shield.com

Skillsoft
www.skillsoft.com

Sneezeguard Solutions Inc.
Bill Pfeifer
www.sneezeguard-solutions.com

Sonoma County Permit and Resource Management Department, Wells and Septic Section
www.sonoma-county.org/prmd

Starbucks Coffee Company
www.starbucks.com

Stater Brothers Market
www.staterbros.com

StateFoodSafety.com
www.StateFoodSafety.com

Sweeps Software, Inc.
Kevin Thrasher
www.sweepssoftware.com

Taylor Technologies, Inc.
www.taylortechnologies.com

Texas Roadhouse
www.texasroadhouse.com

The Steritech Group, Inc.
www.steritech.com

Tri-County Health Department
www.tchd.org

Underwriters Laboratories, Inc.
Gus Schaeffer
www.ul.com

Waco-McLennan County Public Health District
davidl@ci.waco.tx.us

Washington County Environmental Health (Oregon)
environmentalhealth@co.washington.or.us
www.co.washington.or.us/HHS/EnvironmentalHealth

Waukesha County Public Health Division
sward@waukeshacounty.gov
www.oeo.wv.gov

Winn-Dixie Stores, Inc.
www.winn-dixie.com

Educational Institution Members

American Public University
Tatiana Sehring
www.StudyatAPU.com/NEHA

Colorado State University, Department of Environmental/Radiological Health
www.colostate.edu

East Tennessee State University, DEH
Phillip Scheuerman
www.etsu.edu

Eastern Kentucky University
worley.johnson@eku.edu
http://eh.eku.edu

Georgia State University
Christine Stauber
cstauber@gsu.edu

Michigan State University, Online Master of Science in Food Safety
www.online.foodsafety.msu.edu

Ponce School of Medicine, Public Health Program
www.psm.edu/php

University of Illinois Springfield
Sharron LaFollette
www.uis.edu/publichealth

University of Wisconsin–Oshkosh
www.uwosh.edu/llce

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.

David E. Riggs, REHS/RS, MS
First Vice President

National Officers

President—Carolyn Hester Harvey, PhD, CIH, RS, DAAS, CHMM, Professor, Director of MPH Program, Department of Environmental Health, Eastern Kentucky University, Dizney 220, 521 Lancaster Avenue, Richmond, KY 40475. Phone: (859) 622-6342 carolyn.harvey@eku.edu

President Elect—Bob Custard, REHS, CP-FS, 29 Hammond Drive, Lovettsville, VA 20180. Phone: (571) 221-7086 BobCustard@comcast.net

First Vice President—David E. Riggs, REHS/RS, MS, 2535 Hickory Avenue, Longview, WA 98632. Phone: (360) 430-0241 davideriggs@comcast.net

Second Vice President—Adam London, RS, MPA, Environmental Health Director, Kent County Health Department, 700 Fuller NE, Grand Rapids, MI 49503. Phone: (616) 632-7266 adam.london@kentcountymi.gov

Immediate Past President—Alicia Enriquez Collins, REHS enriqueza@comcast.net

Regional Vice Presidents

Region 1—Ned Therien, MPH, Olympia, WA. nedinoly@juno.com
Alaska, Idaho, Oregon, and Washington. Term expires 2017.

Region 2—Marcy A. Barnett, MA, MS, REHS, Emergency Preparedness Liaison, California Department of Public Health, Center for Environmental Health, Sacramento, CA. Phone: (916) 449-5686 marcy.barnett@cdph.ca.gov
Arizona, California, Hawaii, and Nevada. Term expires 2015.

Region 3—Roy Kroeger, REHS, Environmental Health Supervisor, Cheyenne/Laramie County Health Department, 100 Central Avenue, Cheyenne, WY 82008. Phone: (307) 633-4090 roykehs@laramiecounty.com
Colorado, Montana, Utah, Wyoming, and members residing outside of the U.S. (except members of the U.S. armed forces). Term expires 2015.

Region 4—Keith Johnson, RS, Administrator, Custer Health, 210 2nd Avenue NW, Mandan, ND 58554. Phone: (701) 667-3370 keith.johnson@custerhealth.com
Iowa, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin. Term expires 2016.

Region 5—Sandra Long, REHS, RS, Inspection Services Supervisor, City of Plano Health Department, 1520 K Avenue, Suite 210, Plano, TX 75074. Phone: (972) 941-7143 ext. 5282; Cell: (214) 500-8884 sandral@plano.gov
Arkansas, Kansas, Louisiana, Missouri, New Mexico, Oklahoma, and Texas. Term expires 2017.

Region 6—Lynne Madison, RS, Environmental Health Division Director, Western UP Health Department, 540 Depot Street, Hancock, MI 49930. Phone: (906) 482-7382, ext. 107 lmadison@hline.org
Illinois, Indiana, Kentucky, Michigan, and Ohio. Term expires 2016.

Region 7—Tim Hatch, MPA, REHS, Environmental Programs, Planning, and Logistics Director, Center for Emergency Preparedness, Alabama Department of Public Health, 201 Monroe Street, Suite 1310, Montgomery, AL 36104. Phone: (334) 206-7935 tim.hatch@adph.state.al.us
Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee. Term expires 2017.

Region 8—LCDR James Speckhart, MS, USPHS, Health and Safety Officer, FDA, CDRH-Health and Safety Office, WO62 G103, 10903 New Hampshire Avenue, Silver Spring, MD 20993. Phone: (301) 796-3366 jamesmspeckhart@gmail.com
Delaware, Maryland, Pennsylvania, Virginia, Washington, DC, West Virginia, and members of the U.S. armed forces residing outside of the U.S. Term expires 2015.

Region 9—Edward L. Briggs, MPH, MS, REHS, Director of Health, Town of Ridgefield Department of Health, 66 Prospect Street, Ridgefield, CT 06877. Phone: (203) 431-2745 eb.health@ridgefieldct.org
Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. Term expires 2016.

Affiliate Presidents

Alabama—Haskey Bryant, MPH, MPA, Environmental Health Specialist, Jefferson County Dept. of Health, Birmingham, AL. haskey.bryant@jcdh.org

Alaska—Ryan Autenrieth, REHS, Environmental Health Officer, Yukon-Kuskokwim Health Corporation, Bethel, AK. aeha.net@gmail.com

Arizona—Shikha Gupta, Environmental Operations Program Supervisor, Maricopa County, Phoenix, AZ. sgupta@mail.maricopa.gov

Arkansas—Jeff Jackson, Camden, AR. jeff.jackson@arkansas.gov

California—Sarah Crossman, REHS, Environmental Health Specialist IV, Riverside County Dept. of Environmental Health, Riverside, CA. president@ceha.org

Colorado—Mindi Ramig, Environmental Health Supervisor, Jefferson County Public Health, Golden, CO. mramig@jeffco.us

Connecticut—Marco Palmeri, RS, Chief Sanitarian, Plainville-Southington Regional Health District, Plainville, CT. health@plainville-ct.gov

Florida—Jill Wallace, Winter Haven, FL. kninetrainer@aol.com

Georgia—Chris Rustin, MS, DrPH, REHS, Environmental Health Section Director, Georgia Dept. of Public Health, Atlanta, GA. chris.rustin@dph.ga.gov

Hawaii—John Nakashima, Sanitarian IV, Food Safety Education Program, Hawaii Dept. of Health, Hilo, HI. john.nakashima@doh.hawaii.gov

Idaho—Patrick Guzzle, MA, MPH, REHS, Food Protection Program Manager, Idaho Dept. of Health and Welfare, Boise, ID. guzzlep@dhw.idaho.gov

Illinois—Adam Dotson, MPA, LEHP, Community Development Director, City of Oak Forest, Oak Forest, IL. adotson@oak-forest.org

Indiana—Michael Mettler, Indiana State Dept. of Health, Indianapolis, IN. mmettler@isdh.in.gov

Iowa—Sandy Heinen, Environmental Health Officer, Black Hawk County Health Dept., Waterloo, IA. sheinen@co.black-hawk.ia.us

Jamaica—Steve Morris, Chief Public Health Inspector, Ministry of Health, St. Catherine, Jamaica. president@japhi.org.jm

Kansas—Bronson Farmer, RS, HHS, Salina-Saline County Health Dept., Salina, KS. farmerduo@hotmail.com

Kentucky—Leslie Cobb, Technical Consultant, Kentucky Food Safety Branch, Frankfort, KY. leslie.cobb@ky.gov

Louisiana—John Koury, MS, COO, KourCo Enivironmental Services, Inc., Lafayette, LA. jkoury@kourco.com

Maryland—James Lewis, Westminster, MD. jlewis@mde.state.md.us

Massachusetts—Alan D. Perry, REHS/RS, Attleboro Health Dept., Attleboro, MA. president@maeha.org

Michigan—Carolyn Kreiger, REHS, Environmental Quality Analyst, Michigan Dept. of Environmental Quality, Kalamazoo, MI. chobbs@meha.net

Minnesota—Jim Topie, REHS, Planner Principal, Minnesota Dept. of Health, Duluth, MN. james.topie@state.mn.us

Mississippi—Queen Swayze, Food Program Specialist, Mississippi State Dept. of Health, Jackson, MS. elizabeth.swayze@msdh.state.ms.us

Missouri—Paul Taylor, Environmental Representative, St. Louis County Health Dept., St. Louis, MO. ptaylor@stlouisco.com

Montana—Laurel Riek, RS, Program Manager, Lewis & Clark City/County Health Dept., Helena, MT. lriek@lccountymt.gov

National Capitol Area—Shannon McKeon, Environmental Health Specialist, Fairfax, VA. smckeon@ncaeha.com

Nebraska—Kathy King, Environmental Health Specialist II, Lincoln-Lancaster Health Dept., Lincoln, NE. kking@lincoln.ne.gov

Nevada—Tamara Giannini, Environmental Health Supervisor, Southern Nevada Health District, Las Vegas, NV. giannini@snhdmail.org

New Jersey—Marconi Gapas, Health Officer, Township of Union and Borough of Kenilworth Dept. of Health, Union, NJ. mgapas@uniontownship.com

New Mexico—Michael Broussard, CP-FS, Program Specialist, NMED, Santa Fe, NM. michael.broussard@state.nm.us

New York—Contact Region 9 Vice President Edward L. Briggs. eb.health@ridgefieldct.org

North Carolina—Jesse Dail, Environmental Health Specialist, Morehead City, NC. jessed@carteretcountygov.org

North Dakota—Jane Kangas, Environmental Scientist II, North Dakota Dept. of Health, Fargo, ND. jkangas@nd.gov

Northern New England Environmental Health Association—Co-president Brian Lockard, Health Officer, Town of Salem Health Dept., Salem, NH. blockard@ci.salem.nh.us
Co-president Thomas Sloan, RS, Agricultural Specialist, New Hampshire Dept. of Agriculture, Concord, NH. tsloan@agr.state.nh.us

Ohio—Eric J. Zgodzinski, MPH, RS, CPH, Director of Community and Environmental Health, Toledo-Lucas County Health Dept., Toledo, OH. zgodzinski@co.lucas.oh.us

Oklahoma—Matthew Brosh, RPES, Public Health Specialist, Oklahoma City-County Health Dept., Oklahoma City, OK. matt_brosh@occhd.org

Oregon—Delbert Bell, Klamath Falls, OR. Dbell541@charter.net

Past Presidents—Brian Collins, MS, REHS, DAAS, Director of Environmental Health (ret)

Pennsylvania—TBD

Rhode Island—Dottie LeBeau, CP-FS, Food Safety Consultant and Educator, Dottie LeBeau Group, Hope, RI. deejaylebeau@verizon.net

Saudi Arabia—Zubair M. Azizkhan, Environmental Scientist, Saudi Arabian Oil Company, Saudi Arabia. Zubair.azizkhan@aramco.com.sa

South Carolina—Trey Reed, Regional Environmental Health Director, South Carolina Dept. of Health and Environmental Control, Aiken, SC. reedhm@dhec.sc.gov

South Dakota—John Osburn, Pierre, SD. john.osburn@state.sd.us

Tennessee—David Garner, Nashville, TN. david.garner@tnenvironmentalhealth.org

Texas—Cindy Corley, REHS, CP-FS, Environmental Health Manager, City of Garland Health Dept., Garland, TX. ccorley@garlandtx.gov

Uniformed Services—Joseph Hout, Environmental Science Officer, The Uniformed Services University of the Health Sciences, Bethesda, MD. joseph.hout@usuhs.edu

Utah—Ronald Lund, Salt Lake County Health Dept., Murray, UT. rlund@slco.org

Virginia—Christopher Gordon, Executive Advisor-Public Health, Virginia Dept. of Health, Richmond, VA. christopher.gordon@vdh.virginia.gov

Washington—Michael Baker, MS, PhD, Dept. of Environmental Health Director, Whitman County Public Health, Pullman, WA. michael.baker@whitmancounty.net

West Virginia—Elizabeth Green, Parkersburg, WV. elizabeth.s.green@wv.gov

Wisconsin—Laura Temke, REHS, CP-FS, HHS, Environmentalist, City of West Allis Health Dept., West Allis, WI. ltemke@westalliswi.gov

Wyoming—Terri Leichtweis, Environmental Health Specialist, Jefferson County Public Health, Lakewood, CO. tleicht@jeffco.us

NEHA Historian

Dick Pantages, NEHA Past President, Fremont, CA. dickpantages@comcast.net

Technical Advisors

Air Quality—Scott E. Holmes, REHS, MS, Environmental Public Health Manager, Lincoln-Lancaster County Health Dept., Lincoln, NE. sholmes@lincoln.ne.gov

Aquatic Venues/Recreational Health—Tracynda Davis, MPH, Environmental Health Consultant, Colorado Springs, CO. tracynda@gmail.com

Aquatic Venues/Recreational Health—Colleen Maitoza, REHS, Supervising Environmental Specialist, Environmental Management Dept., County of Sacramento, Mather, CA. maitozac@saccounty.net

Children's Environmental Health—M.L. Tanner, HHS, Environmental Health Manager III, Bureau of Environmental Health Services, Division of Food Protection and Rabies Prevention, South Carolina Dept. of Health and Environmental Control, Columbia, SC. tannerml@dhec.sc.gov

Drinking Water/Environmental Water Quality—Sharon Smith, RS, West Central Region Supervisor, Minnesota Dept. of Health, Fergus Falls, MN. sharon.l.smith@state.mn.us

Emergency Preparedness and Response—Martin A. Kalis, Public Health Advisor, CDC/NCEH/DEEHS/EHSB, Atlanta, GA. mkalis@cdc.gov

Emergency Preparedness and Response—Vince Radke, MPH, REHS, CP-FS, DAAS, Sanitarian, CDC/NCEH/DEEHS/EHSB, Atlanta, GA. vradke@cdc.gov

Emerging Pathogens—Lois Maisel, RN, CP-FS, Environmental Health Specialist II, Fairfax County Health Dept., Fairfax, VA. lois.maisel@fairfaxcounty.gov

Environmental Justice—Welford C. Roberts, PhD, DAAS, RS/REHS, Subject Matter Expert, Office of the Air Force Surgeon General, ERP International, LLC., South Riding, VA. welford@erols.com

Food (including Safety and Defense)—Eric Bradley, MPH, REHS/RS, CP-FS, Environmental Health Specialist, Scott County Health Dept., Davenport, IA. Eric.Bradley@scottcountyiowa.com

Food (including Safety and Defense)—John A. Marcello, REHS, CP-FS, Pacific Regional Food Specialist, FDA, Tempe, AZ. john.marcello@fda.hhs.gov

General Environmental Health—Ron de Burger, Retired Director, Toronto Public Health, Toronto, ON, Canada. rdeburger@gmail.com

General Environmental Health—Eric Pessell, REHS, Environmental Health Division Director, Kent County Health Dept., Grand Rapids, MI. eric.pessell@kentcountymi.gov

Global Climate Change and Health—Steve Konkel, PhD, MCP, AICP, FRIPH, Associate Professor, Environmental Health Sciences, University of Alaska Anchorage, Anchorage, AK. steven.konkel@uaa.alaska.edu

Hazardous Materials/Toxic Substances—Priscilla Oliver, PhD, Life Scientist/Program Manager, U.S. EPA, Atlanta, GA. POliverMSM@aol.com

Healthy Homes and Healthy Communities—Sandra Whitehead, MPA, Environmental Public Health Planner, Division of Environmental Health, Florida Dept. of Health, Tallahassee, FL. Sandra_Whitehead@doh.state.fl.us

Injury Prevention—CAPT Alan J. Dellapenna, Jr., RS, MPH, DAAS, Historian, Indian Health Service, Rockville, MD. alan.dellapenna@gmail.com

Institutions/Schools—TBD

International—Sylvanus Thompson, PhD, CPHI(C), Associate Director, Toronto Public Health, Toronto, ON, Canada. sthomps@toronto.ca

Land Use Planning/Design—Felix I. Zemel, MCP, MPH, RS, DAAS, Health Agent/Administrator, Cohasset Board of Health, Cohasset, MA. felix.zemel@gmail.com

Legal—Doug Farquhar, JD, Program Director, National Conference of State Legislatures, Denver, CO. doug.farquhar@ncsl.org

Mentorship—Sheila D. Pressley, DrPH, REHS/RS, Associate Professor, Eastern Kentucky University, Richmond, KY. sheila.pressley@eku.edu

Mentorship—Marie Woodin, REHS, Deputy Division Chief, Sacramento County Environmental Management Dept., Sacramento, CA. WoodinM@saccounty.net

Occupational Health/Safety—D. Gary Brown, DrPH, CIH, RS, DAAS, Professor, Eastern Kentucky University, Richmond, KY. gary.brown@eku.edu

Radiation/Radon—TBD

Risk Assessment—TBD

Sustainability—Tom R. Gonzales, MPH, REHS, Environmental Health Director, El Paso County Public Health, Colorado Springs, CO. tomgonzales@elpasoco.com

Technology (including Computers, Software, GIS, and Management Applications)—Darryl Booth, MBA, President, Decade Software Company, Fresno, CA. darrylbooth@decadesoftware.com

Vector Control—Zia Siddiqi, PhD, BCE, Director of Quality Systems, Orkin, Inc., Atlanta, GA. zsiddiqi@rollins.com

Wastewater—Craig Gilbertson, RS, Environmental Planner, TrackAssist-Online, Walker, MN. cgilbertson@yaharasoftware.com

Workforce Development, Management, and Leadership—CAPT Michael E. Herring, REHS, MPH, Senior Environmental Health Scientist/Training and Technical Assistance Team Leader, CDC, Atlanta, GA. mherring@cdc.gov

Workforce Development, Management, and Leadership—George Nakamura, MPA, REHS/RS, DAAS, President/CEO, Nakamura Leasing, Sunnyvale, CA. gmlnaka@comcast.net

NEHA Staff: (303) 756-9090

Rance Baker, Program Administrator, NEHA Entrepreneurial Zone (EZ), ext. 306, rbaker@neha.org

Trisha Bramwell, Customer & Member Services Specialist, ext. 336, tbramwell@neha.org

Laura Brister, Customer & Member Services Specialist, AEC Registration Coordinator, ext. 309, lbrister@neha.org

Patricia Churpakovich, Credentialing Coordinator, ext. 317, pchurpakovich@neha.org

Ginny Coyle, Grants/Projects Specialist, Research and Development (R&D), ext. 346, gcoyle@neha.org

Jill Cruickshank, Chief Operating Officer (COO), ext. 342, jcruickshank@neha.org

Vanessa DeArman, Project Coordinator, R&D, ext. 311, vdearman@neha.org

Cindy Dimmitt, Receptionist, Customer & Member Services Specialist, ext. 300, cdimmitt@neha.org

Elizabeth Donoghue-Armstrong, Copy Editor, *Journal of Environmental Health,* nehasmtp@gmail.com

Eric Fife, Learning Content Producer, NEHA EZ, ext. 344, efife@neha.org

Soni Fink, Strategic Sales Coordinator, ext. 314, sfink@neha.org

Michael Gallagher, IFSS Logistics and Training Coordinator, NEHA EZ, ext. 343, mgallagher@neha.org

TJay Gerber, Credentialing Specialist, ext. 328, tgerber@neha.org

Dawn Jordan, Customer Service Manager, Office Coordinator, HR and IT Liaison, ext. 312, djordan@neha.org

Erik Kosnar, Learning Content Production Assistant, NEHA EZ, ext. 318, ekosnar@neha.org

Elizabeth Landeen, Assistant Manager, R&D, (702) 802-3924, elandeen@neha.org

Matt Lieber, Marketing and Communications Assistant, ext. 338, mlieber@neha.org

Larry Marcum, Managing Director, R&D and Government Affairs, ext. 307, lmarcum@neha.org

Marissa Mills, Project Assistant, R&D, ext. 304, mmills@neha.org

Eileen Neison, Credential Department Customer Service Representative, ext. 310, eneison@neha.org

Carol Newlin, Credentialing Specialist, ext. 337, cnewlin@neha.org

Terry Osner, Administrative Coordinator, ext. 302, tosner@neha.org

Barry Porter, Financial Coordinator, ext. 308, bporter@neha.org

Kristen Ruby-Cisneros, Content Editor, *Journal of Environmental Health*, ext. 341, kruby@neha.org

Michael Salgado, Assistant Manager, NEHA EZ, ext. 315, msalgado@neha.org

Jill Schnipke, Education Coordinator, ext. 313, jschnipke@neha.org

Joshua Schrader, Sales & Training Support, NEHA EZ, ext. 340, jschrader@neha.org

Clare Sinacori, Marketing and Communications Manager, ext. 319, csinacori@neha.org

Christl Tate, Project Coordinator, R&D, ext. 305, ctate@neha.org

To update information, contact Terry Osner at tosner@neha.org.

NEHA **NEWS**

NEHA Staff Profiles

As part of tradition, NEHA features new staff members in the *Journal* around the time of their one-year anniversary. These profiles give you an opportunity to get to know the NEHA staff better and to learn more about the great programs and activities going on in your association. This month we feature two staff members from one of NEHA's key programs—credentialing. Contact information for all NEHA staff can be found on page 51.

Patricia Churpakovich

In August 2013 I started at NEHA in the role of credentialing coordinator. I bring six years of program management experience from the continuing medical education world of WebMD. I have worked on bringing a process- and results-driven focus to the credentialing department here at NEHA. More than anything, I have strived to bring together a team of very talented individuals who now make up the credentialing department, and I couldn't be prouder of our success. We are continuing to improve on our department functions as well as customer relationships. As time progresses, we look to do more to add to the customer experience for our credentialed professionals.

Originally from the Jersey Shore, I have since relocated back to New Jersey and continue my role as credentialing coordinator from the East Coast. I majored in print journalism at James Madison University in Virginia, and began my career working at a small newspaper and a business-to-business publishing company. While I truly enjoy writing, I found my skill set to lean more toward program management—specifically the streamlining of processes. My time in Denver was extremely special to me, even more so because it brought me to NEHA.

When not working at NEHA I enjoy spending time with my two young boys and my husband. I'm enjoying being near the beach again, and love being outdoors with my family.

I look forward to many further years here at NEHA and hope to continue to grow our credentialing team and take this department into the future of credentialing programs and environmental health.

TJay Gerber

I joined NEHA in September 2013 as a credentialing specialist after working in the hospitality industry for the previous five years. I am thoroughly enjoying my time here at NEHA as I learn more about the environmental health field and how vital it is to our nation and world. Among other duties, I oversee the Certified Professional–Food Safety (CP-FS), Certified in Comprehensive Food Safety (CCFS), Certified Installer of Onsite Wastewater Treatment Systems (CIOWTS), and Healthy Homes Specialist (HHS) credentials and ensure that our applicants have the tools and resources that will enable them to further their professional goals. Due to my customer service experience from working in hotels, I also review how we interact with our customers and attempt to enhance our communication with our ever-growing customer base.

I am originally from Maryland but went to school at Florida State University (FSU) … go 'Noles! I was a double major at FSU and earned a degree in marketing and hospitality management. Before working at NEHA, I worked for Omni Hotels and Resorts as a front office manager. Working in hospitality enabled me to live in San Francisco, Atlanta, Dallas, and ultimately in my dream city, Denver. I've always known I'd end up in Colorado and am overjoyed to call Denver my home. When I'm not working, I enjoy hiking, camping, skiing, tennis, scuba diving, and travelling to new cities.

It is a pleasure coming in to work each morning surrounded by individuals who are like family. I am happy to be part of a team that supports environmental health professionals from around the world. If I may ever be of any assistance to you, please feel free to reach out to me.

Did You Know?

NEHA's board of directors recently adopted a policy position supporting the Registered Environmental Health Specialist/Registered Sanitarian credential for environmental health professionals in response to a disturbing trend that has some health departments around the country dropping the credential as a hiring qualification. The position paper can be found at www.neha.org/pdf/positions/REHS-RS-Credential.pdf.

79th NEHA AEC

National Environmental Health Association (NEHA)
79th Annual Educational Conference (AEC) & Exhibition

SAVE THE DATES

JULY 13-15, 2015

RENAISSANCE ORLANDO
at SEAWORLD

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

79th NEHA AEC

CALL FOR ABSTRACTS

The National Environmental Health Association presents its 79th Annual Educational Conference & Exhibition in Orlando, FL, July 13-15, 2015.

NEHA IS CURRENTLY...

- Gathering feedback on topics of interest for 2015
- Developing a conference vision
- Researching an improved abstract submission process

Visit NEHA2015AEC.org for information on abstract submissions.

AEC Format

NEHA is seeking abstracts that bring the latest advances in environmental health, as well as unique responses to environmental health and protection problems. Practical applications in both the public and private sectors should be emphasized along with the latest in proven emerging technologies.

Types of training and educational sessions at the AEC:

Lectures

- Interactive presentations will be given first consideration
- Single or multiple speaker presentations in traditional lecture or panel formats

Learning Labs

- Hands-on demonstrations
- Tabletop exercises
- Drop-in learning labs
- Roundtable discussions
- Poster presentations
- Other interactive and innovative presentation formats

Ensuring Attendees a Return on Investment

The NEHA AEC is being rationalized according to return on investment (ROI) principles. Emphasis will be given to those abstracts that impart knowledge to attendees, but also enables them to make cost effective program improvements in their workplaces thereby justifying the investment made for their attendance to the NEHA AEC.

2 WAYS to participate in the Call for Abstracts

Be a speaker.

Be a voice.

The NEHA AEC is designed to train, educate, and advance people who have an interest or career in environmental health and protection, as well as to bring people together to build a professional network of environmental health colleagues, exchange information, and discover new and practical solutions to environmental health issues.

78th NEHA AEC

IN PARTNERSHIP WITH THE IFEH 13TH WORLD CONGRESS

Viva Las Vegas!

It was great that so many members (and potential members!) were able to join us in Las Vegas for the NEHA 2014 Annual Educational Conference (AEC) & Exhibition, July 7–10. It was truly inspiring to meet environmental health professionals from around the world with the International Federation for Environmental Health (IFEH) joining us for their 13th World Congress. Over 1,100 attendees were present representing 22 different countries such as Australia, Canada, Croatia, China, Kenya, Portugal, and Saudi Arabia.

We're confident that all were pleased with the high quality educational sessions at the conference, as well as a taste of the entertainment capital of the world that attendees were able to experience while staying in Las Vegas.

This year's combined NEHA and IFEH event offered sessions designed to 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. Approximately 15% of sessions in each educational track had an internationally focused topic or presenter. A block of sessions was also dedicated to IFEH presenters who covered environmental health issues from an international perspective.

In addition, 20%–30% of sessions highlighted innovative approaches to barriers and day-to-day issues faced by environmental health professionals. We hope attendees benefited from the conference by enabling them to do the following:

- develop their environmental health workforce and apply its proficiency to new areas,
- manage very real funding shortages and leverage resources in new ways,
- apply technology in new ways or use new technology,
- build novel partnerships and collaborative projects, and
- find innovative solutions by exploring international approaches to shared concerns from the local to the global level.

Attending the AEC allowed environmental health professionals opportunities to enjoy a multifaceted experience that gave them training, education, networking, advancement, motivation, inspiration, policy involvement, and enjoyment of the destination. NEHA strives to provide the most updated and relevant information so that the AEC continues to be the premier event in environmental health education and training.

As one attendee stated, "I thoroughly enjoyed the NEHA and IFEH combined AEC this year. Las Vegas was the perfect place to have it. The presenters, accommodations, staff, and topics were impeccable. It was fantastic to catch up with old friends and make new friends, especially recent graduates looking for that first, valuable environmental health job! I returned to my hometown with loads of learning, thoughts of improving my local agency, new ways of seeing things, and gratitude for my environmental health colleagues from all over the world. We DO make a difference!"

Greening of the AEC

Fourth Annual Community Volunteer Event

For the fourth year, NEHA organized a community volunteer event at the AEC to support NEHA's sustainable efforts and give back to the AEC host city and community by helping to offset the energy expenditures and greenhouse gas emissions from holding a large conference. This year's event was held at the Clean the World Foundation's Las Vegas recycling operation center.

Clean the World's mission is to collect and recycle soap and shampoo products discarded by the hospitality industry and prevent millions of deaths caused by hygiene-related illnesses through the distribution of these and other donated hygiene products to impoverished people. Clean the World has accepted in-kind donations of more than one million dollars and put over nine million soap bars and two million pounds of bottled amenities back into human use—while simultaneously diverting over 600 tons of waste.

Clean the World is committed to maintaining an environmentally and hygienically safe recycling process. As the world's first high volume soap recycler, it ensures all bars of soap that are recycled are completely safe using two recycling methods: rebatching and sterilization. The result is the complete elimination of pathogens such as *Listeria monocytogenes, E. coli, Pseudomonas aerogenes, Salmonella,* and *Staphylococcus aureus*.

Twenty-two volunteers attended a 15-minute orientation and unwrapped two pallets of soap that had 15 boxes each and weighed 900 pounds each. The unwrapped soap was melted and made into half a pallet of new soap. This new soap will be donated to local charities in need.

Volunteers worked so quickly and efficiently that they had time for a short tour to learn about the new soap machine and melting/sanitation process.

Volunteers had the opportunity to work alongside their fellow AEC attendees for a great cause and give back to the local community, all while supporting environmental health and sanitation. NEHA again provided collapsible water bottles and Starbucks sponsored the transportation and provided snacks.

Volunteers and NEHA staff also donated at least five large bags of soap, baby hygiene products, and other travel-size amenities. Soap donations will be placed in outgoing hygiene kits to local and international charities in need. Thank you to all of the volunteers for their dedication and participation!

Green Initiatives at the AEC

NEHA continues to make the AEC a more environmentally sustainable event with guidance from the ASTM/APEX Standards, a set of nine formal voluntary standards developed by the meetings, conventions, exhibitions, and events industry. Below are tangible ways NEHA and The Cosmopolitan of Las Vegas achieved some of the requirements of the standards.

Destination Choice: Las Vegas, Nevada

- Las Vegas is close to a large constituency of members, affiliates, and potential attendees.
- The venue was within five miles of an airport.

Exhibits

- Advised exhibitors how to green the exhibition.

Transport/Shuttles

- Contracted with a shuttle company for airport transfers and used mass transit when possible.

AV

- Turned off or placed equipment in power-saving mode at the end of each day.
- Used energy efficient equipment.
- AV supplier participates in an equipment recycling program.

Marketing

- Used online and electronic communications, registrations, and confirmations.
- Printed in ways that reduced the use of paper.
- Reduced waste related to attendee name badges.
- Employed reusable signage wherever possible.

On-Site Offices

- Printed in double-sided mode whenever possible.
- Reused shipping materials.

Food and Beverage

- No bottled water was served.
- Used reusable or compostable glasses, mugs, utensils, and napkins.

AEC Venue/The Cosmopolitan of Las Vegas

- Employs a comprehensive waste management program that hand sorts all solid waste for asset recovery, recycling, and diversion from landfills.
- Considers environmental impact and ethics/reputation of food vendors such as ecological destruction; endangered species; treatment of animals and raising practices; use of chemicals, preservatives, color enhancers, and hormones; etc.
- Purchases organic, local, seasonal, or sustainable foods and beverages.
- Offers vegetarian/vegan meals.
- Donates leftover food from large events to community organizations.
- Composts food waste.

ENVIRONMENTAL HEALTH
TRAINING & EDUCATION

Innovation and International Focus

Training and education are the top reasons why people choose to attend the AEC. This year's agenda was focused around innovation in environmental health and the partnership with IFEH. NEHA included sessions with an internationally focused topic or presenter in each educational track and offered an "International EH: IFEH Special Sessions" track dedicated to IFEH presenters who covered environmental health issues from an international perspective.

We solicited presentations that addressed the challenges of building agency capacity under budget cuts and a fast-changing workforce with innovative responses such as new research/tools/technologies, novel approaches/strategies or collaborations, alternative business models, new programs or methods of program management, new funding streams, new applications of existing skills or resources, new applications of technology, and process improvements across environmental health disciplines.

The educational program included over 170 oral presentations in several formats including mini lectures, lectures, interactive lectures, and learning labs (facilitated group exercises). These sessions provided opportunities to obtain comprehensive information from more than 250 experts. Also, we had some educational sessions that were more attendee driven. In two poster sessions 59 posters were presented, and several drop-in learning lab sessions took place. Poster sessions allowed attendees to look at poster graphics and displays and inquire with the presenters specifically about their area of interest or about their own application of the information. The 15 drop-in learning labs allowed a similar interaction, except that the stations "presented" a live demonstration or hands-on practice in which an attendee could inquire specifically about their own needs to solve their own problems in many areas of environmental health.

This year NEHA also made an effort to crowdsource solutions to common problems environmental health practitioners encounter. The "Graffiti Wall" was a quick and easy way for attendees to exchange ideas and take home valuable ideas, solutions, and practices. Information from the Graffiti Wall is available on the Virtual AEC Web site.

AEC attendees listened intently to a food protection and defense speaker discuss the benefits of incorporating new technology in their routine inspections.

The Graffiti Wall, new this year, provided AEC attendees with the opportunity to share their ideas on a variety of environmental health topics.

Two preconference workshops were offered this year: Springboard to Prevention: The Model Aquatic Health Code (MAHC), 1st Edition and Industry-Foodborne Illness Investigation Training and Recall Response (I-FIIT-RR). Both were very successful. The MAHC workshop had over 135 attendees and I-FIIT-RR was filled to capacity.

Review courses and exams for NEHA's Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) and Certified Professional of Food Safety (CP-FS) were offered after the AEC. A review course and exam were also offered after the conference for NEHA's retail and processor HACCP certifications.

Overall, training and education at the conference spanned an amazing eight days!

Return on Investment (ROI)

NEHA intends for attendees to return to their workplaces with the ability to more than pay for their trip to the conference by continuing to incorporate ROI principles into the education and training structure. The AEC planning committee set out to deliver sessions that 1) were relevant to attendees' job duties; 2) offered new knowledge, skills, or strategies; and 3) gave attendees either an opportunity to practice or the means to apply and implement the new knowledge, skills, or strategies upon returning to their workplace. To that end, presenters were guided to create presentations around learning objectives as tangible outcomes for attendees.

NEHA will measure the ROI of the AEC by distributing a series of electronic surveys to conference attendees over a span of approximately six months inquiring about what was gained, what was applied or implemented, and the quantifiable difference it made in performance, efficiency, or expense.

Environmental Health Topics Covered: You Spoke and We Listened!

Comments and suggestions provided in the 2013 AEC attendee survey, 2014 AEC market research survey, and on NEHA's abstracts blog were used to identify areas to emphasize in the educational program. A heavy emphasis was put on inspection technology and the use of apps in environmental health. Sessions that addressed concerns related to the future of environmental health practice; demonstrating program effectiveness, value, and ROI for environmental health programs; and building agency capacity under reduced budgets were pursued and offered at the AEC.

Many sessions also addressed evaluation of the built environment and its link to public health, water reclamation and reuse, and the role of environmental health in sustainability and climate change. The AEC's training and education program covered all of the following topics.

- Children's Environmental Health
- Emergency Preparedness and Response
- Emerging Environmental Health Issues
- Environmental Justice
- Food Protection and Defense
- General Environmental Health
- Hazardous Materials and Toxic Substances
- Healthy Homes and Communities
- Indoor Air Quality

- Injury Prevention and Occupational Health
- International Environmental Health
- Land Use Planning
- Leadership/Management
- Nuisances, Zoonoses, and Vector Control
- Onsite Wastewater
- Pathogens and Outbreaks
- Recreational Waters
- Schools/Institutions
- Sustainability/Climate Change
- Technology and Environmental Health
- Terrorism/All-Hazards Preparedness
- Uniformed Services
- Wastewater
- Water Quality

Expanded Onsite Wastewater Offerings

NEHA again partnered with the State Onsite Regulators Alliance, Captains of Industry, and the U.S. Environmental Protection Agency's Office of Wastewater Management to develop the educational sessions for the onsite wastewater educational track as well as an off-site field trip. The field trip took place prior to the start of the conference and involved visiting two water reuse and recycling communities. The first stop was Clark County Water Reclamation District's Desert Breeze Water Resource Center, a state-of-the-art facility that collects wastewater flows from the surrounding neighborhoods to produce high-quality reclaimed water and uses it for large turf irrigation applications such as parks and golf courses. The second stop was Las Vegas Valley Water District's Springs Preserve facilities where they reclaim wastewater for reuse on its 180-acre campus.

The educational program included more information on the technology and regulations behind wastewater reuse as well as an in-depth look at real estate point of sale inspection requirements. The education concluded with a data sharing discussion intended to ease the implementation of new onsite wastewater products and technology.

Partners

Other organizations that worked synergistically with NEHA to produce educational content for the conference include the Association of Environmental Health Academic Programs, Association of Pool and Spa Professionals, Centers for Disease Control and Prevention, Food and Drug Administration, International Federation of Environmental Health, State Onsite Regulators Alliance and Captains of Industry, Uniformed Services Environmental Health Association, U.S. Environmental Protection Agency, and U.S. Department of Agriculture's Food and Nutrition Service.

NEHA's Technical Advisors

Finally, NEHA would be remiss if it did not give recognition and thanks to the group of dedicated individuals who make up NEHA's Technical Advisors. The Technical Advisors assisted in the creation of the AEC's training and education program. Please see page 51 for a complete listing.

ENVIRONMENTAL HEALTH VIRTUAL AEC

For those who did not attend the AEC or who attended but did not get to view all the desired sessions, 35 sessions were recorded for viewing online at www.neha2014aec.org/virtual-aec-sessions. These sessions are eligible for NEHA continuing education credits and will be available to conference attendees and Virtual AEC purchasers for the next 12 months to view at their convenience.

Many attendees also used the Virtual AEC Your Meeting Companion to get more out of the conference using the mobile app. Present at the AEC were on-site staff from Zerista's App Squad, who added a personal touch helping attendees use the tool on their mobile devices.

Features of the Virtual AEC Meeting Companion included viewing the AEC schedule, interactive maps, session information, exhibitors, speaker information, and attendee profiles; setting up personal profiles, engaging and networking with other attendees, speakers, and exhibitors; and swapping digital business cards.

Grants, Partners, and Sponsors

Grants

» Food and Drug Administration

Partners

» Association of Pool and Spa Professionals
» Centers for Disease Control and Prevention/National Center for Environmental Health
» Food and Drug Administration
» International Federation of Environmental Health
» NEHA Technical Advisors
» State Onsite Regulators Alliance and Captains of Industry
» Uniformed Services Environmental Health Association
» U.S. Department of Agriculture, Food and Nutrition Service

Sponsors

Tier I
» UL

Tier II
» American Public University
» Decade Software Company, LLC
» Health Space USA Inc.
» NSF International

Tier III
» Digitial Health Department, Inc.
» National Restaurant Association
» Prometric
» Remco
» Skillsoft

Tier IV
» Mitchell Humphrey Software
» Orkin

Tier V
» Anua
» GloGerm
» Industrial Test Systems, Inc.
» Mars Air Systems
» Mycometer
» Perkin Elmer
» Presby Environmental, Inc.
» San Jamar
» Starbucks Coffee Company
» Sweeps Software, Inc.

Honorable Mention

» Center for Environmental Research & Technology, Inc.
» LCDR James Speckhart
» The Kroger Co.

ENVIRONMENTAL HEALTH NETWORKING

Exhibition

This year's exhibition was loaded with information, new products, and invaluable services to help attendees and their organizations improve their environmental health programs and operations. The exhibition opened on Tuesday night with the Exhibition Grand Opening and Party. All enjoyed an evening of food, fun, and of course, the opportunity to do business at this party! The exhibition also gave attendees the chance to view over 30 posters covering a broad spectrum of environmental health topics and engage with presenters in a lively, interactive format.

This year's door prizes included a Roomba, Bluetooth wireless speakers, and a Kindle Fire. Three lucky winners received the door prizes, which were made possible by generous donations from Decade Software Company, LLC; Forensic Analytical Labs; GLO GERM; NSF International; QuanTEM Food Safety Laboratories; Dr. Welford C. Roberts; Salcor, Inc.; Shat-R-Shield, Inc.; and The University of Findlay.

AEC attendees got a chance to chat with keynote speaker Dr. Mark Keim in CDC's booth.

One of the lucky winners of the door prize drawings that took place in the exhibition!

Silent Auction

A big thanks to all those who participated in making this year's Silent Auction a huge success! All 41 items were won and purchased for a grand total of $2,586, which will be applied to the 2015 AEC speaker fund. The Silent Auction would not have been possible without the generous contributions from NEHA members, affiliates, exhibitors, sponsors, board, and staff.

Some of this year's big ticket items included a two-night stay in a terrace suite at The Cosmopolitan of Las Vegas, a three-night stay with breakfast for two at the Renaissance Orlando at SeaWorld, and a case of specially made brown ale from Bonfire Brewing in Eagle, Colorado, appropriately called "Sanitarian Insanity!" The case of beer was generously donated by the Colorado Environmental Health Association along with a Colorado-themed gift basket. Other celebratory baskets were donated including the San Diego ale basket from the California Environmental Health Association, the Pahrump Winery gift basket from the Nevada Environmental Health Association, and a wine basket from the Alabama Environmental Health Association.

The Wyoming Environmental Health Association included their ever-popular "How to tell if you're a health inspector" t-shirt as a part of their donation; the Indiana Environmental Health Association contributed a beautifully framed photo titled, "Brown County, IN"; and the Minnesota Environmental Health Association donated the "Minnesotan's Camper Kitchen," which was full of fantastic treats and other fun goodies. Oklahoma, Missouri, Texas, and Connecticut also provided generous gift baskets.

Thanks to the generous donors, AEC attendees were able to scoop up some great items … if they bid high enough!

Perhaps the most interesting donation came from the Massachusetts Environmental Health Association: two t-shirts and three Duck Dynasty books! The bidding was energetic on those items!

Foreign attendees also participated. The Dutch Association of Food and Non-Food Products Inspectors contributed two traditional wooden shoes with caramel candy and the Chartered Institute of Environmental Health donated two sets of public health books. Two nice leather notebooks from NSF and a REHS workbook were also donated. Finally, NEHA donated pens, logo shirts, and a 2015 AEC registration.

NEHA offers its sincere gratitude to volunteers Regina Poteat and Dawn McFadden and to all the attendees who helped to make this year's Silent Auction a success!

Silent Auction Donors

NEHA affiliates: Alabama, California, Colorado, Connecticut, Indiana, Massachusetts, Minnesota, Missouri, Nevada, Oklahoma, Texas, and Wyoming.

Matt Brosh
Haskey Bryant
Erin Cavin
Chartered Institute of Environmental Health
France A. Cordova
Cindy Corley
Sarah Crossman
Dutch Association of Food and Non-Food Products Inspectors
Jan Homma
Roy Kroeger
Pat Maloney
Mike Mettler
NSF
NEHA board of directors and staff
Marco Palmeri
Mindi Ramig
Renaissance Orlando at SeaWorld
Walter Saraniecki
The Cosmopolitan of Las Vegas
Paul Taylor
Jim Topie
Peter Wright

Exhibitors

ABC Trading Solutions

Advanced Drainage Systems, Inc.

American Academy of Sanitarians

American Chemistry Council

American Public University

Anua

Aqua Test, Inc.

Association of Environmental Health Academic Programs

Association of Food and Drug Officials

Association of Professional Piercers

Association of Schools and Programs of Public Health

Bio-Microbics, Inc.

California Conference of Directors of Environmental Health

Cambro

CDC, National Center for Environmental Health/Agency for Toxic Substances and Disease Registry

CDC, National Environmental Public Health Tracking Network

CDP, Inc.

Columbia Southern University

Conference for the Model Aquatic Health Code

Decade Software Company

Digital Health Department, Inc.

Eljen Corporation

FDA, Center for Safety and Applied Nutrition

Feel Good, Inc.

Forensic Analytical Laboratories

Gizmo Experts

GloGerm

HealthSpace USA Inc.

Hedgerow Software Ltd.

Hoot Systems

Industrial Test Systems, Inc.

Inspect2GO

InspekPro LLC

Instant Off

International Federation of Environmental Health

ITW Professional Brands

Jet, Inc.

LaMotte Company

Mars Air Systems

Michigan State University, Online Master of Science in Food Safety

Michigan State University, Program in Public Health

Mitchell Humphrey

Momentus Software

Mycometer, Inc.

National Environmental Health Association

National Library of Medicine

National Restaurant Association

National Swimming Pool Foundation

NEHA Training & Education

Neogen Corporation

NSF International

Ozark River Hygienic Hand-Wash Station

Paster Training, Inc.

PerkinElmer

Polylok, Inc.

Presby Environmental, Inc.

Prometric

QuanTEM Microbiology Laboratories

Remco Products Corporation

RIAMS UK/Australia

Salcor

San Jamar

Shat-R-Shield, Inc.

Skillsoft

StateFoodSafety.com

STOP Foodborne Illness

Sweeps Software, Inc.

ThermoWorks

Track-Assist Online

UL

University of Findlay

U.S. EPA, Office of Water

U.S. EPA, Indoor Environments Division

USDA, Food Safety and Inspection Service

Walden University

ENVIRONMENTAL HEALTH
POLICY INVOLVEMENT

Board of Directors' Meeting Highlights

NEHA's board of directors meets four times each year, with one meeting always held at the AEC.

1. AEC guests: The AEC meeting is the only one in which guests may address the board on various topics. This year, the board welcomed guests from the Association of Environmental Health Academic Programs, Decade Software Company, International Federation of Environmental Health (IFEH), and Royal Environmental Health Institute of Scotland, among others.
2. CDC/National Center for Environmental Health (NCEH) and NEHA discussions: An update was presented concerning the work NEHA is doing in cooperation with CDC/NCEH and the International Code Council (ICC). Discussions were held in May 2014 to develop a strategy whereby all three organizations could work cooperatively to advance and encourage adoption of the Model Aquatic Health Code and the ICC pool code.
3. AEC and exhibition topics: Former Executive Director Nelson Fabian explained that this AEC had the highest number of registrations since Tucson (2008) with almost 900 registrants. He stated that while the attendance for the IFEH Congress was not as much as hoped, the ability for NEHA to cohost with IFEH is noteworthy, since it has been more than three years in the making. He added many potential attendees had issues in obtaining visas or travel permits. In addition to an increase in registrations, the level of sponsorships increased by nearly 50% over last year's AEC. He added that in addition to the outstanding educational program, other programs like the Community Volunteer Event continue to draw solid numbers each year.
4. Audit: NEHA auditors confirmed that no issues existed with NEHA's financial statements and gave NEHA a clean bill of financial health.
5. Search for a new executive director: President-Elect Carolyn Harvey indicated that the NEHA subcommittee had its first meeting and the committee is currently developing a list of search firms and a request for proposals (RFP). She also indicated that the committee established a tentative salary range for the new executive director. She added that a list of firms should be finalized by the end of August.
6. Membership: The board reviewed and approved staff proposals to the new tiered membership to become available on October 1, 2014. The tiered membership will provide individuals with the option to select a membership that includes a print and electronic copy of the *Journal of Environmental Health (JEH)* or a membership that includes just an electronic copy of the *JEH*.
7. Position paper in support of the Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential: The board reviewed a position paper to support the REHS/RS credential for environmental health professionals. Pending approval of this document, the position paper will be added to the other position papers on the NEHA Web site.
8. E-voting for regional vice president vacancies: In an effort to reduce the amount of time between a vacancy in the office of a regional vice president and appointment by the board, the board approved the process that such vacancies will be decided by the voters of the region, rather than the board.

NEHA's board of directors take a minute to pose as a unified group after finishing up a long board meeting at the start of the AEC.

NEHA's leadership had the opportunity to interact and field questions from attendees at the Town Hall Assembly.

Town Hall Assembly

In what has become almost a tradition, Town Hall Assembly attendees were treated to breakfast that was generously sponsored by the National Restaurant Association (NRA). NEHA President Alicia Enriquez-Collins called the meeting to order and invited David Crownover from NRA to provide a welcome. President Enriquez-Collins then reported on the status of the association over the past year. Her report underscored the various activities NEHA has engaged in, as well as its future directions.

NEHA's election process and summary for the 2014 election were shared. President Enriquez-Collins announced the election results.

- Adam London was elected as second vice president,
- Ned Therein was appointed vice president of Region 1,
- Sandra Long was reelected as vice president of Region 5,
- Tim Hatch was appointed vice president of Region 7, and
- Lynne Madison was elected as vice president of Region 6.

President Enriquez-Collins asked for any nominations from the floor for 2015 second vice president candidates. None were made. Second vice president candidate Vince Radke, who submitted his nomination paperwork to the NEHA office by May 1, 2014, was introduced and given five minutes to speak. Since there were no other candidates for the position, Radke will become second vice president at the end of the 2015 AEC.

NEHA Managing Director Larry Marcum made a special presentation, updating the status of NEHA's grants, contracts, and government affairs program. The floor was then opened up for any member to ask questions or provide comments. Several members recognized and thanked former Executive Director Nelson Fabian for his work and years of service.

Awards Ceremony & Keynote Session

This event opened with tradition and style. NEHA incorporated a long-standing IFEH tradition of a cultural event to welcome attendees and delegates to the World Congress's host country or locale. In this case, the AEC planning committee felt that tapping into the U.S.'s mass exportation of arts and entertainment, with a definitive Las Vegas flavor, was the way to go. Who better to kick off the conference than the King himself … Elvis Presley! His charisma was contagious and his iconic dance moves got the audience excited with a three-song serenade that finished up with VIVA LAS VEGAS!

Keynote speaker Dr. Mark Keim spoke to a packed room about disaster mitigation and environmental health's contribution to reducing disaster-related morbidity and mortality.

NEHA President Alicia Enriquez-Collins (left) presents the Sabbatical Exchange Award to Lydia Zweimiller (right).

Keynote

NEHA attendees were privileged to have 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 CDC, as the keynote speaker. Dr. Keim is one of the foremost experts in the field of disasters and emergency response.

Dr. Keim began his presentation by recounting his personal experience as a survivor of the 1982 F-4 tornado that devastated the town of Marion, Illinois. Ten people died, hundreds were injured, and the town sustained more than $60 million in damage. Global climate change is predicted to increase the probability of extreme weather events and the consequences of extreme weather events also cause extreme health issues. He noted that disasters are increasing worldwide and that interventions must address causes of population vulnerability and not merely the response to such disasters.

Dr. Keim reviewed the evolution in disaster mitigation from response to preparedness to risk management. He further explained the differences between risk management and risk reduction. The focus of disaster risk reduction (DRR) is in preventing a disaster's related adverse health effects *before* it happens. He stated that DRR deals with the root cause of risk reduction and that it is more effective in reducing mortality rates associated with a disaster.

He defined *risk* as the probability that an event will occur, and that the convergence of four key factors affect one's disaster risk—hazard, exposure, vulnerability, and capacity. He gave definitions and examples of each of these factors. He posited that countering disaster risk requires reducing the hazard, amount of exposure, and vulnerability of individuals while increasing the capacity of potentially affected individuals or populations. He noted that reducing exposures can be accomplished by floodplain management, land use planning and regulation, and population protection through increased sanitation and hygiene. Dr. Keim stated that reducing vulnerability levels of populations is done by reducing poverty, promoting health and health care, community planning, and immunization.

In addition to reviewing DRR concepts, Dr. Keim reviewed the National Prevention Strategy that identifies goals, priorities, recommendations, and measures for improving health through prevention. The National Prevention Strategy's seven priorities are designed to improve health and wellness for the entire U.S. population. The seven priorities are 1) tobacco-free living, 2) preventing drug abuse and excessive alcohol use, 3) healthy eating, 4) active living, 5) injury and violence free living, 6) reproductive and sexual health, and 7) mental and emotional well-being.

He explained that the National Prevention Strategy aligns with DRR key factors of mitigating health hazards, reducing exposure, and decreasing the vulnerability of populations affected by a disaster. He added that a last factor, building capacity, can be addressed by societal actions of providing public health and safety, health care, education, and reducing poverty. He noted that environmental health programs reduce the disaster-related morbidity and mortality by encouraging healthy communities (reducing exposures) and healthy people (reducing vulnerability).

If interested in more information, you can visit the LinkedIn DRR group at www.linkedin.com/in/disasterdoc/ or contact Dr. Mark Keim at mjk9@cdc.gov.

Awards and Honors

Walter S. Mangold Award

NEHA's highest honor, the Walter S. Mangold Award, was presented this year to Dr. Welford C. Roberts. Please see page 68, which details Dr. Roberts's distinguished career and contributions to the profession.

Walter F. Snyder Award

NSF International and NEHA honored Dr. Priscilla Oliver with the 2013 Walter F. Snyder Award. Please see page 69, which details Dr. Oliver's distinguished career and contributions to the profession.

A. Harry Bliss Editor's Award

This award was named after Dr. A. Harry Bliss to honor his 40 years of involvement in the production of the *Journal of Environmental Health*. This annual award recognizes individuals or groups that have made significant contributions to the *Journal*.

Nelson Fabian's Final AEC

This AEC marked the final in a long line of AECs attended by former NEHA Executive Director Nelson Fabian. After a 31-year career at NEHA, Fabian stepped down from the position on July 31, 2014. In acknowledging the tribute given to him at the closing President's Banquet, Fabian spoke from his heart about what this all meant to him. Quoting Steve Jobs about how life stories and trends make sense looking back, Fabian shared that from his experiences as a high school and college athlete to his engagement with the counterculture movement to his stint as an elected public official to his years at NEHA, he had come to realize that his life had been about connecting, connections, and being a part of something larger than himself. He offered that meaning and value derive from being connected, as in one's family or even the NEHA family. He called his many NEHA connections dear friends and expressed his deep gratitude for the bounty of friendships he made thanks to NEHA and how precious those friendships were to him.

It gave NEHA great pleasure to announce that by unanimous decision, the 2014 recipient of the A. Harry Bliss Editor's Award was Nelson Fabian. Fabian had been NEHA's executive director and managing editor of the *Journal* for the past 31 years. Over the span of his career at NEHA he penned around 270 columns. His columns provided members with a direct look into the internal workings of NEHA as well as the internal workings of his mind. Beyond the column, he was a driving force behind the continual evolution, growth, and improvement of the *Journal*.

Educational Contribution Award

This award recognizes NEHA members, teams, or organizations for an outstanding contribution within the field of environmental health. The award is a pathway to share creative educational methods and tools to educate one another and the public about environmental health.

Jason Chessher and Cindy Corley of the Garland Health Department (Texas) were the recipients of this award for their work on developing a video to educate students on methods of mosquito control and disease prevention.

Nelson E. Fabian Environmental Health Innovation Award

This award recognizes the creation of new ideas, practices, or products that have a positive impact on improving environmental health services or quality of life. This award also encourages other environmental health professionals to search for creative solutions to challenges. In honor of his innovative spirit and service to NEHA, it was announced at the awards ceremony that the name of this award was being officially changed to the Nelson E. Fabian Environmental Health Innovation Award.

NEHA was pleased to name the Sacramento County Environmental Management Department as the recipient of this year's award for its Cross Connection Program.

Excellence in Sustainability Award

NEHA's Excellence in Sustainability Award recognizes organizations, businesses, associations, and individuals who are solving environmental challenges by using innovative and environmentally sustainable practices. UL generously sponsors this award through a $1,000 honorarium and award memento.

Energy Smart Colorado was selected as this year's winner. Energy Smart Colorado is a multi-jurisdictional, comprehensive energy-efficiency retrofit program that provides health, safety, and energy efficiency services to rural mountain communities in Colorado.

Sabbatical Exchange Award

This award offers an amazing opportunity for professional growth and information exchange on an international level. The recipient may go either to England, in cooperation with the Chartered Institutes of Environmental Health, or to Canada, in cooperation with the Canadian Institute of Public Health Inspectors. UL currently sponsors the sabbatical.

The award jury this year selected Lydia Zweimiller, REHS, an environmental health specialist with the Virginia Department of Health, as this year's recipient. Ms. Zweimiller will study retail food safety enforcement in the United Kingdom.

NEHA/AAS Scholarship Awards

This scholarship program is cosponsored by NEHA and the American Academy of Sanitarians. A committee chaired by NEHA Past President Jim Balsamo manages the scholarship program. The following scholarships were presented on behalf of the committee.

- $2,500 graduate scholarship to Huisuo Huang from the University of Missouri
- $1,500 undergraduate scholarship to Genette Lynn Stump from Old Dominion University

Student Research Presentations

Every year, the Association of Environmental Health Academic Programs (AEHAP) and CDC/NCEH sponsor and financially support undergraduate and graduate student research presentations. Thanks to a generous donation from NCEH, six students and their faculty mentors had the opportunity to present their research at the AEC. Each student participant received a $500 award, a plaque, and a stipend of up to $1,000 to cover travel and research expenses.

Effects of Blood Meal Source on Aedes albopictus *Life Table Characteristics and Vector Competence for Dengue Virus*
Caitlin van Dodewaard, Graduate Student, East Carolina University

Removal of Arsenic From Water Under Static-State Conditions
Jordan Kyle Finneseth, Undergraduate Student, California State University, San Bernardino

Single and Binary Adsorption of Heavy Metals in Aqueous Solution Using Shrimp Shells Derivatives
Noelle A. Mware, Undergraduate Student, Benedict College

Competitive Adsorption of Pb^{2+}, Cu^{2+}, and Cr^{2+} via a Packed Bed Column Using Pinecone Derived Adsorbents
Faith A. Kibuye, Undergraduate Student, Benedict College

The Lurking Element: A Study About the Dangers of Lead and Other Harmful

Elements in Northern Kentucky Toy Vending Machines
Brittany Wells, Undergraduate Student, Eastern Kentucky University

$PM_{2.5}$ Airborne Particulates Near Frac Sand Operations
Kristen A. Walters, Undergraduate Student, University Wisconsin, Eau Claire

NSF International Scholarship

AEHAP, in partnership with NSF International, offers a paid internship project to students from National Environmental Health Science and Protection Accreditation Council–accredited programs. The NSF International Scholarship program is a great opportunity for an undergraduate student to gain valuable experience in the environmental health field. This year's winner was Keidre' Long, an undergraduate student from Eastern Kentucky University. Long's research was titled "National Survey on the Model Aquatic Health Code."

Dr. Neil Lowry Memorial Award

The Dr. Neil Lowry Memorial Award honors and recognizes public health officials who have made outstanding contributions to advance the public's healthy and safe use of recreational water. The award is given by the Association of Pool & Spa Professionals (APSP) in memory of Dr. Lowry, a long-time member of APSP, who influenced the pool and spa industry for over 25 years as a consultant to government and private industry. This year's award was presented to Middlesex-London Health Unit in Ontario, Canada.

Past Presidents Award

Each year, the Past Presidents group, comprised of former NEHA presidents, identifies a hero from the profession who accomplishes much on behalf of environmental health, but who does a lot of work behind the scenes. This year, the presidents identified two NEHA members who have made enormous contributions to the field. They were happy to recognize Dr. Priscilla Oliver and Tim Hatch.

Presidential Citations

This special award is given to individuals who have made exemplary contributions to NEHA during the president's term of office. President Alicia Enriquez-Collins presented Presidential Citations to the following individuals.

Marcy Barnett
Darryl Booth
Brian Collins
Rick Collins
Steven Cooper
Bob Custard
Michele DiMaggio
Tamara Giannini
Craig Gilbertson
Carolyn Harvey
Tim Hatch
Marion Hinners
Rod House
Mel Knight
Keith Krinn
Sandra Long
George Nakamura
Terry Osner
Dick and Sandi Pantages
Sheila Pressley
Kristen Ruby-Cisneros
Davene Sarrocco-Smith
John Steward
Sacramento County Environmental Management Department

Certificates of Merit

Certificates of Merit are awarded to affiliate members who make exemplary contributions to the profession. Each affiliate selects winners based upon its own criteria for recognition. For 2014, the following winners were announced.

- Alaska—Bruce Gazaway
- California—Corwin Brown
- Colorado—Carmen Vandenbark (Individual) and Boulder County Public Health, Environmental Health Division Staff (Team)
- Connecticut—David Rogers
- Iowa—Timothy Dougherty
- Massachusetts—Michael Blanchard (Individual) and University of Massachusetts Lowell, College of Health Science, Community Health and Sustainability, Environmental Health Program: Joel Tickner, Craig Slatin, Nicole Champagne, and Susan Woskie (Team)
- Michigan—Peggy Dawn French
- Minnesota—Christopher Forslund
- National Capital Area—Erin May (Individual) and Susan Thweatt, Debra Freeman, and Myra Leonard (Team)
- Nebraska—Scott Holmes
- Nevada—Sandra R. Baniaga-Brown
- North Dakota—Douglas E. Jensen
- Texas—Bryan W. Brooks
- Virginia—Bob Custard (Individual) and Preston Smith, Danielle Schools (Team)
- Wisconsin—Natalie M. Vandeveld
- Wyoming—Shawn Moore

Decade Scholarship Awards

Each year, Decade Software Company awards 15 scholarships to environmental health professionals to attend the AEC. A panel of Decade Software executives along with executives and elected officials of NEHA scored the short-essay responses of the applicants. The essay provided an opportunity for applicants to express their innovative ideas for the profession. This year's scholarship winners are listed below.

Rebecca (Becky) Bramlett
Cara Evangelista
James Gutman
Jennifer Johnson
Carolyn Kreiger
Denise Lucas
Taraleen Malcolm
Cynthia Oxley
April Pearce
Kellison Platero
Suzanne Rouleau
Emily Sanders
Candice Sims
Ugochukwu Uzoeghelu
Courtney Ziemar

Student AEC Scholarship Awards

NEHA received donations through its Student AEC Scholarship Fund to provide five students with student registration and $440 travel stipends to attend the AEC. The students submitted applications for the scholarships that included an essay on why it is important for them to receive the scholarship and what they will do at the AEC. They were recognized at the NEHA exhibit booth during the Exhibition Grand Opening Party. A total of $2,975 was donated and used this year, and $705 is already available for the 2015 AEC—so the 2015 AEC is off to a great start for students! Congratulations to the recipients and thank you to all of the donors!

Scholarship Recipients

Cyprian Aende
Kikelomo Akintunde
Kyra Hall
Thais House
Genette Stump

Scholarship Donors

American Academy of Sanitarians
James J. Balsamo
Corwin D. Brown
Laurie A. Cotulla
Jill Cruickshank
Bruce M. Etchison
Hohite Fetene
Steven Michael Humble
Brett Koontz
Kroger
Robert T. Kuchar
Gloria T. Mackie
Richard W. Mitzelfelt
Wendell A. Moore
Milton A. Morris
Timothy Moulson
Kelsey Onaga
Susan V. Parris
Clark A. Pearson
Terrance Powell
Welford C. Roberts
Esther Saintime
Gina Saintime
James M. Speckhart
Charles Treser
Cynthia L. Ulch

The recipients of the 2014 Decade Scholarship Awards pose with Decade's Darryl Booth and NEHA's Nelson Fabian and Alicia Enriquez-Collins.

2014 Mangold Award Recipient

Welford C. Roberts, PhD, RS, REHS, DAAS Lieutenant Colonel (Retired), U.S. Army

NEHA is proud to present the 2014 Walter S. Mangold Award, its highest honor, to Welford C. Roberts, PhD, RS, REHS, DAAS.

Leadership, dedication, intelligence, passion, diversity, and integrity are just a few words that one can use to describe Dr. Welford C. Roberts and his illustrious environmental health career that has spanned over three decades. Beginning in Philadelphia, Pennsylvania, Dr. Welford Clayton Roberts was raised in an urban environment and spent summers in smaller rural towns. This dichotomy of locales allowed him to experience different lifestyles and helped him realize early in life that diversity and variety help to balance a person's life—a philosophy that still influences him today and has contributed to his successes.

While attending Hampton Institute in Virginia, where he would earn a bachelor's degree in biology in 1974, Dr. Roberts joined the U.S. Army Reserve Officer Training Corps. He entered active duty in 1977 at Fort Eustis, Virginia, as a second lieutenant in the U.S. Army Transportation Corps. His introduction to environmental health occurred during this time and was quite by chance. It addition to his normal duties, Dr. Roberts was assigned the responsibility of being his battalion's safety officer. The chief of preventive medicine at Fort Eustis realized the potential within Dr. Roberts and assisted him in changing his military career field to medical service and becoming an environmental science officer. He remained at Fort Eustis and was reassigned to work for the chief of preventive medicine.

Among his many accomplishments in this position from 1978 to 1983 were the development and implementation of industrial hygiene, sanitation, risk evaluation, management, and regulatory programs. During this time Dr. Roberts was promoted to captain and earned his master's degree in biology.

After leaving Fort Eustis in 1983, future assignments would take him to the far-reaching shores of South Korea, back to American soil at Fort Detrick, Maryland, and then beyond to Washington, DC, the U.S. Environmental Protection Agency, the U.S. Army Materiel Command, and the Uniformed Services University of the Health Sciences (USUHS). During his remaining years in the military he rose to the rank of lieutenant colonel, received numerous awards and honors, and earned his doctoral degree from the University of South Carolina in 1990. Dr. Roberts retired from the military on February 1, 1997, after 23 years of service.

Not one to let retirement slow him down, Dr. Roberts was back to work just days after his last day of active service, now working as a civilian with the Henry M. Jackson Foundation for the Advancement of Military Medicine in Rockville, Maryland. When funding for this position ended, he transformed his career again and turned to the private sector. Since 2002, Dr. Roberts has worked as a government contractor for several private companies providing consulting and technical support on numerous environmental and occupational health topics. He currently works for ERP International (Maryland) supporting human performance and force health protection research for the U.S. Air Force.

During this time Dr. Roberts was often approached to provide small, short-duration environmental and occupational health services. He therefore organized such efforts under his own sole proprietorship company simply titled, "Welford Roberts." Through this endeavor he served as an independent consultant in a variety of environmental and occupational health areas.

Dr. Roberts' career as a professor began in 1995 at USUHS. He would serve on the faculty of other higher education institutions such as Trident University International (California) and Elizabeth City State University (North Carolina). Being a professor opened up avenues to him to educate and mentor future environmental health professionals, one of the qualities for which he is highly regaled and respected. He's been an advocate of the profession, promoting it to attract young students to consider it as a career field. His mentorship has enabled many to advance in the profession and has helped to shape future leaders.

Dr. Roberts has been very active in the national environmental health scene focusing on improving and enhancing the profession and increasing the quality of services to the nation. He has been a member of NEHA since 1981 and served as NEHA's president in 2009–2010. Along with this service on NEHA's board of directors, he has been involved with NEHA in many different roles. He has dedicated his time and expertise to the *Journal of Environmental Health* as a peer reviewer, member of the technical editorial advisory board, and technical editor. He has also been a NEHA technical section chair for several areas of expertise and currently serves as NEHA's technical advisor for environmental justice.

He is a member of the Virginia, National Capital Area, and Uniformed Services Environmental Health Associations, as well as a member of NEHA's Past President's Affiliate. He also dedicates his time and energy to other various professional associations. He became a diplomate of the American Academy of Sanitarians in 1987 and was awarded their highest honor, the Davis Calvin Wagner Award, in 2002. He is also a member of the National Environmental Health Diversity Recruitment Task Force formed by Eastern Kentucky University and the Centers for Disease Control and Prevention.

Major Joseph Hout, MSPH, PhD, former REHS, CPH, writes, "Dr. Roberts's noteworthy contributions to the field of environmental health as a teacher, leader, and visionary exemplify the characteristics and principles for which Walter S. Mangold stood."

Colonel Wendell A. Moore, U.S. Army (retired), DAAS, RS, REHS, writes, "Welford has always proven himself to be the consummate professional dedicated to the advancement of environmental health sanitation. His work ethic, sound judgment, superior technical competence, discipline, devotion to duty, and concern for people characterize his overall being."

Nelson Fabian, former NEHA executive director, writes, "Welford inspires by his example. There is a goodness that comes through in his interactions that make you want to be a better person. He touched me deeply with his concerns for others, for environmental health as a topic and as a profession. And everything about his concerns is genuine."

Priscilla Oliver, PhD, writes, "Welford has given exemplary quality and long service to environmental health in his work, leadership, service, consulting, and teaching positions. He has deep integrity and a vision for where we should be heading in the profession. He has been a great mentor to me and a pillar to NEHA. Welford is faithful, sometimes humble, kind, effective, and a representation of the best of the environmental health profession."

Thus, it is a privilege and honor for NEHA to present this award to Dr. Welford C. Roberts, a professional who exemplifies the philosophy, ethics, and dedication expressed through the life of the late Walter S. Mangold.

2014 Walter F. Snyder Award Recipient

Priscilla Oliver, PhD

NSF International and NEHA presented the prestigious Walter F. Snyder Award to Priscilla Oliver, PhD, at the 2014 AEC. The award, given in honor of NSF International's cofounder and first executive director Walter F. Snyder, is presented annually in recognition of outstanding contributions to the advancement of environmental health.

Dr. Oliver was honored for four decades of significant and lasting contributions to environmental and public health through education, leadership, dedication, and community service.

Dr. Oliver is a senior life scientist with the Office of the Regional Administrator of the U.S. Environmental Protection Agency (U.S. EPA) in Atlanta. She also serves as the U.S. EPA Region 4 regional program manager for Partnerships for Sustainable Healthcare, working with state agencies and hospitals throughout the southern U.S. to reduce overall hospital waste and prevent pollution. This program was first formed as a voluntary partnership with the American Hospital Association and other agencies.

Dr. Oliver lectures in environmental health at Morehouse College and Spelman College. She helped start the Morehouse School of Medicine master of public health (MPH) program and serves on the MPH curriculum advisory board. She has previously taught at Kennesaw State University, Troy University, and Clark Atlanta University, and started the Atlanta University Center Faculty Environmental Health Forum.

Dr. Oliver is dedicated to mentoring students in environmental and public health. She founded the Physician and Undergraduate Student Educational Partnerships Foundation and has advised and supervised students with clinical shadowing, service projects, and internships at the Atlanta Veterans Administration Medical Center, U.S. EPA, Georgia State University, medical facilities, health agencies, and various nonprofit organizations.

As a member of the Eastern Kentucky University national environmental health diversity recruitment task force, Dr. Oliver helped develop a mentoring and recruitment strategy to enhance student and faculty diversity. This group has become known as the National Council on Diversity in Environmental Health. As a site reviewer for the National Environmental Health Science and Protection Accreditation Council, she helps colleges obtain accreditation of their environmental health academic programs. In addition, Dr. Oliver serves as a mentor for aspiring students and junior faculty.

Dr. Oliver has helped implement community public health programs, including Atlanta health fairs providing free HIV testing and an American Liver Foundation liver diseases support group for inner-city patients at Grady Memorial Hospital. She created a program for Sam Nunn Atlanta Federal Center employees to participate in the U.S. Drug Enforcement Agency/U.S. EPA National Take-Back Initiative, which removes unwanted prescription drugs from the environmental waste stream.

She was responsible for the Community Action for a Renewed Environment program, which helps communities reduce exposures to toxic pollutants and has worked with the National Environmental Justice Advisory Council providing advice and involving stakeholders in actions. She was also instrumental in developing the sustainability initiative for colleges of the South and historically black colleges and universities.

Dr. Oliver is a long-time NEHA member, including serving as co-chair, chair, and technical advisor of NEHA's hazardous materials and toxic substances section. She received the NEHA Presidential Citation and letters of appreciation for her lengthy service to the NEHA Technical Editorial Advisory Board and as a peer reviewer for the *Journal of Environmental Health.*

She secured a grant and served as project director for a Morehouse School of Medicine longitudinal study of lead poisoning in pregnant women and children. The Centers for Disease Control and Prevention has sought Dr. Oliver to serve on several panels to award environmental public health grants for enhancing cities and communities.

Dr. Oliver has received a Certificate of Appreciation from the U.S. House of Representatives for her service as a legislative fellow to the health and environment subcommittee, and won the Anthony M. Rachal Award of Excellence from Xavier University (New Orleans) for many years of service on the youth motivation task force.

Earlier in her career, she worked as a life scientist inspecting municipal and industrial wastewater facilities for the U.S. EPA and as a biologist managing environmental impact statements and assessments for the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service.

"As a trailblazer, Dr. Oliver has accomplished much on behalf of environmental health goals by teaching, being an active member of the community, and conducting research. She is highly regarded and respected for her ability to encourage environmental health education, service, and collaboration. But most of all, you will just not find a person who is more passionate and more able to excite you about contributing to the good causes that Priscilla works so hard on," said Nelson Fabian, former NEHA executive director.

"Dr. Priscilla Oliver's achievements reflect the principles expressed by Walter F. Snyder and the public health mission of NSF International," said Kevan P. Lawlor, NSF International president and CEO. "Her service educating, mentoring, and encouraging students toward careers in environmental health, as well as her work in community health and professional organizations, demonstrate her strong commitment to the promotion of environmental and public health. These accomplishments make her a worthy recipient of the Walter F. Snyder Award."

ENVIRONMENTAL HEALTH NETWORKING

Annual UL Event

The AEC started off with a hoot at the Terry Fator Show at The Mirage. Fator is a talented ventriloquist who won the second season of America's Got Talent and immediately became a staple on the Las Vegas Strip. Attendees were transported to The Mirage from The Cosmopolitan of Las Vegas where they were greeted by the hosts and sponsors of the evening, UL. Lots of laughs and memories were shared. It was an enjoyable evening taking in a Vegas show and sights … and a great way to start the AEC.

Enhanced Feature Accessible Through the E-*Journal*

Check out the amazing AEC video where you'll see a dancing Elvis, dancing in the streets (okay, sidewalk), and so many photos taken during the conference.

The AEC was packed with many opportunities to network—be it at the Networking Luncheon, Exhibition, President's Banquet, the various meetings and sessions, or in the hotel hallways.

NEHA 2014 AEC photos by Joe Deats Photography.

Build Capacity. Elevate Performance.

Decade provides solutions that empower organizations just like yours.

Building Capacity **is a partnership designed to help professionals confront the changing demands of environmental health across the nation.**

To learn how NEHA and Decade are working together to increase the sophistication of the environmental workforce visit us online or call 800.233.9847.

www.decadesoftware.com

BUILDING CAPACITY
A NEHA INITIATIVE
Powered by Decade™

DECADE®
software company
Trusted to do more.®

8 good reasons *why* your department should consider HealthSpace.

HealthSpace *is the safe and affordable choice*

1. Serving Environmental Health Departments since 1998
2. More state-wide systems deployed than any other company in the field
3. Retained every client department since inception (No one has ever left)
4. Knowledgeable staff with years and years of environmental health experience
5. Leader in mobile inspection and tablet technology
6. Scalable pricing formula making HealthSpace affordable for small county health departments
7. Verifiable reputation for responsive and effective service
8. Configurable systems to match your organization's workflow and business rules

HEALTHSPACE
HARMONIZED INTELLIGENCE

Envirointel MANAGER

HealthSpace EnviroIntel Manager provides the busy professional with Intelligence and the ability to get more done with less work.

HealthSpace provides data and communication management systems for Environmental and Public Health organizations across North America. HealthSpace EnviroIntel Manager is a proprietary system with design architecture that makes it easy to configure to meet the needs of the organization.

For more information please visit us at:

www.healthspace.com