JOURNAL OF

Environmental Health

fifteen dollars

Dedicated to the advancement of the environmental health professional

Volume 86, No. 1 July/August 2023

Applying the Model Aquatic Health Code to Grade Swimming Pool Safety

Published by the National Environmental Health Association

www.neha.org

Fast, Easy, and Effective

It's simple for staff to get sanitizing right every time with these powerful, ready-to-use products that quickly kill 99.9% of viruses and bacteria. Plus, the **one-step sanitizing and disinfecting formula** is made to use on food-contact surfaces without rinsing so **it's even easier to help prevent cross-contamination**. Available in spray and wipes.

Finally, There's a Better Way to Wipe Out Germs

See how PURELL® Surface Sanitizers do it.
Visit **Surfaces.GOJO.com/learn-more**.

©2023 GOJO Industries, Inc. All rights reserved. | 34593 (01/2023)

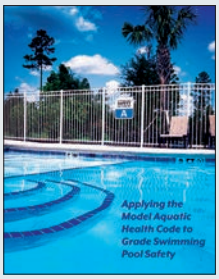
JOURNAL OF

Environmental Health

Dedicated to the advancement of the environmental health professional

Volume 86, No. 1 July/August 2023

ABOUT THE COVER



The Model Aquatic Health Code (MAHC) from the Centers for Disease Control and Prevention provides voluntary guidelines that reduce the risk of disease, injury, and drowning at aquatic facilities. In this month's cover article, "Applying the Model Aquatic Health Code to Grade Swimming Pool Safety in a Large Metropolitan Area," the authors sought to develop a swimming pool safety grading system in a metropolitan area by applying the MAHC to city swimming pool inspection data. Overall, the MAHC can be applied to grade swimming pool safety in jurisdictions where it has not been adopted. Furthermore, the degree of safety violations can be spatially demonstrated to inform injury prevention measures.

See page 8.

Cover image © iStockphoto: peedees

ADVERTISERS INDEX

ADVANCEMENT OF THE SCIENCE

ADVANCEMENT OF THE PRACTICE

ADVANCEMENT OF THE PRACTITIONER

YOUR ASSOCIATION

don't miss

in the next *Journal of Environmental Health*

- A Collaborative Approach to National *Food Code* Adoption
- Federal Meat and Poultry Inspection Duties and Requirements—Part 4: Food Defense, Product Sampling, Rules of Practice, and Summary
- Needs Assessment of Environmental Health Professionals in Montana: A Post-COVID-19 Perspective

Official Publication

neha National Environmental Health Association

Journal of Environmental Health
(ISSN 0022-0892)

Kristen Ruby-Cisneros, Managing Editor

Ellen Kuwana, MS, Copy Editor

Hughes design|communications, Design/Production

Cognition Studio, Cover Artwork

Soni Fink, Advertising
For advertising call (303) 802-2139

Technical Editors

William A. Adler, MPH, RS
Retired (Minnesota Department of Health), Rochester, MN

Gary Erbeck, MPH
Retired (County of San Diego Department of Environmental Health), San Diego, CA

Thomas H. Hatfield, DrPH, REHS, DAAS
California State University, Northridge, CA

Dhitinut Ratnapradipa, PhD, MCHES
Creighton University, Omaha, NE

Published monthly (except bimonthly in January/February and July/August) by the National Environmental Health Association, 720 S. Colorado Blvd., Suite 105A, Denver, CO 80246-1910. Phone: (303) 802-2200; Fax: (303) 691-9490; Internet: www.neha.org. E-mail: kruby@neha.org. Volume 86, Number 1. Yearly subscription rates in U.S.: $150 (electronic), $160 (print), and $185 (electronic and print). Yearly international subscription rates: $150 (electronic), $200 (print), and $225 (electronic and print). Single copies: $15, if available. Reprint and advertising rates available at www.neha.org/jeh.

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

© Copyright 2023, National Environmental Health Association (no refunds). All rights reserved. Contents may be reproduced only with permission of the managing editor.

Opinions and conclusions expressed in articles, columns, and other contributions are those of the authors only and do not reflect the policies or views of NEHA. NEHA and the *Journal of Environmental Health* are not liable or responsible for the accuracy of, or actions taken on the basis of, any information stated herein.

NEHA and the *Journal of Environmental Health* reserve the right to reject any advertising copy. Advertisers and their agencies will assume liability for the content of all advertisements printed and also assume responsibility for any claims arising therefrom against the publisher.

The *Journal of Environmental Health* is indexed by Clarivate, EBSCO (Applied Science & Technology Index), Elsevier (Current Awareness in Biological Sciences), Gale Cengage, and ProQuest. The *Journal of Environmental Health* is archived by JSTOR (www.jstor.org/journal/jenviheal).

All technical manuscripts submitted for publication are subject to peer review. Contact the managing 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, managing 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 105A, Denver, CO 80246-1910.

Printed on recycled paper.

PRINTED WITH SOY INK

NOWRA

National Onsite Wastewater Recycling Association

NEHA MEMBERS
Save 10% on NOWRA Online Training with Code NEHA2023

Offer expires December 31, 2023

Providing quality education, service, products and research to the onsite/decentralized wastewater industry.

EDUCATION

Over 40 Online Courses in the Following Areas:
Onsite Wastewater Fundamentals • Installer Training
Troubleshooting • Design Courses
Courses range from 1-hour to multi-hour bundles.

MEMBERSHIP

Serving the Onsite Wastewater Professional
6,000+ Members • 29 State Affiliates
Annual Technical Conference

ADVOCACY

Working with Capitol Hill and Regulatory Agencies
Lobbying to increase federal funding and advocating better regulations

Need to learn more about onsite wastewater?
Join us for the onsite event of the year!
October 22 - 25, 2023 • Hampton Virginia

Clean Water for Healthy Communities

Onsite Wastewater Mega-Conference 2023 Hampton, Virginia

Visit www.nowra.org for more information
PO Box 982, Westford, MA 01886 • (978) 496-1800 • info@nowra.org

PRESIDENT'S MESSAGE

Tom Butts, MSc, REHS

Environmental Health Professionals: Stand Up and Be Recognized

Greetings from Colorado. I am honored to have been elected to serve as the 2023–2024 president of the National Environmental Health Association (NEHA). I have been a member since 1985. Prior to being elected to the NEHA Board of Directors, I served as the technical section co-chair for terrorism and all-hazard preparedness in 2003–2005 and counted NEHA election ballots back when they were paper.

I have observed many changes at NEHA and am now part of working to assure we actively support the profession and build a solid foundation to continue that work moving forward. This work is not without its own challenges for a profession that regularly steps up to meet the ever-evolving list of national emerging issues to backyard disasters. The profession is faced with the need to evolve and grow. The profession is also challenged at times to manage directives to trim back when economic pressures or other priorities impact their budgets—a hazard of being partly or fully funded by program fees.

I have benefited from attending and presenting at a variety of NEHA Annual Educational Conferences (AECs) over the years in great spots such as Denver, Anchorage, Las Vegas, Grand Rapids, and Spokane. I look forward to the 2023 AEC in New Orleans with anticipation about both the content and the people. The AECs and the variety of other webinars and continuing education programs and opportunities NEHA provides are quality ways to refresh knowledge, learn new skills, and engage with subject matter experts and peers from across the country.

We need to capitalize on the contacts and community members we interact with to demonstrate the value of our work.

I landed in the environmental health undergraduate program at Colorado State University after considering environmental engineering and other programs. The program appealed to my interests in science and the environment, and how that impacts human health, disease control, and epidemiology. The final piece of this program was an internship with a toxicologist from Region 8 of the U.S. Environmental Protection Agency where I listened to community members impacted by sites in urban communities and in the rural Rocky Mountains, and witnessed the challenges of responding to large and complex sites with evolving environment data, health effects, and toxicology uncertainties.

After graduating with a bachelor of science degree in environmental health with a minor in chemistry, I took an entry-level position as an environmental health specialist with the Tri-County Health Department in the Denver metropolitan area. I benefited from a well-crafted, agency-specific training program to become field ready. My knowledge and skills were also built, in a significant way, by attending many general and specialized training and education programs provided by the Colorado Environmental Health Association (CEHA). The great annual educational conferences offered by the NEHA affiliates are still the places many go to share successes and learn about new ways of doing our work.

I joined CEHA as a student in 1984 and later served as a regional board member from 2007–2009 and treasurer from 2009–2011 (yes, I did the ever-important organization tax 1099s and maintained our nonprofit good standing status). I then served as the CEHA president elect, president, and past president from 2016–2018. Working with my peers from across the state—from the uniformed services to retail food and wastewater industries—was rewarding and challenging. This work helped me to understand the range of systems we operate in and the driving forces we need to acknowledge. Having support from my employer to participate in these roles to build skills and knowledge paid dividends when I took on leadership roles in the agency.

Early in my career, I learned from the first environmental health director I worked for at Tri-County Health Department, Dr. Chris Wiant, that an environmental health group could play a key role identifying and working to address a wide range of community challenges. Dr. Wiant went on to serve as president of NEHA from 1992–1993. He was open to exploring new activities and programs, with the supporting funding of course, and while working to support and improve existing core environmental health programs. This exploration resulted in

unique coordination with organizations that represented consumer product safety, local first responders, and healthcare providers. Dr. Wiant empowered the staff to participate in Local Emergency Planning Commissions, to learn and use GIS to map old landfills, and to work directly to represent local interests where Superfund sites impacted communities. These efforts were supported by hiring engineers and occupational health staff (i.e., certified industrial hygienists) to address community hazards.

During my career in environmental health at the local government level, I have had the pleasure of holding positions with responsibilities in food safety, water quality and wastewater, childcare, household chemical waste, hazardous waste, air quality, and emergency preparedness, along with leadership roles as the environmental health director and agency deputy director. Each position provided an opportunity to collaborate with peers to learn, grow, and engage. Currently, I am an environmental public health consultant.

As community needs and interests change, so has the scope of the environmental health practice. It also varies widely with large agencies having up to 20 or more programs and small agencies only able to provide core programs. Working to assure compliance with sound science-based regulations is foundational for food safety, water quality, and other programs. Working to influence land use cases to address healthy eating, active living, environmental injustice, and local hazards is an important role as well. Explaining that all these issues are encompassed by environmental health is the real trick.

NEHA and our members currently face the ongoing evolution of the food industry and must continue to engage with many partners to assure food safety. We also must find ways to keep and gain new funding and provide support for our communities. We should become more prepared for emerging issues such as harmful algal blooms and per- and polyfluoroalkyl substances (PFAS) in our water, wastewater, and biosolids. We must strengthen our risk communication skills to be prepared to engage with citizen science using low-cost tools to gather air and water quality data in our communities. The Spark! Leadership Series and Environmental Health Leadership Academy offered by NEHA are terrific programs to build skills and interface with experts and peers.

Here are a couple of issues I hope you will see as priorities for our profession and NEHA:

- Assure support for and recognition of environmental health practitioners and the key roles they play in protecting communities from adverse health impacts.
- Reinforce and enhance the value and recognition of the Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential.
- Encourage an active role for environmental health professionals as evidence-based policy advocates as we work in all our environmental programs and to address environmental justice, sustainability, and climate change.

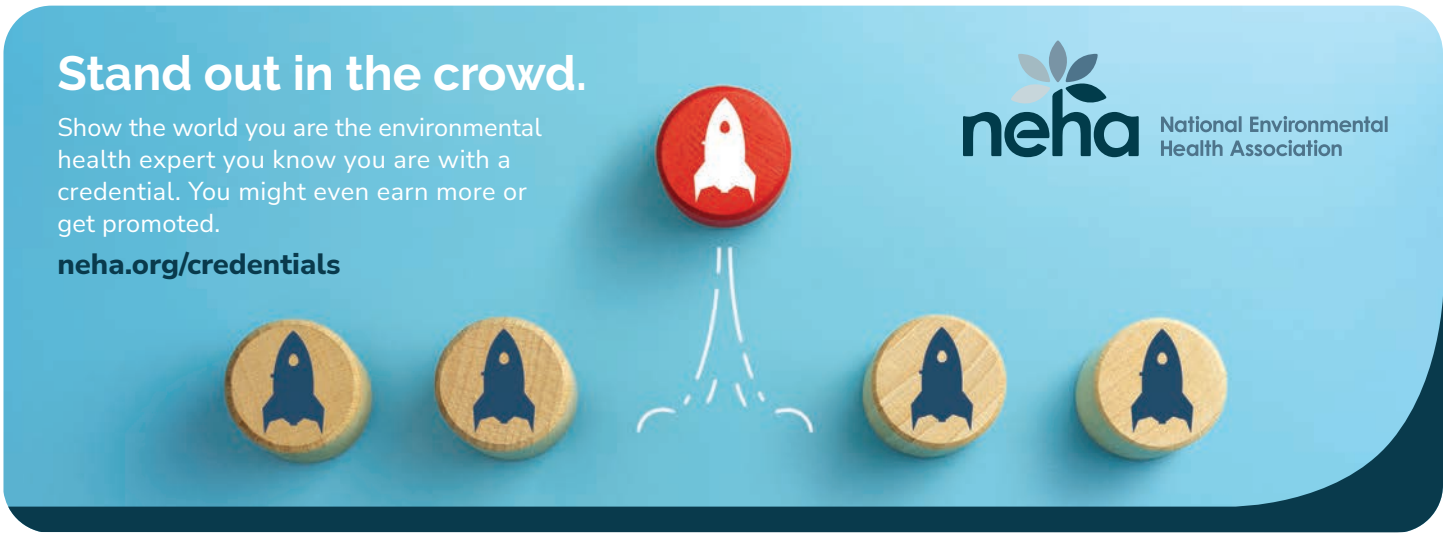
I see governmental environmental health professionals as the most can-do part of the public health system. We have great partners in industry and academia that we must continue to actively work with and support where possible.

Environmental health professionals have more contact with the community than any other element of the environmental public health system. We need to capitalize on the contacts and community members (e.g., the regulated community, local agency contacts, the public at large) we interact with to demonstrate the value of our work. As I reflect on the work we do, I like to say, "Public health is an important part of environmental health."

President@neha.org

Did You Know?

For every $1 we receive in membership dues, we return $19 in the form of investments in capacity building—leadership, training, and education. Join now to take advantage of this return on investment at www.neha.org/membership.



Applying the Model Aquatic Health Code to Grade Swimming Pool Safety in a Large Metropolitan Area

Miguel A. Arroyo, Jr., MD
Division of Emergency Medicine, Department of Pediatrics, Baylor College of Medicine and Texas Children's Hospital

Jennifer L. Jones, MS
Division of Emergency Medicine, Department of Pediatrics, Baylor College of Medicine and Texas Children's Hospital

Antoine Nguyen
University of Houston

Rohit P. Shenoi, MD
Division of Emergency Medicine, Department of Pediatrics, Baylor College of Medicine and Texas Children's Hospital

Abstract **The Model Aquatic Health Code (MAHC) provides voluntary guidelines that reduce the risk of disease, injury, and drowning at aquatic facilities. Its use varies across state and local jurisdictions. We sought to develop a swimming pool safety grading system in a metropolitan area by applying the MAHC to city swimming pool inspection data. We conducted a cross-sectional study that involved routine inspections of commercial aquatic venues in Houston, Texas, during 2016. We calculated the overall percentage of items in compliance with the MAHC. Next, we graded swimming pools by assigning points based on the MAHC to corresponding swimming pool violations and assigning a letter grade: A = 95–100%; B = 85–94%; C = 75–84%; and fail (F) = <75%. Graded pools were projected onto a map of Houston to geographically sort and visualize their location.**

There were 3,100 commercial aquatic venues in Houston that were inspected. Venues were graded for safety as: A = 40.2%; B = 0.5%; C = 0%; and F = 59.3%. Swimming pool enclosure violations were most frequent (18.0%). Most swimming pools, irrespective of the degree of pool safety violations, were located in the Southwest section of Houston. Overall, the MAHC can be applied to grade swimming pool safety in jurisdictions where it has not been adopted. The degree of safety violations can be spatially demonstrated to inform injury-prevention measures.

Introduction

Drowning is the leading cause of unintentional injury death in U.S. children 1–4 years (National Center for Injury Prevention and Control, 2018). In children, swimming pools account for 33% of fatal drownings (Clemens et al., 2021) and 65.7% of nonfatal submersions in the U.S. (Felton et al., 2015). During 2017–2019, an average of 6,700 pool- or spa-related nonfatal drowning injuries treated in hospital emergency departments occurred each year in children <15 years; each year, an estimated 76% occurred in children <5 years (Yang, 2020).

The risk of submersion is 2.7 times higher for a child at a multifamily residence compared with a single-family residence and 28 times more likely in a multifamily swimming pool than a single-family pool (Shenoi et al., 2015). The American Academy of Pediatrics recommends multiple layers of protection to prevent drowning (Denny et al., 2021). Waterborne diseases, drowning, falling, diving, chemical use, and suction injuries are major recreational water illnesses and injuries (RWIs) associated with public aquatic facilities, particularly for young children. Between 2000–2014, there were 493 outbreaks of waterborne diseases associated with treated recreational water that resulted in at least 27,219 cases and 8 deaths (Hlavsa et al., 2018). Additionally, between 2003–2012 there were an estimated 4,247 emergency department visits for swimming pool chemical-related injuries (Hlavsa et al., 2014).

State and local agencies regulate safety at public aquatic facilities, as there is no federal regulatory authority responsible for the design, construction, operation, maintenance, and management of public pools and hot tubs/spas. Public pool codes for preventing and responding to RWIs are developed, reviewed, and approved by state and local public health officials or legislatures and thus can vary among local and state jurisdictions.

In 2007, the Centers for Disease Control and Prevention (CDC, 2023a) developed the Model Aquatic Health Code (MAHC) to provide guidance to local and state agencies regarding the design, operation, and maintenance of public aquatic facilities to reduce RWIs. As a result, 25 jurisdictions located in the 5 states with the highest estimated counts of public aquatic venues—Arizona, California, Florida, New York, and Texas—and a

TABLE **1**

Comparison of the Model Aquatic Health Code (MAHC) and City of Houston Safety Codes and Violation Points

Safety Code	MAHC Violation Points	City of Houston Violation Points
Pool and spa		
Enclosure in good repair	10	10
Self-closing/self-latching gates	10	10
Protected overhead electrical wires	10	10
Grab rails, ladders secured; shell, deck in good repair	5	5
Float/safety line clearly present	5	5
Depth and no diving markers; stair stripes; in good repair and visible	5	5
Skimmers: weirs and baskets installed; clean and operating; covers in good repair	5	5
Recirculation inlets functional	5	5
Main drain grate secured in place and in good repair	10	10
Water is clear, main drain visible	10	10
Starting blocks removed, covered, or access blocked	5	5
Pool deck free from obstructions; emergency exit marked	5	5
Emergency phone or other communication device available and well-marked	5	5
First aid kit available	5	5
Appropriate safety equipment present and in good repair	10	10
Adequate supervision of the facility	10	*
Signs: bathing load, rules, chemicals, and spa legible and in good repair	5	5
Spa temperature ≤104 ºF (40 ºC)	10	10
Water chemicals		
Approved NSF/ANSI Standard 50 DPD test kit	5	5
Proper disinfectant level	10	10
pH between 7.2 and 7.8	10	10
Combined chlorine <0.4 ppm	5	*
Cyanuric acid ≤100 ppm	5	*

continued on page 10

few other counties and states have adopted the MAHC (Hlavsa et al., 2016). The City of Houston, Texas, has not adopted the MAHC and instead uses a Code of Ordinances to regulate the safety of city swimming pools (City of Houston, 2023).

The primary aim of our study was to develop a grading system for swimming pool safety for Houston by applying the MAHC to city swimming pool inspection data. We hypothesized that by using a safety grading system for public aquatic facilities, it would be possible to disseminate swimming pool safety information to guide injury-prevention measures and inform pool operators and the public about problematic pools.

Methods

Study Design and Setting

We conducted a cross-sectional study of swimming pool safety inspection data for 3,107 public swimming pools, including spas and wading pools, in Houston during 2016. We defined a public swimming pool as one that is intended to be used collectively by people for swimming or bathing. This classification included a swimming pool owned or operated as part of a multifamily dwelling project, nonprofit recreational facility, hotel, educational facility, or fitness center (Houston Health Department, 2023a).

In 2021, Houston had a population of 2.29 million (U.S. Census Bureau, 2021). The Houston Health Department regulates public pools and spas through enforcement of Chapter 43 of the City of Houston Code of Ordinances (City of Houston, 2023). The code was adopted from the Texas Administrative Code (Public Swimming Pools and Spas, 2023), Texas Health and Safety Code (Pool Yard Enclosures, 1994), and International Code Council, Inc. (2018).

The ordinance ensures that aquatic facilities provide a clean, healthy, and safe environment for the public by protecting against waterborne illness and preventing drowning. The pool safety inspection consists of safety and administrative elements (Houston Health Department, 2019). All public pools, including multifamily and community swimming pools, require an annual inspection. More frequent inspections occur when safety violations are discovered at the time of inspection or in response to a complaint.

The city also lists critical violations that can result in immediate closure of the swimming pool (Houston Health Department, 2019). If uncorrected, these violations can be life-threatening. Private single-family residential swimming pools are not subject to annual safety inspections by the city but can be inspected when requested by the owner. These pools were excluded from our study. Our study did not involve human subjects. Patients or the public were not involved in the design, conduct, reporting, or dissemination plans of our research.

Inspection Data

Inspection data of all registered commercial swimming pools within the city limits of Houston were obtained from the Houston Health Department (HHD). Data included name and address of the property where the pool was sited, housing type (e.g., apartment, spa, city pool, club, condominium, commu-

nity association, fitness club, hotel, hospital, nursing home, mobile home, park, school, day care), and publicly available information on swimming pool violations per the Code of Ordinances for Houston.

Data obtained from HHD also included pool addresses. In some cases, the addresses that were provided were the establishment's parent company that was located outside Houston or were post office boxes rather than the physical location of the swimming pool. The addresses of these swimming pools were traced from their respective HHD swimming pool accounts. In total, seven swimming pools did not have associated addresses or a corresponding active account with HHD; these pools were excluded from our analysis. Swimming pool addresses were converted to longitude and latitude coordinates, geographically coded using Texas State Plane Southcentral NAD 83 (a projection system used by most government agencies in the region), and projected onto a map of Houston using ArcGIS Pro version 2.5.0.

Application of the MAHC to Swimming Pool Safety Violation Codes

The MAHC codifies aquatic safety inspection items and includes an inspection form to grade the safety of swimming pools against RWIs (CDC, 2018a, 2018b). The inspection form consists of 49 inspection items based on safety, chemical, and health hazards. The safety categories on the inspection form pertain to the pool and spa area, water chemicals, equipment and chemical room, hygiene facilities, records room, and general items.

Within each category are subitems that are assigned points. Points are deducted from subitems that are not in compliance with code after a pool inspection is performed. Overall, 13 of the MAHC compliance items are deemed critical for passing swimming pool inspections because noncompliance can be potentially life-threatening. Swimming pools are assigned safety grades based on the proportion of subitems that have passed inspection (expressed as a percentage). A swimming pool receives a failing grade if the percentage of subitems that pass inspection is <75% or if there is a critical violation that can be life-threatening (CDC, 2018a).

HHD inspects 29 items for safety violations during routine swimming pool inspections. These items are referenced by their corresponding code in the Code of Ordinances for Houston. We reviewed the MAHC with HHD staff to determine which of the 49 safety items on the MAHC were in use by Houston during their swimming pool inspections. HHD confirmed using 29 of 49 MAHC items and 11 of the 13 critical items in the MAHC. Moreover, there are additional subcodes in use by HHD that match

TABLE **1** continued from page 9

Comparison of the Model Aquatic Health Code (MAHC) and City of Houston Safety Codes and Violation Points

Safety Code	MAHC Violation Points	City of Houston Violation Points
Equipment and chemical room		
Automated feeder operable	10	10
Automated controller operable	5	*
Piping and valves identified and marked	5	5
Flow meter present and operating	5	5
Recirculation pump: approved, in good repair, operating	10	10
Filter: approved, in good repair, operating	10	10
Pump strainer: baskets in good condition, not clogged	5	5
Filter gauges operable: filter inlet and outlet, strainer; sight glass	5	5
Proper functioning UV system; ozone system	5	*
Chemicals: labeled, stored safely, secured	10	10
Appropriate personal protective equipment available	5	*
Hygiene facilities		
Diaper changing station present; sink, adjacent trash can, sanitizer	5	*
Used equipment separated from clean equipment	5	*
Toilets: clean, in good repair, bathroom appropriately stocked	5	*
Rinse showers: in good repair, accessible	5	*
Cleansing showers: warm, nonscalding water available; in good repair; soap	5	*
Records room		
Operator training certification available on-site	5	
Lifeguard training certification available on-site	5	5
Inspection report conspicuously posted at each entrance	5	*
Operator inspection daily items: checklist used daily	5	*
Operator inspection items: evidence of appropriate steps promptly taken	5	*
Chemical records: filled out daily	5	*
Chemical records: evidence of appropriate steps promptly taken	5	*
Emergency action plan available on-site	5	*
General		
Substantial unauthorized alterations/equipment replacement	10	*
Other: imminent health hazards are a 10-point critical violation	5 or 10	*

* Indicates items that the City of Houston does not inspect.
Note. Bolded items represent critical code items in the MAHC.

TABLE **2**

City of Houston Swimming Pool Violation Codes With Matching Model Aquatic Health Code (MAHC) Items

MAHC Item	City of Houston Swimming Pool Violation Code
Pool and spa	
Enclosure in good repair	25 TAC §265.200, HSC 757.00, HSC 757.005
Self-closing/self-latching gates	25 TAC §265.200, HSC 757.004
Protected overhead electrical wires	25 TAC §265.192
Grab rails, ladders secured; shell and deck in good repair	25 TAC §265.186
Float/safety line clearly present	25 TAC §265.199
Depth and no diving markers; stair stripes; in good repair and visible	25 TAC §265.199
Skimmers: weirs and baskets installed; clean and operating; covers in good repair	25 TAC §265.191
Recirculation inlets functional	25 TAC §265.191
Main drain grate secured in place and in good repair	25 TAC §265.190, Sec 1404
Water is clear, main drain visible	25 TAC §265.203
Starting blocks removed, covered, or access blocked	25 TAC §265.186
Pool deck free from obstructions; emergency exit marked	25 TAC §265.186
Emergency phone or other communication device available and well-marked	25 TAC §265.199
First aid kit available	25 TAC §265.199
Appropriate safety equipment present and in good repair	25 TAC §265.199
Adequate supervision of the facility	N/A
Signs: bathing load, rules, chemicals, and spa legible and in good repair	25 TAC §265.205
Spa temperature ≤104 ºF (40 ºC)	25 TAC §265.205
Water chemicals	
Approved NSF/ANSI Standard 50 DPD test kit	Sec 43-4(b)
Proper disinfectant level	25 TAC §265.204
pH between 7.2 and 7.8	25 TAC §265.204
Combined chlorine ≤0.4 ppm	N/A
Cyanuric acid ≤100 ppm	N/A

continued on page 12

some of the 29 items that are common with the MAHC and HHD inspection forms.

The 20 items in the MAHC that do not have a corresponding HHD code were not included for analysis and were listed as "not applicable." Items in the MAHC are scored 5 or 10 points; critical items carry a higher value of 10 points. We used the same scoring in the MAHC for the corresponding HHD safety items. All 49 inspection items in the MAHC inspection form are not required to generate a complete score; an option for "not applicable" is available (CDC, 2018a). Based on this scoring, the maximum number of compliance points possible after an HHD swimming pool inspection is 210.

Letter grades were calculated as total compliance points scored after an inspection divided by the maximum possible compliance points. Letter grades were classified as: A = 95–100%; B = 85–94%; C = 75–84%; and fail (F) = <75% or noncompliance of a critical element regardless of the total score. Table 1 describes the 49 items in the MAHC, with the matching 29 items used by HHD during swimming pool inspections. Table 2 describes the subsection of the statutes used in the HHD code and its matching MAHC item.

We used descriptive statistics to describe pool violation data. SAS version 9.4 was used to group, analyze, combine items, and apply inspection data to the MAHC. All 2016 inspections and violation data from Houston were merged by unique identifiers in both data sets. Data were queried on active establishment status, nonabatement license status, and annual routine inspections. If a pool had more than one routine inspection, then the first date of inspection was selected. Violation codes were grouped into 29 categories with a score assigned to each violation group.

Results

There were 3,107 swimming pools inspected in Houston in 2016. Of these, 3,100 had addresses and accounts located within the city limits of Houston; a total of 7 pools had addresses that were not in the city limits or had a post office box listed and no current account associated. Table 3 describes the safety grades for swimming pool establishments based on the MAHC with 79.2% of the pools located in multifamily establishments. The second-most common type of establishment were pools located in hotels or motels (10.5%). Two swimming pools did not have a listed establishment.

As shown in Table 3, the safety grading process resulted in 1,246 (40.2%) swimming pools with an A grade, 15 (0.5%) pools with a B grade, 0 pools with a C grade, and 1,839 (59.3%) pools with an F grade. Of the 1,839 pools that received an F grade, 14 (<1%) obtained their failing grade based on a failing overall percentage. The remainder of pools with failing grades were noncompliant with ≥1 critical safety item in the MAHC.

Table 4 demonstrates the frequency of the pool violations for each of the 29 items in the MAHC that were observed during inspections in Houston. Violations related to swimming pool enclosures were the most frequent, with 729 violations (18.0%), followed by 558 violations (13.8%) related to self-closing or self-latching gates. The third-most common violation was related to disinfectant levels (516, 12.7%). Application of the city code inspection criteria resulted in 1,285 swim-

ming pools that failed safety inspection (30% less) compared with 1,839 pools that would have failed based on applying the MAHC.

Figures 1 and 2 demonstrate the spatial distribution of swimming pools in Houston based on their safety grades. Most swimming pools, irrespective of the degree of pool safety violations, were located in the Southwest section of Houston.

Discussion

In this study, we applied the MAHC inspection checklist to Houston pool violation data to grade swimming pools for safety in a jurisdiction that has not adopted the MAHC. The safety grading of commercial swimming pools revealed that pool safety violations were widespread, with more than one half of the pools receiving a failing grade.

In almost all cases, the cause of the failing grade was a critical violation that could have been life-threatening if not corrected. The majority of swimming pools that failed inspection occurred in multifamily establishments. A prior study in Harris County, Texas, for which Houston is the county seat, found that out of 196 unintentional drownings, one half occurred in multifamily residential pools (Warneke & Cooper, 1994). Another study in the same region revealed that pediatric drownings are 28 times more likely in a multifamily swimming pool than a single-family pool (Shenoi et al., 2015).

We observed that the most common safety violations were due to faulty swimming pool enclosures, gates and safety equipment, and improper disinfectant levels. Swimming pool chemical violations also occurred frequently. Our results are consistent with the high incidence of faulty pool enclosures and improper levels of pool chemicals documented on pool inspections conducted elsewhere in the U.S. Documenting the magnitude of pool violations and the number of RWIs is a first step toward advocating for improved legislation and enforcement of swimming pool safety regulations.

Additionally, data from 15 jurisdictions found that pool chemical violations were present in 10.7% of pool inspections (CDC, 2010). Hlavsa et al. (2016) described similar results with disinfectant concentration violations and pool chemical safety violations, which were identified in 11.9% and 4.6% of routine inspections, respectively. These findings are important because the median estimated number of persons visiting emergency departments for chemical-related injuries from pools was 4,247 per year between 2003 and 2012 (Hlavsa et al., 2014). Identifying these violations and enforcing corrective action can mitigate the risk of swimming pool chemical-related injuries.

We also observed that faulty swimming pool enclosures and gates and inappropriate safety equipment were the most common violations found during routine pool inspections. Many of these violations resulted in immediate pool closure. This finding is similar to another study where pool enclosure violations and

TABLE **2** continued from page 11

City of Houston Swimming Pool Violation Codes With Matching Model Aquatic Health Code (MAHC) Items

MAHC Item	City of Houston Swimming Pool Violation Code
Equipment and chemical room	
Automated feeder operable	25 TAC §265.197, 25 TAC §265.204
Automated controller operable	N/A
Piping and valves identified and marked	25 TAC §265.187
Flow meter present and operating	25 TAC §265.187
Recirculation pump: approved, in good repair, operating	25 TAC §265.189
Filter: approved, in good repair, operating	25 TAC §265.188
Pump strainer: baskets in good condition, not clogged	25 TAC §265.189
Filter gauges operable: filter inlet and outlet, strainer; sight glass	25 TAC §265.187, 25 TAC §265.188
Proper functioning UV system; ozone system	N/A
Chemicals: labeled, stored safely, secured	25 TAC §265.197
Appropriate personal protective equipment available	N/A
Hygiene facilities	
Diaper-changing station present; sink, adjacent trash can, sanitizer	N/A
Used equipment separated from clean equipment	N/A
Toilets: clean, in good repair, bathroom appropriately stocked	N/A
Rinse showers: in good repair, accessible	N/A
Cleansing showers: warm, nonscalding water available; in good repair; soap	N/A
Records room	
Operator training certification available on-site	N/A
Lifeguard training certification available on-site	25 TAC §265.199
Inspection report conspicuously posted at each entrance	N/A
Operator inspection daily items: checklist used daily	N/A
Operator inspection items: evidence of appropriate steps promptly taken	N/A
Chemical records: filled out daily	N/A
Chemical records: evidence of appropriate steps promptly taken	N/A
Emergency action plan available on-site	N/A
Substantial unauthorized alterations/equipment replacement	N/A
Other: imminent health hazards are a 10-point critical violation	N/A

Note. Bolded items represent critical code items in the MAHC. HSC = Texas Health and Safety Code; N/A = not applicable; TAC = Texas Administrative Code.

TABLE **3**

Swimming Pool Safety Grades by Establishment After Applying the Model Aquatic Health Code

Establishment	Swimming Pool Safety Grades # (%)				
	A	B	C	F	Total
Multifamily	951	14	0	1,491	2,456 (79.2)
Hotel or motel	117	1	0	206	324 (10.5)
Health or fitness facility	52	0	0	47	99 (3.2)
Club	34	0	0	42	76 (2.5)
City or public facility	55	0	0	20	75 (2.4)
School or day care	25	0	0	26	51 (1.6)
Healthcare facility	8	0	0	5	13 (0.4)
Other	4	0	0	2	6 (0.2)
Total	1,246 (40.2)	15 (0.5)	0 (0)	1,839 (59.3)	3,100 (100)

Note. A = 95–100%; B = 85–94%; C = 75–84%; and F = <75% or noncompliance of a critical element regardless of the total score.

TABLE **4**

Frequency of Observed Swimming Pool Violations

Item From the Model Aquatic Health Code (MAHC) Inspection Form Observed by the City of Houston	Observed Violations # (%)
Pool and spa	
Enclosure in good repair	729 (18.0)
Self-closing/self-latching gates	561 (13.8)
Protected overhead electrical wires	56 (1.4)
Grab rails, ladders secured; shell and deck in good repair	34 (0.8)
Float/safety line clearly present	0 (0)
Depth and no diving markers; stair stripes; in good repair and visible	136 (3.4)
Skimmers: weirs and baskets installed; clean and operating; covers in good repair	24 (0.6)
Recirculation inlets functional	0 (0)
Main drain grate secured in place and in good repair	244 (6.0)
Water is clear, main drain visible	88 (2.2)
Starting blocks removed, covered, or access blocked	5 (0.1)
Pool deck free from obstructions; emergency exit marked	1 (0.02)
Emergency phone or other communication device available and well-marked	151 (3.7)
First aid kit available	0 (0)
Appropriate safety equipment present and in good repair	374 (9.2)
Signs: bathing load, rules, chemicals, and spa legible and in good repair	88 (2.2)
Spa temperature ≤104 ºF (40 ºC)	7 (0.2)

continued on page 14

inappropriate safety equipment were identified in 5.1% and 12.7% of pool inspections, respectively (Hlavsa et al., 2016).

It is known that isolation swimming pool fences reduce the risk of drowning (Thompson & Rivara, 1998). As such, the American Academy of Pediatrics recommends a multilayered approach to reduce drowning that includes functioning isolation swimming pool fencing and self-latching and self-closing gates (Denny et al., 2021).

We found that pool safety inspections in Houston, as currently conducted, captured 30% fewer swimming pool violations than if the MAHC criteria were used. Almost all of the safety violations observed were individual violations and <1% of the swimming pools that failed did so because of a low overall score.

Many of the items that are not listed in the code used by Houston but that appear in the MAHC pertain to facility hygiene, recordkeeping, and unauthorized alterations or replacement of equipment. Except for the latter, which could be potentially dangerous, the first two items pertain to maintaining a clean facility to reduce the transmission of illness and disease and implementing proper aquatic management practices. Other reasons for not including these MAHC items could be that inspections are conducted based on the basic and common certification requirements and therefore these less common requirements might be neglected (National Association of County and City Health Officials, 2015).

Implications

Our results have the following implications. Recreational water safety is regulated at the state or local level, and thus there is wide variation in implementing policy and safety practices across jurisdictions. Houston might need to update its inspection criteria to current MAHC standards and institute best practices for pool safety.

There has been a marked increase in recreational use of residential and public disinfected water as leisure time around the pool has increased. Changes in the design of aquatic facilities have occurred and regulatory agencies need to keep abreast of these changes. A legislative approach that includes instituting updated versions of the MAHC would be one solution. There are fiscal implications, however, that will also need to be evaluated.

These changes would involve training current safety inspectors and using an incremental approach to allow regulatory and industry partners to adapt to changing MAHC guidelines. CDC (2023b) provides resources for public health officials and aquatic staff to implement MAHC recommendations or strengthen their aquatic health and safety programs. The advantages of incorporating MAHC guidelines would be use of the most effective water safety inspection criteria, which could translate into reduced RWIs. Furthermore, inspection results could be compared with other jurisdictions that use similar inspection criteria.

A promising aspect of our study is the ability to illustrate the distribution of swimming pools in Houston based on their safety grade. This mapping has potential use in injury prevention. This approach has been used in playground safety, where the safety scores of playgrounds in need of maintenance were spatially mapped in Chicago to effect improvements in fall surfacing and equipment maintenance (Allen et al., 2013).

The same approach could be applied to swimming pool safety in Houston. Currently, Houston maintains an up-to-date listing of all pool violations by property that is accessible to the public (Houston Health Department, 2023b). The City of Plano, Texas, employs a similar scoring system that allows the public to look up swimming pools with color-coded scores that show the results of the swimming pool inspection (Plano Health Department, n.d.).

Data from our study demonstrate that the swimming pools that failed safety inspections were predominantly concentrated in Southwest Houston, which has a larger percentage of residents belonging to a lower socioeconomic status (City of Houston Planning & Development Department, 2016a) and racial and ethnic minority groups (City of Houston Planning & Development Department, 2016b). The rate of unintentional drownings is higher in children belonging to racial and ethnic minorities (Felton et al., 2015; Gilchrist & Parker, 2014), which could serve as a focus for injury prevention efforts to reduce drowning.

Limitations

There are several limitations to our study. First, our findings are not generalizable to other jurisdictions that have other types of

TABLE **4** continued from page 13

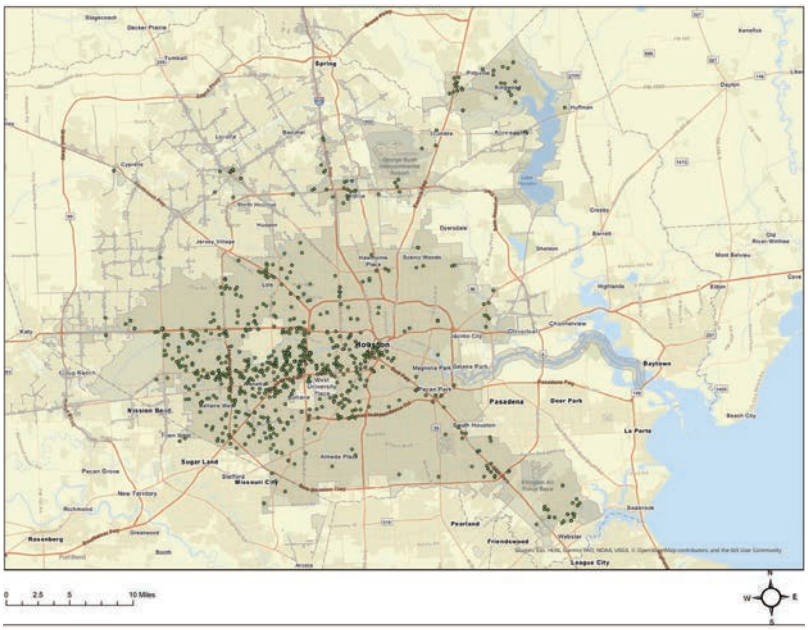
Frequency of Observed Swimming Pool Violations

Item From the Model Aquatic Health Code (MAHC) Inspection Form Observed by the City of Houston	Observed Violations # (%)
Water chemicals	
Approved NSF/ANSI Standard 50 DPD test kit	2 (0.05)
Proper disinfectant level	516 (12.7)
pH between 7.2 and 7.8	449 (11.1)
Equipment and chemical room	
Automated feeder operable	99 (2.4)
Piping and valves identified and marked	238 (5.9)
Flow meter present and operating	126 (3.1)
Recirculation pump: approved, in good repair, operating	38 (0.9)
Filter: approved, in good repair, operating	8 (0.2)
Pump strainer: baskets in good condition, not clogged	1 (0.02)
Filter gauges operable: filter inlet and outlet, strainer; sight glass	74 (1.8)
Chemicals: labeled, stored safely, secured	1 (0.02)
Records room	
Lifeguard training certification available on-site	2 (0.05)

Note. Bolded items represent critical code items in the MAHC.

FIGURE **1**

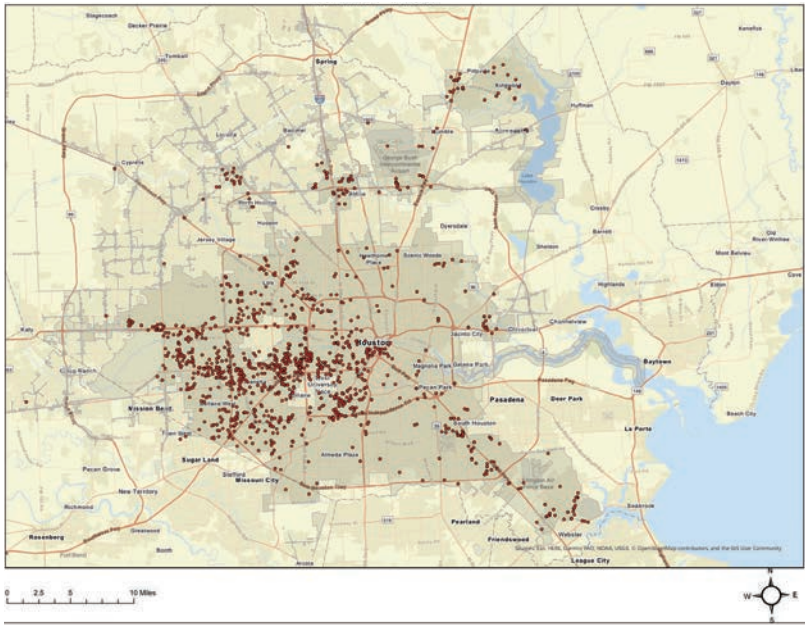
Location of Swimming Pools in the City of Houston That Received A Grades



Note. Shaded area indicates the City of Houston.

FIGURE **2**

Location of Swimming Pools in the City of Houston That Received F Grades



Note. Shaded area indicates the City of Houston.

aquatic bodies and permitting agencies. For example, we did not study pool violations in single-family homes, as they are not subject to annual safety inspections. Second, we included only 1 year of data. It would, however, be preferable to include additional years of data to assess safety trends. Third, some swimming pools that failed safety inspection might have corrected their deficiencies after the routine inspection. Thus, we were unable to determine if the safety deficiency was long-standing. It is highly likely, however, that the safety concerns were addressed in a timely manner because the property managers would want to open the aquatic facility to their clients at the earliest possible point. Finally, we cannot comment on aboveground or portable swimming pools, as they are not subject to safety inspections.

Conclusion

The strength of our study is that our methodology could be used by other jurisdictions that have not adopted MAHC criteria yet. If used across jurisdictions, our approach can ensure consistency in swimming pool safety grading. Future directions include evaluating if safety issues with swimming pools persist in subsequent years, investigating prevailing socioeconomic and health disparities in areas with a high concentration of pools that fail safety inspections, and developing an online platform that is available to the public that could host a map of swimming pools by safety grade. Overall, the MAHC can be applied to grade swimming pool safety in jurisdictions where it has not yet been adopted. The degree of safety violations can be spatially demonstrated (e.g., mapped) to inform injury-prevention measures.

Acknowledgements: We gratefully acknowledge Kenneth Malveaux and Naomi Macias of the Commercial/Residential Pool Program within the Houston Health Department for providing us with pool inspection data and their insight on swimming pool inspections. We also acknowledge Ryan Ramphul for his help with geographical mapping of the swimming pools.

Corresponding Author: Rohit P. Shenoi, Division of Emergency Medicine, Department of Pediatrics, Baylor College of Medicine and Texas Children's Hospital, 6621 Fannin Street, Suite A2210, Houston, TX 77030. Email: rshenoi@bcm.edu.

References

Allen, E.M., Hill, A.L., Tranter, E., & Sheehan, K.M. (2013). Playground safety and quality in Chicago. *Pediatrics*, *131*(2), 233–241. https://doi.org/10.1542/peds.2012-0643

Centers for Disease Control and Prevention. (2010). Violations identified from routine swimming pool inspections—Selected states and counties, United States, 2008. *Morbidity and Mortality Weekly Report*, *59*(19), 582–587.

Centers for Disease Control and Prevention. (2018a). *Model Aquatic Health Code facility inspection report* (CS300555-A). https://www.cdc.gov/mahc/pdf/MAHC-Form-2019-508c.pdf

Centers for Disease Control and Prevention. (2018b). *2018 Model Aquatic Health Code: Code language* (3rd ed., CS288986-A). https://www.cdc.gov/mahc/pdf/2018-MAHC-Code-Clean-508.pdf

Centers for Disease Control and Prevention. (2023a). *The Model Aquatic Health Code (MAHC): An all-inclusive model public swimming pool and spa code*. https://www.cdc.gov/mahc/index.html

Centers for Disease Control and Prevention. (2023b). *The Model Aquatic Health Code (MAHC): An all-inclusive model public swimming pool and spa code—MAHC tools and training*. https://www.cdc.gov/mahc/networks-tools-forms.html

City of Houston. (2023). *Code of Ordinances: Chapter 43—Pool and spa safety*. https://library.municode.com/tx/houston/codes/code_of_ordinances?nodeId=COOR_CH43POSPSA

City of Houston Planning & Development Department. (2016a). *2016 median household income*. https://www.houstontx.gov/planning/Demographics/docs_pdfs/2016acsd/Median-HHI.pdf

continued on page 16

References *continued from page 15*

City of Houston Planning & Development Department. (2016b). *2016 race/ethnicity*. https://www.houstontx.gov/planning/Demographics/docs_pdfs/2016acsd/Race-Ethnicity.pdf

Clemens, T., Moreland, B., & Lee, R. (2021). Persistent racial/ethnic disparities in fatal unintentional drowning rates among persons aged ≤29 years—United States, 1999–2019. *Morbidity and Mortality Weekly Report*, *70*(24), 869–874. https://doi.org/10.15585/mmwr.mm7024a1

Denny, S.A., Quan, L., Gilchrist, J., McCallin, T., Shenoi, R., Yusuf, S., Weiss, J., Hoffman, B., & Council on Injury, Violence, and Poison Prevention. (2021). Prevention of drowning. *Pediatrics*, *148*(2), e2021052227. https://doi.org/10.1542/peds.2021-052227

Felton, H., Myers, J., Liu, G., & Davis, D.W. (2015). Unintentional, non-fatal drowning of children: US trends and racial/ethnic disparities. *BMJ Open*, *5*(12), e008444. https://doi.org/10.1136/bmjopen-2015-008444

Gilchrist, J., & Parker, E.M. (2014). Racial/ethnic disparities in fatal unintentional drowning among persons aged ≤29 years—United States, 1999–2010. *Morbidity and Mortality Weekly Report*, *63*(19), 421–426.

Hlavsa, M.C., Cikesh, B.L., Roberts, V.A., Kahler, A.M., Vigar, M., Hilborn, E.D., Wade, T.J., Roellig, D.M., Murphy, J.L., Xiao, L., Yates, K.M., Kunz, J.M., Arduino, M.J., Reddy, S.C., Fullerton, K.E., Cooley, L.A., Beach, M.J., Hill, V.R., & Yoder, J.S. (2018). Outbreaks associated with treated recreational water—United States, 2000–2014. *Morbidity and Mortality Weekly Report*, *67*(19), 547–551. https://doi.org/10.15585/mmwr.mm6719a3

Hlavsa, M.C., Gerth, T.R., Collier, S.A., Dunbar, E.L., Rao, G., Epperson, G., Bramlett, B., Ludwig, D.F., Gomez, D., Stansbury, M.M., Miller, F., Warren, J., Nichol, J., Bowman, H., Huynh, B.-A., Loewe, K.M., Vincent, B., Tarrier, A.L., Shay, T., . . . Beach, M.J. (2016). Immediate closures and violations identified during routine inspections of public aquatic facilities—Network for Aquatic Facility Inspection Surveillance, five states, 2013. *Morbidity and Mortality Weekly Report: Surveillance Summaries*, *65*(5), 1–26. https://doi.org/10.15585/mmwr.ss6505a1

Hlavsa, M.C., Robinson, T.J., Collier, S.A., Beach, M.J., & Centers for Disease Control and Prevention (CDC). (2014). Pool chemical-associated health events in public and residential settings—United States, 2003–2012, and Minnesota, 2013. *Morbidity and Mortality Weekly Report*, *63*(19), 427–430.

Houston Health Department. (2019). *Aquatic facility inspection requirements: Swimming pools, spa, splash pad*. https://www.houstontx.gov/health/Environmental/Documents/acquatic-facility-inspection-requirements-2020.pdf

Houston Health Department. (2023a). *Residential pools*. https://www.houstontx.gov/health/Environmental/residentialpools.html

Houston Health Department. (2023b). *Swimming pool inspection reports*. https://www.houstontx.gov/health/Environmental/pool-inspection-reports.html

International Code Council, Inc. (2018). *2018 International Swimming Pool and Spa Code (ISPSC)*. https://codes.iccsafe.org/content/ISPSC2018P4

National Association of County and City Health Officials. (2015). *Statement of policy: Recreational water safety* (15-01). https://www.naccho.org/uploads/downloadable-resources/Policy-and-Advocacy/15-01-recreational-water-safety.pdf

National Center for Injury Prevention and Control. (2018). *10 leading causes of injury deaths by age group highlighting unintentional injury deaths, United States—2018*. Centers for Disease Control and Prevention. https://www.cdc.gov/injury/images/lc-charts/leading_causes_of_death_by_age_group_unintentional_2018_1100w850h.jpg

Plano Health Department. (n.d.). *Swimming pool establishment inspection scores—City of Plano*. https://ecop.plano.gov/swimmingpoolscores/

Pool Yard Enclosures, Texas Health and Safety Code, Title 9, Subtitle A, §757 (1994). https://statutes.capitol.texas.gov/Docs/HS/htm/HS.757.htm

Public Swimming Pools and Spas, Texas Administrative Code, Title 25, Part 1, § 265.181 (2023). https://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=25&pt=1&ch=265&sch=L&rl=Y

Shenoi, R.P., Levine, N., Jones, J.L., Frost, M.H., Koerner, C.E., & Fraser, J.J., Jr. (2015). Spatial analysis of paediatric swimming pool submersions by housing type. *Injury Prevention*, *21*(4), 245–253. https://doi.org/10.1136/injuryprev-2014-041397

Thompson, D.C., & Rivara, F.P. (1998). Pool fencing for preventing drowning of children. *Cochrane Database of Systematic Reviews*, *1998*(1), Article CD001047. https://doi.org/10.1002/14651858.CD001047

U.S. Census Bureau. (2021). *QuickFacts: Houston city, Texas*. https://www.census.gov/quickfacts/houstoncitytexas

Warneke, C.L., & Cooper, S.P. (1994). Child and adolescent drownings in Harris County, Texas, 1983 through 1990. *American Journal of Public Health*, *84*(4), 593–598. https://doi.org/10.2105/ajph.84.4.593

Yang, T. (2020). *Pool or spa submersion: Estimated nonfatal drowning injuries and reported drownings, 2020 report*. U.S. Consumer Product Safety Commission. https://www.cpsc.gov/s3fs-public/2020-Submersion-Report-4-29-20.pdf

Did You Know?

The 2024 Integrated Foodborne Outbreak Response and Management (InFORM) Conference will be held on January 22–24, 2024, in Washington, DC. Stay tuned to www.neha.org/inform for details on abstract submission, preconference sessions, registration, and room reservations.

JEH QUIZ

FEATURED ARTICLE QUIZ #1

Applying the Model Aquatic Health Code to Grade Swimming Pool Safety in a Large Metropolitan Area

Available to those with an active National Environmental Health Association (NEHA) membership, the *JEH* Quiz is offered six times per calendar year and is an easily accessible way to earn continuing education (CE) contact hours toward maintaining a NEHA credential. Each quiz is worth 1.0 CE.

Completing quizzes is now based on the honor system and should be self-reported by the credential holder. Quizzes published only during your current credential cycle are eligible for CE credit. Please keep a copy of each completed quiz for your records. CE credit will post to your account within 3 business days.

Paper or electronic quiz submissions will no longer be collected by NEHA staff.

INSTRUCTIONS TO SELF-REPORT A *JEH* QUIZ FOR CE CREDIT

1. Read the featured article and select the correct answer to each *JEH* Quiz question.
2. Log in to your MyNEHA account at https://neha.users.membersuite.com/home.
3. Click on Credentials located at the top of the page.
4. Select Report CEs from the drop-down menu.
5. Enter the date you finished the quiz in the Date Attended field.
6. Enter 1.0 in the Length of Course in Hours field.
7. In the Description field, enter the activity as "*JEH* Quiz #, Month Year" (e.g., *JEH* Quiz 1, July/August 2023).
8. Click the Create button.

➔ Quiz effective date: July 1, 2023 | Quiz deadline: October 1, 2023

1. The Model Aquatic Health Code (MAHC) provides voluntary guidelines that reduce the risk of disease, injury, and drowning at aquatic facilities.
   a. True.
   b. False.
2. In children, swimming pools account for __ of fatal drownings in the U.S.
   a. 22%
   b. 33%
   c. 44%
   d. 67%
3. Between 2000–2014, there were __ outbreaks of waterborne diseases associated with treated recreational water that resulted in at least 27,219 cases and 8 deaths.
   a. 293
   b. 393
   c. 493
   d. 593
4. The primary aim of this study was to develop a grading system for swimming pool safety for Houston, Texas, by applying the MAHC to city swimming pool inspection data.
   a. True.
   b. False.
5. This study conducted a cross-sectional study of swimming pool safety inspection data for __ public swimming pools, including spas and wading pools, in Houston during 2016.
   a. 2,107
   b. 2,607
   c. 3,107
   d. 3,607
6. The inspection data obtained from the Houston Health Department included
   a. name and address of the property where the pool was sited.
   b. housing type.
   c. publicly available information on swimming pool violations.
   d. all of the above.
   e. none of the above.
7. Of the 49 items included on the MAHC inspection form, the Houston Health Department inspects for __ of those items.
   a. 13
   b. 23
   c. 29
   d. 39
8. Of the 1,839 pools that received an F grade, __ obtained their failing grade based on a failing overall percentage.
   a. <1%
   b. 6%
   c. 11%
   d. 14%
9. A prior study in Harris County, Texas, found that out of 196 unintentional drownings, __ occurred in multifamily residential pools.
   a. one quarter
   b. one third
   c. one half
   d. two thirds
10. This study observed that the most common safety violation were due to
    a. faulty swimming pool enclosures.
    b. faulty gates and safety equipment.
    c. improper disinfectant levels.
    d. a and b.
    e. all of the above.
11. The median estimated number of persons visiting emergency departments for chemical-related injuries from pools was __ per year between 2003 and 2012.
    a. 4,247
    b. 4,747
    c. 5,247
    d. 5,747
12. The study found that pool safety inspections in Houston, as currently conducted, captured __ fewer swimming pool violations than if the MAHC criteria were used.
    a. 10%
    b. 20%
    c. 30%
    d. 40%

JEH Quiz #5 Answers

March 2023

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

Enveloped Phi 6 Bacteriophage Persistence and Cross-Contamination on the Surface of Farmers Market Fomites

Zahra H. Mohammad, PhD
Conrad N. Hilton College of Global Hospitality Leadership, University of Houston

Thomas A. Little
Conrad N. Hilton College of Global Hospitality Leadership, University of Houston

Sujata A. Sirsat, MS, PhD
Conrad N. Hilton College of Global Hospitality Leadership, University of Houston

Abstract **This study aimed to investigate the survival and persistence of enveloped phi 6 bacteriophages on several fomites at farmers markets and simulate cross-contamination at farmers markets. Fomites from farmers markets were inoculated with phi 6 bacteriophages (a surrogate for coronaviruses such as SARS-CoV-2) and plaque forming units (PFUs) were assessed over 30 days at 23 ± 2 °C. Phi 6 persisted up to 16 days on wicker, 13 days on plastic, 4 days on cardboard and molded pulp fiber, and 2 days on tablecloths.**

The transfer rate of phi 6 from fomites to hands and produce was assessed at high and low phi 6 concentrations at 23 ± 2 °C. With a high concentration level (10^7 PFU/ml), the mean transfer rate from fomites to produce ranged from 21% to 30%, and fomites to hands ranged from 21% to 29%, while with a low phi 6 load (10^3 PFU/ml), the transfer rate from fomites to produce ranged from 10% to 30%, and no phi 6 was detected from fomites to hands. The results highlight the high risk of cross-contamination from fomites.

From a practitioner and public health standpoint, the results of our study show the need to address the use of containers made from cardboard, molded pulp fiber, and wicker, and to ensure that these containers are not reused over time. In addition, managers of farmers markets should encourage the use of nonporous and easy-to-clean and sanitize reusable containers and other food contact surfaces.

Introduction

According to the U.S. Department of Agriculture (USDA, 2019), the number of farmers markets has risen from 1,755 in 1994 to 8,771 in 2019. This expansion of farmers markets has addressed consumer demand for local fresh produce (Stewart, 2018); however, managers and vendors at farmers markets need to be equipped with science-based resources to address food safety challenges. Previous studies have found gaps in training and implementation related to these challenges that have the potential to lead to issues of contamination and cross-contamination (Harrison et al., 2013; Mohammad et al., 2020; Pollard et al., 2016).

A survey of vendors and managers at Texas and Arkansas farmers markets found that only 37% had received formal food safety training and only 50% of the managers said they provide guidelines or training to vendors (Mohammad et al., 2020). In another study that observed produce vendors in Southwest Virginia, Pollard et al. (2016) found none of the 42 vendors had handwashing stations, used gloves, or had hand sanitizer present in their stalls, regardless of previous food safety training from the Virginia Cooperative Extension. A survey of farmers from Georgia, Virginia, and South Carolina found that only 39% used sanitizers of any kind on surfaces that touch produce on the farm and only 33% always cleaned containers between uses for transporting produce to market (Harrison et al., 2013).

The COVID-19 pandemic has had devastating worldwide effects (Suman et al., 2020). While the Food and Drug Administration (FDA, 2023) stated in 2020 and continues to state that there is no risk of virus transmission via food or food packaging, the World Health Organization (2021) has reported that coronaviruses can persist on frozen foods, packaging, and cold-chain products. Previous research has shown that storage containers from farmers markets have the potential to harbor bacterial pathogens and MS2 bacteriophages (viral surrogate) for up to 59 days (Beiza et al., 2021).

Additionally, studies have reported that respiratory viruses are able to survive for several days on fresh produce (Blondin-Brosseau et al., 2021; Yépiz-Gómez et al., 2013). Respiratory viruses can contaminate fomites from a) droplets of an infected person, b) air (aerosols), c) contaminated hands, or d) other contaminated fomites (Castaño et al., 2021). Research has also shown that the transmission of respiratory viruses—such as Middle

East respiratory syndrome (MERS or MERS-CoV) and severe acute respiratory syndrome (SARS-CoV-1)—can persist on surfaces and potentially cause infection (Aboubakr et al., 2021; Marzoli et al., 2021). MERS and SARS-CoV-1 belong to the same family as SARS-CoV-2 (the virus that caused the recent COVID-19 pandemic) and are characterized as enveloped, single-strand, positive-sense RNA viruses (Yang & Wang, 2020). Thus, the potential survival and transmission of SARS-CoV-2 via fomites at farmers markets are possible.

SARS-CoV-2 is difficult to work with, requires careful handling, and necessitates a Biosafety Level 3 laboratory; for these reasons, we used a phi 6 bacteriophage surrogate. Phi 6 regularly is used as a surrogate to study enveloped viruses in environmental investigations (Aquino de Carvalho et al., 2017; Casanova & Weaver, 2015; Turgeon et al., 2014).

There is no literature on the survival and persistence of enveloped viruses on fomites at farmers markets and the risk of viral cross-contamination via fomites. Thus, the objectives of our study were to: 1) investigate the survival and persistence of phi 6 on fomites from farmers markets and 2) determine the transfer rate and cross-contamination of phi 6 particles from fomites to produce and hands.

Methods

Bacteriophage (phi 6) and the host (*Pseudomonas syringae)* were provided by the Centers for Disease Control and Prevention (CDC). We purchased the media and reagents from VWR. Additionally, we purchased four materials (plastic, molded pulp fiber, wicker, and tablecloths) that are widely used at farmers markets from an online retail store. These materials were chosen due to their use in previous studies to assess microbiological persistence related to farmers markets (Beiza et al., 2021). We selected bell peppers, cantaloupe, and lettuce as produce samples due to their history of foodborne illness outbreaks and use in microbiological analysis (Centers for Disease Control and Prevention, 2023; Stine et al., 2005).

Virus and Host Propagation

For safety purposes, we used phi 6 as a surrogate for coronavirus (SARS-CoV-2) and *P. syringae* as a host. The host was cultivated on tryptic soy agar (TSA) and grown in tryptic soy broth (TSB). The host was prepared by streaking *P. syringae* on TSA plates from a previously prepared TSA slant using a sterile plastic inoculation loop; plates were incubated for 18 hr at 22 °C. After incubation, a single colony of *P. syringae* was activated from overnight growth on TSA and, using a plastic inoculated needle, inoculated in a 250-ml flask containing 50 ml of TSB. The flask was then incubated in a shaking incubator for 18 hr at 22 °C. Lastly, the density of the culture was checked using a spectrometer by reading the optical density level at 550 nM to reach an absorbance range of 0.5–0.8 on the spectrophotometer (Spectronic 20D, Thermo Fisher Scientific).

Lyophilized Phage Reconstitution

After preparing the host, 1 ml of room temperature (23 ± 2 °C) TSB was added to the lyophilization tube containing phi 6 and vortexed for 1 min to mix and rehydrate. Next, 500 µl of this rehydrated phi 6 was added to the flask containing 50 ml of TSB, followed by 100 µl of overnight growth of *P. syringae* (host). The flask containing TSB, phi 6, and *P. syringae* was placed in a shaking incubator for 18 hr at 22 °C. After incubation, virus purification was performed using a 0.22-µm PVDF membrane filter attached to a sterile needle-less Millipore SLGV033RS 60-cc syringe. Then the syringe plunger was pulled out from the syringe and 15 cc of the overnight culture was pipetted into the syringe barrel. Lastly, the plunger was replaced, the syringe filtered out bacterial debris, and phi 6 bacteriophages were collected in a sterile polypropylene tube (centrifuge tube). All procedures were performed inside a biosafety cabinet.

Plaque Assay

Plaque assays were used to determine the phi 6 concentration for filtrate viruses. A 1-ml aliquot of filtrate phi 6 was used and serially diluted in 0.02% phosphate buffered saline (PBS) and Tween (PBST, 100 ml of PBS + 0.02% Tween 20) buffer. The remaining filtrate phi 6 was stored in a refrigerator at 4 °C for later use after wrapping tubes with aluminum foil to protect the phi 6 from light. Next, 1 ml of diluted phi 6 was mixed with 100 µl of the overnight cultures of *P. syringae*. The mixture was then added to a tube containing 3 ml of prewarmed (45–50 °C) TSB soft agar. The soft agar with host and phi 6 was quickly poured onto TSA plates and tilted by hand to evenly distribute the soft agar on top. The plates were left to dry for 30 min, inverted, and incubated for 24 hr at 22 °C. After incubation, plaques were enumerated by multiplying the number of plaques by dilution factors, and the concentration of phi 6 was determined.

Persistence Experiment

For our study, we used plastic, cardboard, molded pulp fiber, wicker, and tablecloths that are commonly used at farmers markets. Before the start of the experiment, all materials (except wicker) were manually cut into square 10 cm x 10 cm (100 cm^2) coupons. The wicker samples were cut into square 5 cm x 5 cm (25 cm^2) coupons. Later, all items were sterilized in an autoclave for 15 min at 121 °C or sterilized using 70% ethanol. Next, 5 ml of the stocked phi 6 was used for inoculation after being diluted in 45 ml of virus buffer (0.02% PBST). Subsequently, 0.2 ml of the described diluted phi 6 inoculum (10^8 PFU/ml) was spotted on the top of each item and spread over the surface using an L-shaped plastic spreader. Afterward, the inoculated items were air-dried for 1 hr at room temperature (23 ± 2 °C) and relative humidity (74 ± 2%). After the drying period, each item underwent microbiological analysis to enumerate phi 6 plaques on each plate.

Microbiological Analysis

Two samples of each surface (fomite) were randomly taken from their respective group and placed into sterile stomacher bags containing 45 ml or 90 ml of virus buffer (0.02% PBST), then homogenized for 2 min. Next, 10-fold-dilutions were made. TSA soft agar tubes were prepared for the overlay process by melting prepared TSA soft agar in a water bath set to 48–50 °C. Then 1 ml from each dilution and 100 µl of the overnight host was added to one melted and tempered soft (3 ml) TSA agar overlay tube and poured onto a TSA plate. The TSA plate was agitated to ensure the overlay mixture completely covered the TSA plates. The plates were then allowed to solidify in a biosafety cabinet for 30 min, inverted, and incubated for 18–24 hr at 22 °C. Negative control plates used sterile phage buffer (i.e., no virus) to test for potential contamination. After the incubation

period, plates were enumerated and plaques were recorded as PFU/cm. The procedures for counting the phi 6 were carried out on days 1, 2, 3, 4, 7, 10, 13, 16, 19, 22, 25, 28, and 30 days, at which time no phi 6 was detected. The same procedures were repeated for each of three biological replicates under similar experimental conditions.

Simulation Experiment

A simulation experiment was conducted to determine the potential of phi 6 contamination and cross-contamination at farmers markets and the transfer rate from the fomites to hands and produce (i.e., bell pepper, cantaloupe, and lettuce). The simulation was performed using two different levels of phi 6 concentrations (high level = approximately 10^7 log PFU/ml; low level = approximately 10^3 log PFU/ml) in two separate experiments with three biological replicates and duplicate samples each.

Cross-Contamination From Inoculated Surfaces With High or Low Level Phi 6 to Produce

A 0.2 ml of phi 6 suspension (10^7 log PFU/ml or 10^3 log PFU/ml) was inoculated onto the surfaces of each fomite: plastic, molded pulp fiber, and wicker. Each fomite was held at room temperature (23 ± 2 °C) for 1 hr to facilitate attachment. Next, the produce items were placed on top of each inoculated surface after a portion of the produce was marked using a red marker. This marked area was left in touch with the fomite for 1 hr. The marked portion of each produce item was swabbed individually using an alginate cotton swab and placed into a tube containing 5 ml of virus buffer. A 1-ml aliquot from each collected sample and 100 µl of the overnight host were added to a tube containing 3 ml of soft TSA. The contents were mixed by hand and quickly poured onto TSA plates. The plates were allowed to solidify before being inverted and incubated for 24 hr at 22 °C. Following incubation, the plaques were counted and recorded as PFU/cm^2.

Cross-Contamination From Inoculated Surfaces With a High or Low Level Phi 6 to Hands

To start, proper handwashing was performed for 20 s with soap and warm water (40 °C), and hands were dried with paper towels. Hands were then sprayed with 70% ethanol and allowed to air-dry. Next, one hand touched the inoculated surfaces one at a time with the index finger (primary transfer) for 20 s. Lastly, samples from the hand were collected using a glove-juice method (Larson et al., 1980; Sirsat et al., 2013) with some modifications. In detail, the index finger from each hand touched the inoculated items for 20 s, and then the subject wore a sterile surgical glove containing 1 ml of sterile 0.02% PBST virus buffer in the index finger section of the glove. Next, the hand with the glove on was vortexed for 60 s. The sample was then transferred from the glove index finger region to a sterile 10-ml conical tube using a sterile pipette. Finally, 1 ml from each collected sample and 100 µl of the overnight host were added to a tube containing 3 ml of soft TSA, shaken by hand, and quickly poured onto TSA plates. The plates were allowed to solidify before being inverted and incubated for 24 hr at 22 °C. Following incubation, the plaques were counted and recorded as PFU/cm^2.

TABLE **1**

Survival and Persistence of Phi 6 on the Surface of Farmers Market Fomites

Day	Mean Log PFU/cm^2 and Standard Deviation on Surface of Each Fomite [a]				
	Plastic	Cardboard	Molded Pulp Fiber	Wicker	Tablecloth
1	5.8 ± 0.2	5.1 ± 0.5	5.5 ± 0.5	5.7 ± 0.2	4.9 ± 0.1
2	3.7 ± 0.2	2.7 ± 0.1	3.1 ± 0.2	3.7 ± 0.1	1.7 ± 0.2
3	2.5 ± 0.3	2.4 ± 0.3	2.4 ± 0.1	2.6 ± 0.2	0.8 ± 0.2
4	2.3 ± 0.2	1.8 ± 0.4	2.0 ± 0.3	2.2 ± 0.2	0.5 ± 0.3
7	1.8 ± 0.5	0.8 ± 0.6	0.7 ± 0.2	1.8 ± 0.2	ND ± 0
10	1.4 ± 0.3	0.5 ± 0.4	0.4 ± 0.3	1.5 ± 0.1	ND ± 0
13	1.1 ± 0.4	0.5 ± 0.3	0.7 ± 0.1	1.3 ± 0.1	ND ± 0
16	0.7 ± 0.2	ND ± 0	0.4 ± 0.2	1.2 ± 0.2	ND ± 0
19	0.5 ± 0.4	ND ± 0	ND ± 0	0.8 ± 0.3	ND ± 0
22	ND ± 0	ND ± 0	ND ± 0	0.7 ± 0.1	ND ± 0
25	ND ± 0	ND ± 0	ND ± 0	0.5 ± 0.2	ND ± 0
28	ND ± 0	ND ± 0	ND ± 0	0.4 ± 0.2	ND ± 0
30	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0

[a] Means and standard deviation of survival of phi 6 on each farmers market fomite over 30 days (N = 6).
Note. ND = none detected.

Data Analyses

The enumerated plaques were converted into log10, and the survival curve was created using Microsoft Excel. Next, the persistence results were recorded for each fomite as PFU/cm^2. We calculated the transfer rates using the formula below:

Percent transfer rates = (log PFU/cm^2 of phi 6 on exposed subject [hand or produce] / log PFU/cm^2 of phi 6 on the original fomite) × 100

The transfer rates were calculated and the results were compared to determine the potential cross-contamination from farmers market fomites to produce or hands.

Results and Discussion

Persistence of Phi 6 on the Surface of Farmers Market Fomites

Table 1 shows the recovery of phi 6 on the surfaces of the plastic, cardboard, molded pulp fiber, wicker, and tablecloth coupons. The rapid reduction of phi 6 was observed on days 1 and 2, where a >2 log PFU/cm^2 reduction was recorded on all surfaces. The results observed in this experiment were similar to those of a pervious study where persistence of MS2 bacteriophage (a surrogate for norovi-

TABLE **2**

Transfer Rate of Phi 6 From Farmers Market Fomites to Produce and Hands

Surface	Log and Transfer Rate With High Level Inoculation (10^7 PFU/cm^2)		Log and Transfer Rate With Low Level Inoculation (10^3 PFU/cm^2)	
	Log PFU/cm^2 [a]	Transfer Rate [b] (%)	Log PFU/cm^2	Transfer Rate (%)
Plastic				
To bell pepper	1.7 ± 0.3	24	0.7 ± 0.5	23
To cantaloupe	1.5 ± 0.1	21	0.9 ± 0.3	30
To lettuce	2.4 ± 0.2	34	0.5 ± 0.3	17
To hands	2.0 ± 0.2	29	0.5 ± 0.3	17
Wicker				
To bell pepper	2.1 ± 0.4	30	0.6 ± 0.3	20
To cantaloupe	1.9 ± 0.4	27	0.4 ± 0.2	13
To lettuce	2.1 ± 0.3	30	0.9 ± 0.1	30
To hands	1.5 ± 0.1	21	0.3 ± 0.2	10
Molded pulp fiber				
To bell pepper	1.6 ± 0.1	23	0.9 ± 0.2	30
To cantaloupe	2.0 ± 0.1	29	0.3 ± 0.3	10
To lettuce	2.2 ± 0.1	31	0.6 ± 0.3	20
To hands	1.7 ± 0.2	24	0.3 ± 0.3	10

[a] Mean and standard deviation of phi 6 from each inoculated fomite (10^7 or 10^3 PFU/cm^2) to produce that touched the fomite surface for 1 hr or to hands that touched the fomite surface for 20 s ($N = 6$).

[b] The transfer rates (percentage) of mean and standard deviation of phi 6 from each inoculated fomite (10^7 or 10^3 PFU/cm^2) to produce that touched the fomite surface for 1 hr or to hands that touched the fomite surface for 20 s ($N = 6$).

rus) was investigated on famers market fomites (Beiza et al., 2021). In both studies, virus surrogates survived for a similar amount of time on their respective fomites.

In our study, the tablecloth had the greatest initial reduction between days 1 and 2 (3.2 log PFU/cm^2). On day 3, it fell below the detection limit of 0.9 log PFU/cm^2, and no PFUs were detected by day 7. While cardboard and molded pulp fiber coupons were observed to have greater initial reductions (2.4 log PFU/cm^2) and a shorter time of detection (4 days), there are concerns related to their use because of the difficulty of cleaning and sanitizing them correctly (U.S. Department of Health and Human Services, 2017). Cardboard has been found to be a common vehicle of cross-contamination, especially if used for a long time (Krall, 2003). Therefore, cardboard should be considered as a high risk for cross-contamination, as cardboard is regularly reused for a long time at farmers markets, creating an ideal environment for the growth of microorganisms (Pollard et al., 2016).

Wicker was shown to have the lowest initial reduction (2.0 log PFU/cm^2), longest detectible time (16 days), and the longest overall detection (28 days) of phi 6. Plastic had the second-longest persistence by each of the metrics, with 2.1 log PFU/cm^2, 13 days, and 19 days, respectively. Based on these results, increased vigilance should be observed in cleaning and sanitizing produce items to prevent possible transmission of virus particles.

Hands have also been found to be a common source of contamination and the spread of microorganisms, including viruses (Ansari et al., 1991; Scott, 2013). According to past studies, vendors at farmers markets undertake many tasks, such as handling produce and containers, touching their smartphones, and handling money without practicing proper handwashing or wearing gloves (Behnke et al., 2012). These situations highlight the risk of cross-contamination from containers (fomites) to hands and vice versa.

Simulation of Cross-Contamination With High and Low Level Phi 6

The transfer rates of phi 6 from artificially contaminated fomites to hands and produce are presented in Table 2. Experiments with high (10^7 log PFU/cm^2) and low (10^3 log PFU/cm^2) initial concentrations were observed. At the low concentration, each fomite had a different produce sample that registered as the highest transfer rate. The combinations of plastic to cantaloupe, wicker to lettuce, and molded pulp fiber to bell pepper all had transfer rates of 30%. In each experiment, the high value sample was the only sample at or above the detection limit of 0.9 log PFU/cm^2. The transfer from plastic to cantaloupe (30%) was much greater than other fomites (wicker: 13% and molded pulp fiber: 10%). The trans-

fer from fomite to hands was the lowest in each group with values of 17% (plastic) and 10% (molded pulp fiber and wicker).

At the high concentration, the transfer from wicker to all produce samples was consistent and high with values of 30% (bell pepper and lettuce) and 27% (cantaloupe). Lettuce samples had the highest transfer rate for each fomite group with values of 34% (plastic), 31% (molded pulp fiber), and 30% (wicker). The transfer from fomites to hands was found to be lower compared with produce samples in all cases except for plastic, where the rate was 29%, which was the second highest for that group. All samples at high concentration were found to be above the detection limit of 0.9 log PFU/cm^2. Due to the ability of respiratory viruses to survive on produce items (Blondin-Brosseau et al., 2021; Yépiz-Gómez et al., 2013), increased caution should be taken by managers and workers at farmers markets to clean and sanitize containers to prevent the spread of the SARS-CoV-2 virus.

Conclusion

The data from our study indicate that phi 6 bacteriophages (used as a surrogate for SARS-CoV-2) can persist and stay viable on fomites at farmers markets for an extended time, especially on nonporous materials. Our study indicates that respiratory viruses pose a risk for transmission from fomites at farmers markets.

Based on these data, managers at farmers markets should encourage vendors to use single-use containers or switch storage containers to ones that can be cleaned easily and sanitized. Additionally, farmers markets should offer sanitation training. One limitation of our study is that the fomites were inoculated with phi 6, which might not be fully representative of the actual survival and transmission of SARS-CoV-2. Additionally, this research was conducted under laboratory conditions and in a controlled environment, which are different from the setting of a farmers market.

Acknowledgement: The authors acknowledge the Food Safety Research Funds at the Conrad N. Hilton College of Global Hospitality Leadership. Furthermore, the authors declare no conflict of interest in the publication of this article.

Corresponding Author: Sujata A. Sirsat, Associate Professor, Conrad N. Hilton College of Global Hospitality Leadership, University of Houston, 4450 University Drive, S230, Houston, TX 77204-3028.
Email: sasirsat@central.uh.edu.

References

Aboubakr, H.A, Sharafeldin, T.A, & Goyal, S.M. (2021). Stability of SARS-CoV-2 and other coronaviruses in the environment and on common touch surfaces and the influence of climatic conditions: A review. *Transboundary and Emerging Diseases*, *68*(2), 296–312. https://doi.org/10.1111/tbed.13707

Ansari, S.A., Springthorpe, V.S., Sattar, S.A., Rivard, S., & Rahman, M. (1991). Potential role of hands in the spread of respiratory viral infection: Studies with human parainfluenza virus 3 and rhinovirus 14. *Journal of Clinical Microbiology*, *29*(10), 2115–2119. https://doi.org/10.1128/jcm.29.10.2115-2119.1991

Aquino de Carvalho, N., Stachler, E.N., Cimabue, N., & Bibby, K. (2017). Evaluation of phi6 persistence and suitability as an enveloped virus surrogate. *Environmental Science & Technology*, *51*(15), 8692–8700. https://doi.org/10.1021/acs.est.7b01296

Behnke, C., Seo, S., & Miller, K. (2012). Assessing food safety practices in farmers' markets. *Food Protection Trends*, *32*(5), 232–239. https://www.foodprotection.org/files/food-protection-trends/May-12-Behnke.pdf

Beiza, A.A., Mohammad, Z.H., & Sirsat, S.A. (2021). Persistence of foodborne pathogens on farmers' market fomites. *Journal of Food Protection*, *84*(7), 1169–1175. https://doi.org/10.4315/JFP-20-406

Blondin-Brosseau, M., Harlow, J., Doctor, T., & Nasheri, N. (2021). Examining the persistence of human Coronavirus 229E on fresh produce. *Food Microbiology*, *98*, Article 103780. https://doi.org/10.1016/j.fm.2021.103780

Casanova, L.M., & Weaver, S.R. (2015). Evaluation of eluents for the recovery of an enveloped virus from hands by whole-hand sampling. *Journal of Applied Microbiology*, *118*(5), 1210–1216. https://doi.org/10.1111/jam.12777

Castaño, N., Cordts, S.C., Kurosu Jalil, M., Zhang, K.S., Koppaka, S., Bick, A.D., Paul, R., & Tang, S.K.Y. (2021). Fomite transmission, physicochemical origin of virus–surface interactions, and disinfection strategies for enveloped viruses with applications to SARS-CoV-2. *ACS Omega*, *6*(10), 6509–6527. https://doi.org/10.1021/acsomega.0c06335

Centers for Disease Control and Prevention. (2023). *List of multistate foodborne outbreak notices*. https://www.cdc.gov/foodsafety/outbreaks/lists/outbreaks-list.html

Food and Drug Administration. (2023). *Emergency preparedness and response*. https://www.fda.gov/emergency-preparedness-and-response

Harrison, J.A., Gaskin, J.W., Harrison, M.A., Cannon, J.L., Boyer, R.R., & Zehnder G.W. (2013). Survey of food safety practices on small to medium-sized farms and in farmers markets. *Journal of Food Protection*, *76*(11), 1989–1993. https://doi.org/10.4315/0362-028X.JFP-13-158

Krall, K. (2003). Every kitchen's dirty little secret: Cardboard—Bacteria superstore and roach motel. *Journal of Environmental Health*, *65*(7), 24–26. http://www.jstor.org/stable/44531078

Larson, E.L., Strom, M.S., & Evans, C.A. (1980). Analysis of three variables in sampling solutions used to assay bacteria of hands: Type of solution, use of antiseptic neutralizers, and solution temperature. *Journal of Clinical Microbiology*, *12*(3), 355–360. https://doi.org/10.1128/jcm.12.3.355-360.1980

Marzoli, F., Bortolami, A., Pezzuto, A., Mazzetto, E., Piro, R., Terregino, C., Bonfante, F., & Belluco, S. (2021). A systematic review of human coronaviruses survival on environmental surfaces. *Sci-*

References

ence of the Total Environment, *778*, Article 146191. https://doi.org/10.1016/j.scitotenv.2021.146191

Mohammad, Z.H., Yu, H., Neal, J.A., Gibson, K.E., & Sirsat, S.A. (2020). Food safety challenges and barriers in Southern United States farmers markets. *Foods*, *9*(1), 1–12. https://doi.org/10.3390/foods9010012

Pollard, S., Boyer, R., Chapman, B., di Stefano, J., Archibald, T., Ponder, M.A., & Rideout, S. (2016). Identification of risky food safety practices at Southwest Virginia farmers' markets. *Food Protection Trends*, *36*(3), 168–175.

Scott, E. (2013). Community-based infections and the potential role of common touch surfaces as vectors for the transmission of infectious agents in home and community settings. *American Journal of Infection Control*, *41*(11), 1087–1092. https://doi.org/10.1016/j.ajic.2013.05.014

Sirsat, S.A., Choi, J.K., Almanza, B.A., & Neal, J.A. (2013). Persistence of *Salmonella* and *E. coli* on the surface of restaurant menus. *Journal of Environmental Health*, *75*(7), 8–14.

Stewart, H. (2018, March 5). Shopping at farmers' markets and roadside stands increases fruit and vegetable demand. *Amber Waves*. U.S. Department of Agriculture, Economic Research Service. https://www.ers.usda.gov/amber-waves/2018/march/shopping-at-farmers-markets-and-roadside-stands-increases-fruit-and-vegetable-demand/

Stine, S.W., Song, I., Choi, C.Y., & Gerba, C.P. (2005). Effect of relative humidity on preharvest survival of bacterial and viral pathogens on the surface of cantaloupe, lettuce, and bell peppers. *Journal of Food Protection*, *68*(7), 1352–1358. https://doi.org/10.4315/0362-028x-68.7.1352

Suman, R., Javaid, M., Haleem, A., Vaishya, R., Bahl, S., & Nandan, D. (2020). Sustainability of coronavirus on different surfaces. *Journal of Clinical and Experimental Hepatology*, *10*(4), 386–390. https://doi.org/10.1016/j.jceh.2020.04.020

Turgeon, N., Toulouse, M.-J., Martel, B., Moineau, S., & Duchaine, C. (2014). Comparison of five bacteriophages as models for viral aerosol studies. *Applied and Environmental Microbiology*, *80*(14), 4242–4250. https://doi.org/10.1128/AEM.00767-14

U.S. Department of Agriculture, Agricultural Marketing Service. (2019). *National count of farmers market directory listings*. https://www.ams.usda.gov/sites/default/files/media/NationalCountofFarmersMarketDirectoryListings082019.pdf

U.S. Department of Health and Human Services, Public Health Service, Food and Drug Administration. (2017). *Food Code: 2017 recommendations of the United States Public Health Service, Food and Drug Administration*. https://www.fda.gov/media/110822/download

World Health Organization. (2021). *WHO-convened global study of origins of SARS-CoV-2: China part*. https://apo.org.au/sites/default/files/resource-files/2021-03/apo-nid311637.pdf

Yang, P., & Wang, X. (2020). COVID-19: A new challenge for human beings. *Cellular & Molecular Immunology*, *17*(5), 555–557. https://doi.org/10.1038/s41423-020-0407-x

Yépiz-Gómez, M.S., Gerba, C.P., & Bright, K.R. (2013). Survival of respiratory viruses on fresh produce. *Food and Environmental Virology*, *5*(3), 150–156. https://doi.org/10.1007/s12560-013-9114-4

The food industry moves fast.

The **Certified Professional–Food Safety (CP-FS)** credential keeps you up-to-date with the rapidly changing food industry and tells your community that you know the science and practice to keep them safe.

Learn the requirements:
neha.org/cpfs-credential

neha National Environmental Health Association

SPECIAL REPORT

Federal Meat and Poultry Inspection Duties and Requirements—Part 3: Monitoring of Food Safety Systems

Roger W. Amery, CP-FS

Abstract **This 4-part series aims to inform environmental health specialists of the duties and requirements for federal meat and poultry inspectors and the companies they regulate. Part 1 provided general attributes of the U.S. Department of Agriculture Food Safety and Inspection Service inspection personnel and regulated companies (Amery, 2023a). Part 2 covered the computer-based system used to communicate results of inspection tasks, the marks of inspection, and slaughter inspection duties and company responsibilities (Amery, 2023b). Part 3 will cover the duties performed by consumer safety inspectors who monitor food safety systems. These duties include monitoring of Sanitation Standard Operating Procedures, hazard analysis critical control point (HACCP) procedures, reinspection, labeling issues, and company allergen controls. The remaining part of the series will be presented in a subsequent issue.**

Introduction and Overview

Consumer safety inspectors (CSIs) are responsible, as their title suggests, for ensuring that food is safe for consumption. Their responsibilities include general sanitation issues as well as food safety in fabrication (i.e., processing) off the slaughter lines. CSIs inspect facilities for evidence of pests, segregation of inedible foods from edible foods, water purity, ventilation control, and warehousing procedures.

To ensure that food is safe for consumption, companies are required to have two sets of written procedures: 1) Sanitation Standard Operating Procedures (SSOPs) and 2) hazard analysis critical control point (HACCP) procedures. SSOPs detail how the companies will prevent contamination of foods and direct food-contact surfaces and then what actions will be taken to bring the company into compliance if contamination does occur. HACCP procedures identify potential product hazards if control measures are not in place.

In both cases, CSIs observe the activities and review the generated records to determine company compliance. Reinspections are performed daily to ensure quality and public health. Labels are checked for deceit so that consumers are truthfully informed about ingredients, such as allergens present in products.

Fabrication

After slaughter (online) inspection—while still on the slaughter floor and continuing during fabrication (processing)—Food Safety and Inspection Service (FSIS) inspectors within the U.S. Department of Agriculture (USDA) conduct off-line inspections. Inspections by CSIs monitor the company SSOPs, HACCP procedures, and sanitation performance standards (SPS), both on the slaughter floor and during fabrication.

Sanitation Standard Operating Procedures

Each company is required to have a written SSOP plan. This plan describes how the company will prevent contamination of products and food-contact surfaces on which meat and poultry products are processed and packaged before (preoperational sanitation, or pre-op for short), during (operational sanitation), and after production.

Each company is to generate records documenting implementation of SSOPs and necessary corrective actions. Corrective actions are to include disposition of contaminated product, restoration to sanitary conditions, and prevention of recurrence. The company is to routinely reevaluate the SSOP plan to determine effectiveness.

FSIS inspectors monitor the activities of the companies implementing their SSOP plan by observing the company personnel as they perform their duties and by checking company records. When scheduled—or whenever deemed necessary—FSIS inspectors perform a pre-op inspection, after the company has completed its own pre-op procedures, to determine company effectiveness in preventing product contamination. During operations, CSIs determine if company implementation of the SSOP plan is effective and if the chosen frequency of company inspection is sufficient in preventing contamination of product (Sanitation, 2023a).

General Sanitation Performance Standards

It is the responsibility of companies to produce safe and wholesome meat and poul-

try products in sanitary conditions. CSIs inspect companies and observe how they maintain general sanitation as mandated in the SPS. They inspect equipment, facilities, and building structures, and observe employee hygiene practices. They inspect the inside and outside of the company building for evidence and harborage of pests and to review that condemned and inedible materials are properly identified as such and segregated so that they do not contaminate products that have passed inspection for human consumption (Sanitation, 2023b). CSIs review company files to check that there are letters of guarantee from the suppliers of packaging and food ingredients, such as spices, stating that there is no product adulteration.

Hazard Analysis Critical Control Point Procedures

Federally inspected meat and poultry producing companies are required to have a written HACCP system in place. In this system, each processing step undergoes an analysis for hazards (e.g., biological, chemical, physical). The HAACP system also includes preventive measures that will eliminate or reduce those hazards to acceptable levels. A justification must be provided for why or why not a potential hazard is reasonably likely to occur at each step. If a potential hazard is reasonably likely to be discovered at a specific process step, the hazard must be controlled at a point called the critical control point (CCP), which can be either at that step or in a subsequent step in the process (Hazard Analysis and Critical Control Point [HACCP] Systems, 2023). For instance, *E. coli* O157:H7 is introduced in raw beef products at the receiving step but is controlled at a subsequent step, such as cooking.

CCPs must include the following (Hazard Analysis and Critical Control Point [HACCP] Systems, 2023):

- List of hazards to be controlled at each step.
- The critical limits, which are the minimum or maximum values used to control the hazards (e.g., time and temperature, pH, water activity).
- A procedure and an effective frequency for monitoring the CCPs.
- Corrective actions and preventive measures to ensure that adulterated product is not shipped.
- Ongoing verification that includes calibration of measuring instruments, verification of the monitoring by direct observation, and records review.
- The recordkeeping system that results from this monitoring and verification.

The CCPs must be supported by academic science, in-plant testing, and sound reasoning. FSIS regulations and FSIS publications can also be used to support decisions made in the hazard analysis and HACCP plan (Hazard Analysis and Critical Control Point [HACCP] Systems, 2023).

During the first 90 days of implementing a HACCP plan, a company is required to perform initial validations to show scientifically that the HACCP plan is working as intended. Once the initial validations are completed, the company generates records clearly documenting the activities as written in the HACCP plan; these records are to be authenticated by initials or signatures. The ongoing records serve as documents proving that a company's activities result in safe food production. A preshipment review is conducted daily for all records generated. The company then routinely evaluates and validates the HACCP plan to ensure food safety.

CSIs observe company employees to determine if they are following what is written in the company's HACCP plan and are performing their duties in accordance with the regulations. Examples of how this determination can be accomplished are by checking ambient and product temperatures, checking continuous monitoring cook charts, and comparing results found by the CSI to results generated by the company. When CSIs observe a noncompliance, they document it in noncompliance records.

Mostly, the hazards identified are pathogens specific to the species of meat or poultry produced. At times, FSIS will find data regarding pathogens in the Public Health Inspection System, which prompt FSIS to require a special effort by the companies. FSIS will then develop a directive or a notice stating what additional efforts are to be conducted by a company in their HACCP plan, which FSIS will then monitor.

An example is bovine spongiform encephalopathy (BSE), commonly known as mad cow disease. When the first case in a bovine appeared in the U.S., slaughter companies were directed to segregate cattle ≥30 months from younger cattle. Now all nonambulatory bovine livestock found in the pens are condemned and no longer can be slaughtered for food.

Companies that produce beef are required to have procedures in place after slaughter to remove and properly dispose of specific neural tissues in older bovine carcasses where BSE accumulates. These neural tissues are called "specified risk materials." Slaughter plants are required to provide guarantee letters to fabrication companies that state they have performed these BSE requirements. These procedures are to be included in the HACCP or SSOP plans (Specified Risk Materials From Cattle, 2023).

Where FSIS requires extra efforts to address specific hazards, CSIs (while inspecting) and enforcement investigation and analysis officers (while assessing the companies that process these products) are to ensure that companies have written control measures designed and executed to effectively address these hazards in accordance with the regulations and supporting documentation.

Statistically Based Product Reinspection Programs

FSIS inspects product samples after slaughter processing and during fabrication processing. Some products require inspection using statistically based procedures and criteria for acceptance or rejection before further processing. These reinspections are conducted daily to determine a company's ability to produce wholesome products with an acceptable limit of defects. Inspectors need a flashlight, a ruler to measure some defects (because deeper or larger defects have more weight or a higher numerical value compared with smaller ones), and a worksheet that lists and tabulates the defects with their weighted values (Reinspection, Retention, and Disposal of Meat, 2023).

Finished Product Standards for Raw Poultry

For poultry slaughter facilities that request reinspection to increase line speed and production, there are two off-line inspection stations where CSIs conduct reinspection of the poultry carcasses that have been inspected on the line. One station is the prechill and is located prior to the chilling systems of the facility. The other station is the postchill located after the chilling systems and prior to

further processing. Both prechill and postchill reinspections are done daily.

The prechill reinspection test is divided into two categories. One category is to monitor the dressing and evisceration (processing category) conducted by a company. The other category is to monitor a company's ability to remove unwholesome defects such as lesions and disease conditions (trim category) from the carcasses to produce a wholesome product for the public. Each category is dealt with separately.

Postchill testing is to ensure the finished products meet national standards in the regulations. Testing is completed by the CSI in a manner similar to the prechill testing. If the criteria are not met, the company retests for validity of the results; if the test results are deemed valid, all products representing the samples that did not meet criteria are reworked and retested until results are acceptable. Then routine sampling resumes (Subpart K—Post Mortem Inspection, 2023).

Reinspection of Raw Red Meat

Because all establishments have adopted HACCP plans, statistically based tasks for reinspection of raw red meat have been absorbed into the HACCP inspection processing codes and therefore are not presently required to be performed by FSIS inspectors. Companies may opt to use the former FSIS statistically based method for reinspection. The regulation indicates that new methods for statistically based red meat reinspection are anticipated in the future (Reinspection, Retention, and Disposal of Meat, 2023).

Inspection for Deception and Product Wholesomeness

FSIS protects consumers from unwholesomeness and deceptively labeled products that federally inspected meat and poultry companies might produce inadvertently or intentionally. CSIs are responsible for checking labels for accuracy and regulatory requirement compliance, and by monitoring processing steps where products are weighed and ingredients and additives are formulated and added.

Labeling and Product Standards

FSIS regulates the labeling of meat and poultry products to safeguard consumers from public health concerns and deception. There are regulations for both red meat (Labeling, Marking Devices, and Containers, 2023) and poultry (Subpart N—Labeling and Containers, 2023; Subpart P—Definitions and Standards, 2023). CSIs check the labels and Formulation Sheets for compliance with regulations and the accurate listing of ingredients. In an example of mislabeling, cartons of Korean-style beef were found to contain a chicken-based product that was not declared on the label, and milk, which was an undeclared allergen (Saunders, 2022).

One of the required features of a label occasionally tested by CSIs is the net weight of the product in the packages. The net weight is the weight of the packaged meat and poultry product minus the weight of the packaging (tare weight). The customer pays for only the net weight and not the gross weight (net weight + the tare weight).

Big 9 Formulation Verification

Due to an increase in the number of recalls of products containing allergens that were not declared on the labels, FSIS directs CSIs to schedule a task to verify that companies are complying with the requirement to list allergens. Even though this task involves labeling issues, it has public health significance because anyone consuming an allergen that they are allergic to will suffer health consequences. This task is scheduled once per month for each company that produces allergen-containing products.

The Big 9 Food Allergens refer to nine allergens that account for 90% of all food allergy reactions. In 2023, the Food and Drug Administration (2023) added sesame to the list of major food allergens. The Big 9 are milk, tree nuts, crustaceans, fish, peanuts, wheat, soybeans, eggs, and sesame. CSIs are to observe the formulation of products and review records to verify that there is consistency between the products and the labels, including declaration of allergens. If a company does not comply with the regulatory requirements, the CSI documents a noncompliance record and takes appropriate action to protect public health, such as the initiation of a recall.

Summary and Conclusion

CSIs have a wide range of inspection duties. CSIs monitor the food safety systems via SSOPs, HACCP plans, and general sanitation. Companies are required to have an SSOP plan in place to show what they are going to do to prevent contamination of products and food-contact surfaces. SSOP plans include corrective actions whenever deviations occur. A HACCP plan is an analysis of each step in the process of food production to determine which steps are CCPs. These CCPs include the hazards to be controlled, monitoring procedures and frequencies, verifications and frequencies, critical limits, and recordkeeping. FSIS ensures that product labels are not deceptive and do not contribute to a public health issue such as allergens.

Disclaimer: The information and conclusions of this special report are those of the author and do not necessarily represent the official position of USDA or FSIS. Further, the interpretation of the regulations used to support this special report may not reflect the actual interpretation set forth by USDA and FSIS.

Corresponding Author: Roger W. Amery, 1663 Delaware Court, Geneva, IL 60134.
Email: ameryrogerw@yahoo.com.

References

Amery, R.W. (2023a). Federal meat and poultry inspection duties and requirements—Part 1: History and current responsibilities. *Journal of Environmental Health*, *85*(9), 22–25.

Amery, R.W. (2023b). Federal meat and poultry inspection duties and requirements—Part 2: The Public Health Inspection System, marks of inspection, and slaughter inspections. *Journal of Environmental Health*, *85*(10), 16–19.

Food and Drug Administration. (2023). *Food allergies*. https://www.fda.gov/food/food-labeling-nutrition/food-allergies

References

Hazard Analysis and Critical Control Point (HACCP) Systems, 9 C.F.R. § 417.1–8 (2023). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-E/part-417

Labeling, Marking Devices, and Containers, 9 C.F.R. Part 317 Subpart A § 1 (2023). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-A/part-317

Reinspection, Retention, and Disposal of Meat and Poultry Products at Official Establishments, 9 C.F.R. § 318.2 (2023). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-A/part-318/subpart-A/section-318.2

Sanitation, 9 C.F.R. § 416.11–17 (2023a). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-E/part-416

Sanitation, 9 C.F.R. § 416.1–6 (2023b). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-E/part-416

Saunders, Brian A. (2022, September 19). Healthy Choice recalls nearly 22,000 pounds of frozen beef product due to mislabeling. *PhillyVoice*. https://www.phillyvoice.com/healthy-choice-korean-style-frozen-beef-meal-recalled-dairy-milk-allergy/

Specified Risk Materials From Cattle and Their Handling and Disposition, 9 C.F.R. § 310.22 (2023). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-A/part-310/section-310.22

Subpart K—Post Mortem Inspection; Disposition of Carcasses and Parts, 9 C.F.R. § 381.76(a–b) (2023). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-A/part-381/subpart-K

Subpart N—Labeling and Containers, 9 C.F.R. § 381.115–133 (2023). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-A/part-381/subpart-N

Subpart P—Definitions and Standards of Identity or Composition, 9 C.F.R. § 381.155–174 (2023). https://www.ecfr.gov/current/title-9/chapter-III/subchapter-A/part-381/subpart-P

neha
National Environmental Health Association

THANK YOU FOR SUPPORTING THE NEHA/AAS SCHOLARSHIP FUND

Thomas Abbott
Nick Adams
Erick Aguilar
Tunde M. Akinmoladun
American Academy of Sanitarians
Drake Amundson
Steven K. Ault
Rance Baker
James J. Balsamo, Jr.
Robert Bialas
Ashton Brodahl
D. Gary Brown
Glenn W. Bryant
Timothy J. Callahan
Kimberley Carlton
Diane Chalifoux-Judge
Renee Clark
Gary E. Coleman
Jessica Collado
Alan S. Crawford
Alan M. Croft
Mark Cummins
Daniel de la Rosa
Kristie Denbrock
Michele DiMaggio
Jennifer Dobson
Theresa Dunkley-Verhage
Gery M. DuParc
Justin A. Dwyer
Ana Ebbert
Farzad Effan
Amer El-Ahraf
Alicia Enriquez Collins
Bruce M. Etchison
Julie Fernandez
Natalia Ferney
Krista T. Ferry
Mary K. Franks
Lauren Fuertes
Tiffany D. Gaertner
Heather Gallant
Desire Garcia
Jacob W. Gerke
Keenan Glover
Bernard Goldstein
Cynthia L. Goldstein
Amanda A. Gordon
Carolyn J. Gray
Joshua Greenberg
Samantha K. Hall
Theodore Harding
Kathy Hartman
Scott E. Holmes
Suzanne Howard
Daaniya Iyaz
Margo C. Jones
Gregory D. Kearney
Nola Kennedy
Anna E. Khan
Steve Konkel
Roy Kroeger
Scott Kruger
Willow E. Lake
Philip Leger
Matthew A. Lindsey
Sandra M. Long
Ann M. Loree
Jaime N. Lundblad
Patricia Mahoney
Julianne Manchester
Jason W. Marion
Jose A. Martinez
Pamela Mefford
Traci E. Michelson
Graeme Mitchell
Margarita Mogollon
Derek Monthei
Wendell A. Moore
Emily Moscufo
Bertram F. Nixon
Daniel B. Oerther
Charles S. Otto
Gil Ramon Paiz
Jessica Pankey
Noah Papagni
Michael A. Pascucilla
Stephen E. Pilkenton
Chaucer Pond
Robert W. Powitz
Laura A. Rabb
Vincent J. Radke
Larry A. Ramdin
Jeremiah Ramos
Rufus Redsell
Roger T. Reid
Jacqueline L. Reszetar
Catherine Rockwell
Luis O. Rodriguez
Jonathan P. Rubingh
Kristen Ruby-Cisneros
Kerry E. Rupp-Etling
Jeremy Rush
Michéle Samarya-Timm
Anthony Sawyer
Taylor J. Sawyer
Andrea Scales
Lea Schneider
Mario Seminara
Celine P. Servatius
Jacquelynn Shelton
Anton Shufutinsky
Tom Sidebottom
Sarah-Jean T. Snyder
Karen Solberg
James M. Speckhart
Rebecca Stephany
Martin J. Stephens
M.L. Tanner
Tonia W. Taylor
Ned Therien
Dennis Torrey
Charles D. Treser
Marilyn C. Underwood
Gail P. Vail
Richard S. Valentine
Linda Van Houten
Kennon J. Vann-Kelley
Jessica Walzer
Brian S. White
James M. White
Dawn Whiting
Lisa Whitlock
Erika Woods
Max A. Zarate-Bermudez
Linda L. Zaziski

To donate, visit neha.org/donate.

Environmental Health Department Structure: Literature Review and Recommendations

Gina Bare, RN
Alyssa Wooden, MHS
Jesse Bliss, MPH, PhD
David Dyjack, DrPH, CIH
National Environmental Health Association

Abstract **Local governmental environmental health programs play a critical role in safeguarding public health. Environmental health professionals administer a wide range of professional services, including food safety, septic systems, childhood lead poisoning prevention programs, air quality, water quality, healthy housing, and vector control. Despite the centrality of the environmental health workforce to modern life, a national standard or guidance does not exist for how local environmental health departments should be structured, staffed, and funded. This article aims to provide foundational information to support an effort to describe the characteristics of a minimum viable governmental environmental health department and provide recommendations on optimal structure, staffing, and funding.**

Introduction

Environmental health professionals are employed at local health departments (LHDs) or independent agencies throughout the U.S. They are responsible for ensuring food safety, air and water quality, and the safety of the homes and neighborhoods in which we live. Studies have shown significant associations between increased LHD activities and expenditures and decreased rates of environmental health-related diseases (Bekemeier et al., 2015; Fan et al., 2021). Despite the essential contributions of the environmental health workforce, there is an absence of national guidance for jurisdictions on the specific environmental health services that should be provided or the level of staffing or funding needed to fulfil these services. The lack of a national model makes it difficult for public health officials to justify requests for additional staffing, funding, equipment, and other resources—leaving the nation's health, safety, and financial security at risk.

Background

The environmental health profession comprises the second largest portion of the public health workforce after nursing (National Association of County and City Health Officials [NACCHO], 2020). In most cases, governmental environmental health services reflect local and state statutes, laws, and regulations. Funding for these services is largely local, generally derived from fee-for-service arrangements and supplemented by general funds and appropriations. The absence of a standardized nationwide funding scheme creates ambiguity among elected officials and decision makers when constructing an environmental health services program that reliably protects and promotes the health, safety, and economic prosperity of their communities.

Profile of Local Environmental Health Departments

Structure and Services Vary by Jurisdiction

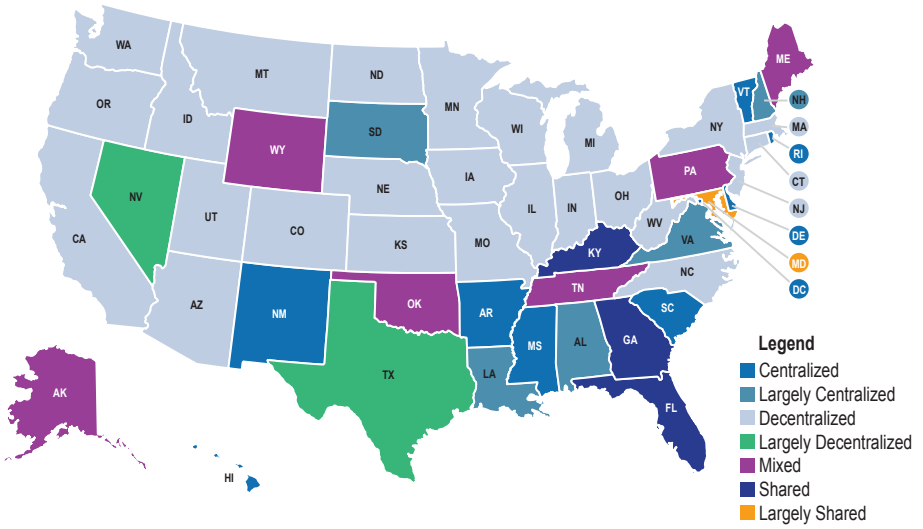
Environmental health services are provided by several distinct government agencies and private organizations working together. In 2019, 84% of LHDs had an environmental health program and 74% of LHDs employed environmental health workers (NACCHO, 2020). While the majority of environmental health programs provide a similar set of core services—including indoor air quality, environmental monitoring and epidemiology, risk assessment, water quality, and food protection—some environmental health services are more commonly provided than others. Urbanicity is a major factor in determining which services are provided, as most services are more likely to be provided by urban LHDs than those in rural areas (NACCHO, 2020).

Staffing Challenges Persist

Many LHDs are significantly understaffed (de Beaumont Foundation & Public Health National Center for Innovations, 2021). There is no clear association, however, between staffing levels and LHD performance, and staffing needs differ between LHDs depending on such factors as services provided, number of regulated facilities, population density, and population risk status (NACCHO, 2011). The Voluntary National Retail Food Regulatory Program Standards from the Food and Drug Administration (2022) specifies the funding, staffing, and equipment required for a food inspection and surveillance program. The standards call for LHDs to employ one full-time equiva-

FIGURE **1**

State and Local Health Department Governance Classification Map



Source: Tariq et al., 2019.

lent (FTE) staff member for every 280–320 retail food inspections performed, which is a helpful measure but does not address the full menu of environmental health services.

The U.S. Bureau of Labor Statistics and the National Association of County and City Health Officials (2011) found that jurisdictions employ environmental health staff at ratios of 3.65 and 3.91 FTE environmental specialists per 100,000 population, respectively. While these numbers should not be considered staffing benchmarks themselves, they suggest that LHDs with a lower environmental health worker-to-population ratio are relatively understaffed. Due of the complexity of environmental health programs, however, more research and modeling are needed to understand not only current staffing levels but also optimal staffing levels.

A 2007 survey of city and county environmental health professionals in California found some of the greatest challenges facing environmental health departments were a lack of qualified candidates and an inability to fill vacant positions. Respondents noted a need for additional employee training, especially in nontechnical areas (Dyjack et al., 2007). A 2022 needs assessment of National Environmental Health Association (NEHA, 2022) members revealed that recruitment and retention of environmental health professionals remain a professional priority.

The COVID-19 pandemic revealed additional environmental health workforce needs. Environmental health professionals have experienced increased responsibilities due to the pandemic. Furthermore, many reported a lack of sufficient staff to conduct the work needed, suggesting that there is a significant shortage of environmental health employees and limited capacity to respond to emergency situations at LHDs (NEHA, 2020).

Governance Structure Variation

The structure of a city or county health department varies widely throughout the U.S. Local health departments and independent environmental health agencies can be centralized, decentralized, mixed, or shared (Association of State and Territorial Health Officials [ASTHO], 2014; Tariq et al., 2019). In centralized states, the state or territorial health agency retains substantial authority over the activities of LHDs, and LHDs are primarily led by state employees. In comparison, in decentralized states, LHDs retain most of their authority and are led by local employees. In shared states, LHDs might be led by employees of the state or local government, and in mixed states, some LHDs are led by state employees, while others are led by local employees (ASTHO, 2014). A survey administered by NEHA found that 12 states and 5 territories operate under a centralized governance structure, 21 states have a decentralized structure, and 17 states have a mixed model (Tariq et al., 2019; Figure 1).

Funding Limitations

LHDs receive funding from federal, state, and local sources, as well as from fines, licensing fees, and inspection fees. The amount of funding from each source as a percentage of total revenue varies depending on the size of population served and the governance structure of the health department. Most of the surveyed state and local public health officials have reported that current funding structures are not sufficient to provide foundational public health services (Leider et al., 2015). In general, environmental health programs receive a greater percentage of revenue from fees and fines and a lower percentage from federal sources than other LHD programs (University of Washington, 2021). Because their funding is so heavily dependent on fees, local environmental health programs might neglect specific activities that do not generate fees and are not mandated by the state (Meit et al., 2013).

Workforce Demographics and Characteristics

The environmental health workforce includes environmental health specialists, scientists, technicians, and sanitarians. Other health department employees whose work might contribute to environmental health include administrative staff, laboratory workers, epidemiologists, and preparedness staff (ASTHO, 2014).

As part of the Understanding the Needs, Challenges, Opportunities, Vision, and Emerging Roles in Environmental Health (UNCOVER EH) initiative, the Centers for Disease Control and Prevention, NEHA, and Baylor University jointly administered a national survey to environmental health professionals to assess characteristics, demographics, practice areas, and professional satisfaction of the environmental health workforce. Key demographic findings are reported in Table 1.

These demographics suggest that the environmental health workforce is slightly less racially diverse but has a more balanced male-to-female ratio than the overall U.S. workforce. Additionally, an aging workforce

might pose a problem for the profession, with approximately one quarter of respondents planning to retire within the next 5 years (ASTHO, 2014).

Few respondents indicated that their undergraduate field of study was environmental health. As a result, many environmental health program employees may lack formal academic training in environmental health sciences, which highlights the need for continuing workforce development.

Similar trends can be found at the state level. The 2017 Public Health Workforce Interests and Needs Survey (PH WINS), which encompassed a nationally representative sample of state and local public health workers, found that the public health workforce is predominantly white, female, and over the age of 40. PH WINS also assessed future training needs and identified the top priorities for the workforce as budgeting and financial management, systems and strategic thinking, and developing a vision for a healthy community (de Beaumont Foundation et al., 2017).

Many respondents indicated that they recognize their work is important but feel they lack sufficient training and that creativity and innovation are not rewarded. The survey also found that health departments could face high turnover rates in the next 5 years. The most frequently cited reasons for leaving are pay and lack of opportunities for advancement. A 2012 ASTHO survey also indicated a high number of vacancies, which health departments might be unable to fill due to budget cuts and hiring freezes (ASTHO, 2014).

Workforce Responsibilities and Development Needs

In 2013, NEHA conducted a job task analysis (JTA) to determine required duties and tasks for Registered Environmental Health Specialists/Registered Sanitarians (REHS/RS). The JTA defines an REHS/RS as someone who "conducts inspections, investigations, and surveillance and response to environmental emergency situations to minimize illness, injury, and disease while increasing environmental public health awareness" (Professional Testing, Inc., 2020).

The current REHS/RS certification examination organizes required tasks into the following categories (Professional Testing, Inc., 2020):

TABLE **1**

Environmental Health Workforce Demographics

Demographic	Respondents (%)
Serves a population of <50,000	20
Serves a population of 50,000–1,000,000	50
Serves a population of >1,000,000	30
Identifies as White	86
Identifies as male	51
Holds a title of environmental health specialist or sanitarian	67
Is ≥46 years	54
Spends more than one half of the time working on non-environmental health programs	37

Source: Gerding et al., 2019.

A. Performing environmental health surveillance, including planning surveillance activities and collecting and analyzing data.
B. Conducting inspections, including reviewing regulations and standards, maintaining inspection equipment, and performing inspections of various facility types.
C. Conducting investigations by performing epidemiology, lead, and other environmental health investigations and verifying risk abatement.
D. Conducting compliance reviews by conducting plan reviews and determining permitting status.
E. Providing environmental health information by collaborating with stakeholders, conveying environmental health risks, and implementing emergency response preparedness plans.

Research has shown that there is a need for increased workforce development programs and initiatives within state and local health departments. An assessment by the UNCOVER EH initiative sought to identify the highest priority needs for advancing the environmental health workforce. From the assessment, Gerding et al. (2020) found that environmental health professionals lack sufficient training and development opportunities, as well as standardized qualifications, educational requirements, and credentialing. As such, formal leadership training programs would provide professionals with specialized skills and enhance the impact of environmental health programs. Moreover, standardized qualifications would provide a common identity for environmental health professionals, raise awareness of environmental health services, and increase the ability to generate evidence of the value of the environmental health profession.

Many environmental health departments do not have up-to-date equipment or technology, which can hinder the ability of environmental health professionals to conduct inspections and deliver essential services (Gerding et al., 2020). Additionally, environmental health data and management systems are inconsistent across jurisdictions, which limits the ability to identify the emergence of environmental health issues and evaluate the impact of services (Gerding et al., 2020). Furthermore, many environmental health departments report a lack of sufficient staff and a high number of vacancies; therefore, there is a need to raise awareness about the benefits of environmental health as well as generate financial and political support for the profession. Finally, health departments should form partnerships with other agencies and organizations and engage in cross-jurisdictional sharing of resources to increase capacity (Gerding et al., 2020).

Conclusion and Recommendations

Despite the importance of environmental health programs in protecting public health, there remains little standardized guidance

on how local environmental health departments should be structured, staffed, and funded. As a result, many local environmental health programs lack the ability to offer evidence-based recommendations on the staffing and resources necessary to provide essential services, which leaves communities at greater risk of environmentally caused diseases.

Based on the information in this review, the following recommendations are presented to develop a standardized local environmental health department structure:

1. Define the services and programs that environmental health departments should be structured and staffed to provide, including both required and recommended services. Equipment and technology required to carry out these services should also be identified.
2. Develop a new methodology to create staffing benchmarks that takes into account individual health department structure, setting, and provided services.
3. Establish a funding structure based on resources needed to retain sufficient staff, maintain necessary equipment and technology, and perform essential services.
4. Establish a credentialing requirement for environmental health employees.
5. Prioritize identified workforce development needs, including budgeting and financial management, systems and strategic thinking, increased leadership development opportunities, and strengthening support for the environmental health profession.
6. Identify organizations and agencies that may be interested in partnering with the environmental health department and sharing resources and personnel.

The information contained in this review consists of existing reports, studies, and surveys. Additional research in the form of interviews and surveys with local environmental health professionals from urban, rural, and frontier communities is needed to gather intelligence on the funding, staffing, and resource needs of local environmental health programs. Interviews and surveys should be used to identify a methodology for determining staffing benchmarks for environmental health departments. NEHA will use the results of this research to develop an environmental health program standard that accurately reflects the current challenges and future needs of the environmental health profession.

The activities performed by environmental health professionals—including assessment, assurance, policy development, surveillance, enforcement, and risk communication—are crucial for safeguarding community health and safety. Through this review, we aim to inform the development of an environmental health department standard that can be adopted by local health departments and independent environmental health agencies to ensure that jurisdictions are properly equipped and that residents have access to suitable environmental health services.

Corresponding Author: Gina Bare, Associate Director, Program and Partnership Development, National Environmental Health Association, 720 South Colorado Boulevard, Suite 105A, Denver, CO 80246-1910.
Email: gbare@neha.org.

References

Association of State and Territorial Health Officials. (2014). *Profile of state environmental health: Summary and analysis of workforce changes from 2010–2012*.

Bekemeier, B., Yip, M.P.-Y., Dunbar, M.D., Whitman, G., & Kwan-Gett, T. (2015). Local health department food safety and sanitation expenditures and reductions in enteric disease, 2000–2010. *American Journal of Public Health*, *105*(Suppl. 2), S345–S352. https://doi.org/10.2105/AJPH.2015.302555

de Beaumont Foundation, Association of State and Territorial Health Officials, National Association of County and City Health Officials, & Big Cities Health Coalition. (2017). 2017 *national findings: Public Health Workforce Interests and Needs Survey*. https://debeaumont.org/wp-content/uploads/2019/04/PH-WINS-2017.pdf

de Beaumont Foundation, & Public Health National Center for Innovations. (2021). *Staffing up: Workforce levels needed to provide basic public health services for all Americans* [Research brief]. https://debeaumont.org/wp-content/uploads/2021/10/Staffing-Up-FINAL.pdf

Dyjack, D.T., Case, P., Marlow, H.J., Soret, S., & Montgomery, S. (2007). California's county and city environmental health services delivery system. *Journal of Environmental Health*, *69*(8), 35–43.

Fan, D., Li, Y., Liu, W., Yue, X.-G., & Boustras, G. (2021). Weaving public health and safety nets to respond to the COVID-19 pandemic. *Safety Science*, *134*, Article 105058. https://doi.org/10.1016/j.ssci.2020.105058

Food and Drug Administration. (2022). *Voluntary National Retail Food Regulatory Program Standards—Standard 8: Program support and resources*. https://www.fda.gov/media/86864/download

Gerding, J.A., Brooks, B.W., Landeen, E., Whitehead, S., Kelly, K.R., Allen, A., Banaszynski, D., Dorshorst, M., Drager, L., Eshenaur, T., Freund, J., Inman, A., Long, S., Maloney, J., McKeever, T., Pigman, T., Rising, N., Scanlan, S., Scott, J., . . . Sarisky, J. (2020). Identifying needs for advancing the profession and workforce in environmental health. *American Journal of Public Health*, *110*(3), 288–294. https://doi.org/10.2105/AJPH.2019.305441

Gerding, J.A., Landeen, E., Kelly, K.R., Whitehead, S., Dyjack, D.T., Sarisky, J., & Brooks, B.W. (2019). Uncovering environmental health: An initial assessment of the profession's health department workforce and practice. *Journal of Environmental Health*, *81*(10), 24–33. https://www.neha.org/workforce-and-practice-assessment

Leider, J.P., Juliano, C., Castrucci, B.C., Beitsch, L.M., Dilley, A., Nelson, R., Kaiman, S., & Sprague, J.B. (2015). Practitioner perspectives on foundational capabilities. *Journal of Public Health Management and Practice*, *21*(4), 325–335. https://doi.org/10.1097/PHH.0000000000000189

Meit, M., Knudson, A., Dickman, I., Brown, A., Hernandez, N., & Kronstadt, J. (2013). *An examination of public health financing in the United States: Final report*. NORC at the University of Chicago.

continued on page 32

References *continued from page 31*

https://www.norc.org/PDFs/PH%20Financing%20Report%20-%20Final.pdf

National Association of County and City Health Officials. (2011). *Local public health workforce benchmarks*. https://www.naccho.org/uploads/downloadable-resources/local-public-health-workforce-staffing-benchmarks.pdf

National Association of County and City Health Officials. (2020). *2019 national profile of local health departments*. https://www.naccho.org/uploads/downloadable-resources/Programs/Public-Health-Infrastructure/NACCHO_2019_Profile_final.pdf

National Environmental Health Association. (2020). *COVID-19 environmental health workforce needs assessment II report*. https://emergency-neha.org/covid19/wp-content/uploads/2020/11/COVID-19-EH-Workforce-Needs-Assessment-II-Report.pdf

National Environmental Health Association. (2022). *Understanding the needs of our members: Findings from the 2022 membership survey*. https://www.neha.org/Images/resources/Member%20Questionnaire%20Summary.pdf

Professional Testing, Inc. (2020). *Job/task analysis (JTA) for National Environmental Health Association (NEHA): Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS)* [Internal document].

Tariq, R., Jaramillo, D., & Dyjack, D.T. (2019). Environmental health systems and delivery of services in the United States and its territories. *Journal of Environmental Health*, *82*(5), 22–27.

University of Washington, School of Nursing. (2021). *Public Health Activities & Services Tracking: Uniform chart of accounts main dash board*. https://phastdata.org/viz/coa-dashboard

SUPPORT THE **NEHA ENDOWMENT FOUNDATION**

National Environmental Health Association

Our Endowment Foundation was created to allow us to do more for the environmental health profession than our annual budget might allow. Donations are used for the sole purpose of advancing the profession and its practitioners.

Thank you to our donors!

This list represents all donations made to the Endowment Foundation in the last 12 months as of press time. It does not include amounts pledged.

DELEGATE CLUB
($1–$99)

Thomas Abbott
Erick Aguilar
Tunde M. Akinmoladun
Drake Amundson
Steven K. Ault
Paul Bartlett
Logan Blank
Jeffrey M. Brasel
Glenn W. Bryant
Andrea Carrillo-Mogollon
Alan S. Crawford
Mark Cummings
Bonnie Czander
Daniel de la Rosa
Phyllis Dickens
Carol J. Drury
Theresa Dunkley-Verhage
Gery M. DuParc
Mina Emamy
Bruce M. Etchison
Krista T. Ferry
Mary K. Franks
Keith Frey
Desire Garcia
Monica Garcia
Jacob W. Gerke
Keenan Glover
Cynthia L. Goldstein
Dolores Gough
Monica V. Grezzi
Karen Gulley
Dianne Harvell
Catherine Hefferin
Steven Hernandez
Jessica Hicks-Brown
Scott E. Holmes
Kurt Johnson
Margo C. Jones
Gail Joseph
Leila Judd
Zachary Kane
Gregory D. Kearney
Nola Kennedy
Theodore J. Koenig
Richard Lavin
Allan R. Levesque
Matthew A. Lindsey
Jaime N. Lundblad
Patricia Mahoney
Patrick J. Maloney
Jose A. Martinez
Joseph W. Matthews
Ralph M Matthews
Pamela Mefferd
Lucas Meiller
Peter M. Mirandi
Dominique Mitial
Derek Monthei
Johany D. Negron Bird
Daniel B. Oerther
Christopher B. Olson
Gregory S. Padgett
Michael A. Pascucilla
Jeffrey A. Priebe
Michael K. Pyle
Rosanna Y. Rabago
Jeremiah Ramos
Homan Razeghi
Leejay Robles
Catherine Rockwell
Luis O. Rodriguez
John Rothenbuhler
Kerry E. Rupp-Etling
Anthony Sawyer
Taylor J. Sawyer
Anton Shufutinsky
Dennis Torrey
William Toscano
Marilyn C. Underwood
James M. White

HONORARY MEMBERS CLUB
($100–$499)

Kimberley Carlton
Deborah Carpenter
Kenneth C. Danielson
Michele DiMaggio
Raymond E. Glos
Gwendolyn R. Johnson
Soheila Khaila
Robert W. Landry
Philip Leger
Sandra M. Long
Ann M. Loree
Wendell A. Moore
Victoria A. Murray
Susan V. Parris
Larry A. Ramdin
Jacqueline L. Reszetar
Jonathan P. Rubingh
Michéle Samarya-Timm
Mario Seminara
Tonia W. Taylor
Linda Van Houten
Sandra Whitehead
Lisa Whitlock

21st CENTURY CLUB
($500–$999)

D. Gary Brown
Bette J. Packer

SUSTAINING MEMBERS CLUB
($1,000–$2,499)

James J. Balsamo, Jr.
Thomas J. Butts
Brian K. Collins
Peter M. Schmitt
James M. Speckhart
Ned Therien

AFFILIATES CLUB
($2,500–$4,999)

David T. Dyjack
Timothy N. Hatch

EXECUTIVE CLUB AND ABOVE
(>$5,000)

Vincent J. Radke

Make your contribution to the practice at neha.org/donate.

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

Visit **www.nsf.org/regulatory** to submit inquiries,
request copies of NSF standards or join the regulatory mailing list.

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

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES

Chad Curtiss

Equipping Educators to Empower Students With a Tracking Education Kit

Editor's Note: The National Environmental Health Association 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 this column on environmental health services from the Centers for Disease Control and Prevention (CDC) in every issue of the *Journal*.

In these columns, authors from CDC's Water, Food, and Environmental Health Services Branch, as well as guest authors, will share tools, resources, and guidance for environmental health practitioners. The conclusions in these columns are those of the author(s) and do not necessarily represent the official position of CDC.

Chad Curtiss is an Oak Ridge Institute for Science and Education (ORISE) fellow with the CDC National Environmental Public Health Tracking Program. He works to accelerate public health workforce development within the Tracking Program for educators and public health practitioners.

A survey from 2019 found that one in four environmental health professionals are older than 55 years and furthermore, one in four environmental health professionals planned to retire within 5 years (Gerding et al., 2019). Those findings reveal serious recruitment needs within the environmental health workforce. In addition, the public health landscape continues to evolve, with technological improvements in data collection, analysis, visualization, and dissemination. New environmental public health professionals must be equipped with the most current and best resources to help them succeed in their jobs. Educating new environmental health professionals starts at the undergraduate level. It continues through graduate studies and beyond, and the Environmental Public Health Tracking Program (Tracking Program) within the Centers for Disease Control and Prevention is ready with timely and practical resources for this growing area of need.

Public Health Educator Goals and Responsibilities to Prepare Students

Public health educators in universities and colleges are crucial in providing essential public health knowledge to students. As they prepare students for the workforce, they are responsible for covering a wide range of topics and tools as part of their course delivery. Their instruction is instrumental in guiding student understanding of environmental health topics such as environmental justice, climate and health, air and water quality, and environmental hazards. Addressing the breadth of topics requires time to plan and awareness of relevant resources—challenges that many educators face.

The Tracking Program provides publicly accessible resources educators can use to support common environmental health activities such as:

- Monitoring community health.
- Identifying people who live or work in settings that put them at greater risk from exposure to hazards.
- Conducting epidemiological studies.
- Planning and applying prevention activities.
- Sharing information with communities.
- Informing city or state planning and health policies.

Tracking Program Resources for Educators

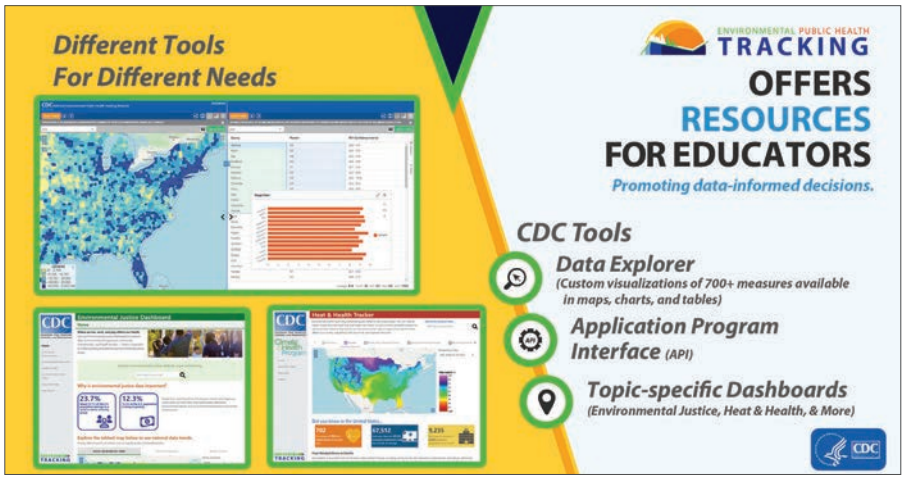
The Tracking Program recognizes that it is not enough to just have data. It is equally important to deliver these data in a variety of ways to serve the different needs of users and inform research and decision making at local, state, and national levels.

The Tracking Program provides powerful public health data and visualization tools that can help educators and their students better characterize public health issues of interest. The tools enable students to explore data connections between people who live in locations that put them at greater risk of being exposed to hazards, environmental factors, and diseases. The tools also provide links to information about the selected data and to all Tracking Program content areas, indicators, data, and associated information.

Educators will benefit from the Tracking Program data visualization resources that can be used to develop lesson plans. Students can use Tracking Program data to better include data-informed connections in their work.

FIGURE **1**

National Environmental Public Health Tracking Program Tools From the Centers for Disease Control and Prevention (CDC)



Essential Tracking Program tools (Figure 1) that can be used in the environmental health workforce include the following:

- Data Explorer
- Dashboards
- Application program interface (API).

The interactive Data Explorer (www.cdc.gov/ephtracking) has more than 700 environmental and health data measures from more than 90 sources. Students can explore choropleth maps (i.e., a type of statistical thematic map that uses color to show how data changes from place to place) to evaluate specific data side-by-side with other maps. They can analyze trends and issues that involve a variety of health conditions, including asthma, heart disease, and diabetes. Students can also view these data in charts and tables that can be downloaded for further analysis. With some simple coding, users can export and embed any Data Explorer map, chart, or table into their own website.

The Tracking Program also offers interactive dashboards that can be tailored to a specific community. The dashboards provide additional context to the data, such as text or infographics, to help with data literacy and provide a better understanding of the data.

All the data available on the Tracking Network can be accessed by an API, which supports creation of apps or websites. In fact, the Tracking Network uses its own API to feed data from the Data Explorer into the dashboards to ensure that the latest data are always available.

Learn About the Tracking Education Kit

The Tracking Program aims to connect environmental and health information in one place, making it accessible to anyone and easy to share. Tools are only effective, however, when they are known and used. To that end, the developing workforce must recognize and learn how to benefit from Tracking Program tools, which begins with education.

To support educator curriculum development, inform student educational needs, and demonstrate how Tracking Program tools are helpful, the Tracking Program created the Tracking Education Kit. The kit is a collection of instructor lesson resources featuring PowerPoint slides, an assignment bank, a questions bank, an assignment bank navigator, and an instructor guide.

To create a robust kit that would serve college-level educators, the Tracking Program formed an academic advisory group. Feedback from the academic advisory group was instrumental in shaping the development of the kit. The academic advisory group is made up of five members from three universities: Emory University Rollins School of Public Health, Georgia State University School of Public Health, and Rutgers University School of Public Health. Based on input from the

What Is in the Tracking Education Kit?

PowerPoint Slides: The slides are separated into independent sets by topic to allow educators flexibility in choosing which information to highlight. The slides give an overview of the National Environmental Public Health Tracking Program (Tracking Program) and introduce the Data Explorer, Environmental Justice Dashboard, Heat & Health Tracker, Melanoma Dashboard, and the application program interface (API). The slides also cover topics such as emergency preparedness and where to find more information about tracking.

Questions Bank: The questions bank includes questions with answers based on information in the presentation slides. The questions can be added to an exam, quiz, or knowledge check.

Assignment Bank: The assignment bank provides more than 30 assignments that guide users through the practical application of Tracking Program tools and resources. Many assignments feature additional instructions on conducting an in-person or virtual class activity and include prompts for discussion posts. The activities and prompts can be completed alongside the main assignment or as an independent class activity.

Supporting Resources:

- Assignment Bank Navigator: The assignment bank navigator helps educators explore assignments in the assignment bank. It organizes assignments by 14 Council on Education for Public Health competencies, 8 domains, and 10 learning objectives across undergraduate- and graduate-level courses. It specifies whether an assignment includes an in-person or virtual activity; contains a discussion prompt; and is for a group, an individual, or both.
- Instructor Guide: The instructor guide helps educators become familiar with Tracking Program resources and provides guidance on navigating and integrating content from the Tracking Education Kit into existing course content.

advisory group, the Tracking Education Kit is designed to fulfill standards set by the Council on Education for Public Health for undergraduate- and graduate-level courses. Additionally, the content includes assignments for in-person and virtual settings.

Request Access to the Tracking Education Kit

The Tracking Education Kit is available by request beginning in mid-2023. To learn more or request the kit, email: trackingsupport@cdc.gov.

Corresponding Author: Chad Curtiss, Oak Ridge Institute for Science and Education (ORISE) Fellow, National Center for Environmental Health/Agency for Toxic Substances and Disease Registry, Centers for Disease Control and Prevention.
Email: ccurtiss@cdc.gov.

Reference

Gerding, J.A., Landeen, E., Kelly, K.R., Whitehead, S., Dyjack, D.T., Sarisky, J., & Brooks, B.W. (2019). Uncovering environmental health: An initial assessment of the profession's health department workforce and practice. *Journal of Environmental Health*, *81*(10), 24–33. https://www.neha.org/workforce-and-practice-assessment

DIRECT FROM ecoAmeria *continued from page 39*

air conditioning prevalence. *Journal of Urban Health*, *82*(2), 191–197. https://doi.org/10.1093/jurban/jti043

Pagán-Santana, M., Liebman, A.K., & Seda, C.H. (2023). Deepening the divide: Health inequities and climate change among farmworkers. *Journal of Agromedicine*, *28*(1), 57–60. https://doi.org/10.1080/1059924X.2022.2148034

Parks, R.M., Bennett, J.E., Tamura-Wicks, H., Kontis, V., Toumi, R., Danaei, G., & Ezzati, M. (2020). Anomalously warm temperatures are associated with increased injury deaths. *Nature Medicine*, *26*, 65–70. https://doi.org/10.1038/s41591-019-0721-y

Stevens, H., & Samenow, J. (2022, September 13). Maps show where extreme heat shattered 7,000 records this summer. *The Washington Post*. https://www.washingtonpost.com/climate-environment/interactive/2022/temperature-records-summer/

U.S. Department of Labor, Occupational Safety and Health Administration. (2021). *Heat illness prevention in outdoor and indoor work settings*. https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202104&RIN=1218-AD39

World Health Organization. (2018). *Heat and health*. https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health

326756-B

Healthy land, healthy people.

Get certified in Environmental Health and Land Reuse and help build a healthier community. Visit neha.org/ehlr.

ATSDR

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Elevate Your Standards

Standard Methods for the Examination of Water and Wastewater, 24th Edition

Published by the American Public Health Association, American Water Works Association, and Water Environment Federation, *Standard Methods* is the culmination of thousands of hours of volunteer effort by experts in the field of environmental water analysis.

24th edition updates include:

- **45 new or updated methods across Part 9000 Microbiological Examination**
- **11 new or updated methods in Part 4000 Inorganic Nonmetallic Constituents**
- **10 new or updated methods across Part 7000 Radioactivity**
- **4 new sections (9750 *Naegleria fowleri*; 4500-H_2O_2 Hydrogen Peroxide; 4500-PAA Peracetic Acid; 10110 Algal Toxin Analysis: MC and NOD)**
- **82 new or updated methods**

Available in print and digital editions. Plus, subscribe to Standard Methods Online to access methods anywhere, anytime.

Learn more and purchase:
www.standardmethods.org

APHA
AMERICAN PUBLIC HEALTH ASSOCIATION
For science. For action. For health.

American Water Works Association

Water Environment Federation®
the water quality people®
www.wef.org

DIRECT FROM ecoAmerica

Ben Fulgencio-Turner, MPP, CPH

Nicole Hill, MPH

Staying Cool in a Changing Climate: Caring for Health in Extreme Heat

Editor's Note: The National Environmental Health Association (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 this column from ecoAmerica whose mission is to build public support and political resolve for climate solutions. NEHA is an official partner of ecoAmerica and works closely with their Climate for Health Program, a coalition of health leaders committed to caring for our climate to care for our health. The conclusions in this column are those of the author(s) and do not necessarily represent the official position of NEHA.

Ben Fulgencio-Turner is the director of Climate for Health within ecoAmerica. Nicole Hill is the research and marketing manager for ecoAmerica.

As we enter into the warmest months of the year, it is good to remind ourselves that environmental health professionals play a vital role in protecting public health from the hazards of heat, which are increasing due to climate change. Likewise, we must remember that to safeguard the general public, the environmental health workforce needs to protect itself from these very same threats.

To date, climate change has increased global temperatures about 1.8 °F on average (Eltahir & Krol, 2022). What this change translates to is not just a mere increase in global temperature—it also increases the frequency of extreme heat days (Intergovernmental Panel on Climate Change, 2021). The Intergovernmental Panel on Climate Change (2021) reports that extreme temperature events that previously would occur only once every 10 years are now 2.8 times more frequent due to global temperature increase.

People are feeling these effects as cities across the country are experiencing hotter summers, including not only hotter days but also many more of them. In 2022 alone, over 7,000 daily temperature records were broken in the U.S. (Stevens & Samenow, 2022). According to the World Health Organization (2018), the number of people exposed to heat waves globally increased by 125 million between 2000 and 2016.

In the U.S., heat is now the number one cause of weather-related death (National Weather Service, 2021). When people are exposed to extreme heat, they can lose control of their internal temperature, which can result in short-term but dangerous symptoms such as heat cramps, exhaustion, heatstroke, and hyperthermia (National Institute of Environmental Health Sciences [NIEHS], 2022). Furthermore, preexisting chronic conditions—including cardiovascular disease, respiratory disease, cerebrovascular disease, and conditions connected to diabetes—can be worsened by extreme heat (NIEHS, 2022). A study by Parks et al. (2020) found that unusually warm years are associated with an increase in injury-related deaths such as drowning, transport, assault, and suicide.

Temperature alone is not the only impact of extreme heat. Climate change also influences humidity levels (Eltahir & Krol, 2022). When there is a high saturation of moisture in the air, our bodies are not able to cool down through the evaporation of sweat as they normally would, which makes it difficult to regulate our internal temperature and exacerbates or hastens the health impacts previously mentioned (Eltahir & Krol, 2022).

Some individuals in our communities are at more risk than others, including people older than 65 years who are at risk due to the likelihood of having a chronic medical condition that can impact the body's natural response to heat (Centers for Disease Control and Prevention, 2020). People who do not have access to cooling are another affected group. On average, Black households have 50% less access to central air conditioning than White households while experiencing higher heat-related mortality rates (O'Neil, 2005). Discriminatory housing policies such as redlining have put people of color at higher risk of heat exposure. Hoffman et al. (2020) found that formerly redlined neighborhoods are on average 2.6 °C (36.7 °F) hotter than non-redlined neighborhoods. Children are also at risk due to physical characteristics such as not producing sweat as quickly and because they are more reliant on adults to access cool areas (Huetteman, 2022).

There are many other individuals that are also at higher risk of heat-related health

impact, including environmental health professionals, especially if they work outdoors. According to the Occupational Safety and Health Administration (OSHA), heat stress resulted in 815 worker deaths nationally between 1992 and 2017 and seriously injured more than 70,000 workers (U.S. Department of Labor, 2021). Black and Hispanic outdoor workers are at higher risk of heat-related fatality (Gubernot et al., 2015). Because the environmental health workforce is vast—and includes outdoor workers such as sanitation workers, industrial hygienists, OSHA compliance specialists, and beyond—the workforce must protect its own employees as it works to protect the health of the public.

So, what can environmental health professionals do? One of the most important things to do is be aware of extreme heat. The National Integrated Heat Health Information System maintains HEAT.gov with updates on current conditions and risks, as well as phone apps to track exposure to extreme heat in real time. Further, the U.S. Department of Homeland Security also offers clear information and best practices for preparedness at www.ready.gov/heat. These tools can be lifesavers.

Outdoor workers should expect safe working conditions, with rest and shade breaks and proper hydration based on federal recommendations (Field Sanitation, 2023). Since many outdoor workers may feel disempowered due to language access, immigration status, or perceived value to employers (Pagán-Santana et al., 2023), it is even more important for environmental health professionals to set an example and actively advocate for these standards of safety.

Health centers can also prepare for the increased frequency of extreme heat events. The Climate Resilience for Frontline Clinics Toolkit offers tools to prepare for and manage extreme heat (Americares, 2023). The tool kit includes 1-page flyers for patients with a variety of risk factors, care plans for clinicians, and preparation guidance for health facilities. This tool can be shared with environmental health colleagues in these roles as temperatures rise.

Through all of these actions to prepare for and manage the risks of heat and other impacts of a changing climate, speaking with colleagues and the community on the topics remains incredibly important. Many people recognize the heatwave–climate change connection but fewer than two fifths of people in the U.S. say heat waves make them concerned about the issue. In 2022, 61% said they associated heat waves with climate change, more than any other climate-related impact (ecoAmerica, 2022). And people are seeing the impact—in 2021, 79% of people in the U.S. said they noticed more extreme heat over the past few years (ecoAmerica, 2021).

Even still, environmental health professionals know that the public needs assistance with preparing for and responding to these impacts. The good news is that ecoAmerica offers the Climate for Health Ambassador Program and 5 Steps to Effective Climate Communication to help build confidence in communicating on climate action in a productive and positive way (Climate for Health, 2022, ecoAmerica, 2023). Environmental health voices matter and can make a significant difference in shifting awareness, attitudes, and behavior toward health.

As heat ramps up this summer, join environmental health professionals across the nation in speaking about the health-related impacts of a changing climate, exploring what can be done to protect health, and taking action on solutions. We can all take steps to make a big difference!

Corresponding Author: Nicole Hill, Research and Marketing Manager, ecoAmerica, 1730 Rhode Island Avenue NW, Suite 200, Washington, DC 20036.
Email: nicoleh@ecoamerica.org.

References

Americares. (2023). *The risk: Climate crisis*. https://www.americares.org/what-we-do/community-health/climate-resilient-health-clinics/

Centers for Disease Control and Prevention. (2020). *CDC WONDER: About multiple cause of death, 1999–2020*. http://wonder.cdc.gov/mcd-icd10.html

Climate for Health. (2022). *Ambassador training: Climate for Health Ambassadors*. ecoAmerica. https://climateforhealth.org/ambassadors-training/

ecoAmerica. (2021). *American Climate Perspectives: Severe weather drives climate concerns* (Vol. IV). https://ecoamerica.org/wp-content/uploads/2021/08/acps-2021-vol-iv-severe-weather.pdf

ecoAmerica. (2022). *American Climate Perspectives: Are Americans making the health and climate connection?* (Vol. II, Part I). https://ecoamerica.org/wp-content/uploads/2022/05/acps-2022-vol-ii-part-i-final.pdf

ecoAmerica. (2023). *5 steps to effective climate communication*. https://ecoamerica.org/climate-action-sheet/5-steps-to-effective-climate-communication/

Eltahir, E., & Krol, A. (2022). *Extreme heat*. MIT Climate Portal. https://climate.mit.edu/explainers/extreme-heat

Field Sanitation, 29 C.F.R. § 1928.110 (2023). https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1928/subpart-I/section-1928.110

Gubernot, D.M., Anderson, G.B., & Hunting, K.L. (2015). Characterizing occupational heat-related mortality in the United States, 2000–2010: An analysis using the census of fatal occupational injuries database. *American Journal of Industrial Medicine*, *58*(2), 203–211. https://doi.org/10.1002/ajim.22381

Hoffman, J.S., Shandas, V., & Pendleton, N. (2020). The effects of historical housing policies on resident exposure to intra-urban heat: A study of 108 US urban areas. *Climate*, *8*(1), Article 12. https://doi.org/10.3390/cli8010012

Huetteman, E. (2022, August 4). 'Children are not little adults' and need special protection during heat waves. *KFF Health News*. https://kffhealthnews.org/news/article/children-heat-wave-risk-heatstroke/

Intergovernmental Panel on Climate Change. (2021). *Climate change 2021: The physical science basis. Working Group 1 contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf

National Institute of Environmental Health Sciences. (2022). *Temperature-related death and illness: Climate change and human health*. https://www.niehs.nih.gov/research/programs/climatechange/health_impacts/heat/

National Weather Service. (2021). *Weather related fatality and injury statistics*. https://www.weather.gov/hazstat/

O'Neill, M.S., Zanobetti, A., & Schwartz, J. (2005). Disparities by race in heat-related mortality in four US cities: The role of

continued on page 36

SPOTLIGHT ON SUCCESS STORIES FROM THE FIELD

Active Managerial Control: Implementation and Insights

Olivia Alexander-Leeder, MS

Mia Gzebb

Environmental Health Services, Washoe County Health District

Editor's Note: The National Environmental Health Association (NEHA) strives to provide relevant and useful information through the pages of the *Journal* for environmental health professionals. In a recent membership survey, we heard your request for information that spotlights successful environmental health programs across the different areas of environmental health and from different sectors of the profession. We listened and are pleased to introduce a new column that shines a spotlight on success stories from the environmental health field. These stories enable us to learn from our peers and provide an avenue to incorporate successful programs, innovative solutions, and unique approaches to our own programs and initiatives.

The conclusions of this column are those of the author(s) and do not necessarily represent the views or official position of NEHA, our funders, or our partners.

Olivia Alexander-Leeder is an environmental health specialist within the Food Safety and Consumer Protection Program/HACCP Review and Program Standards Subprogram of Environmental Health Services at Washoe County Health District. Mia Gzebb is an environmental health specialist within the Food Safety and Consumer Protection Program/Special Events and Foodborne Disease Subprogram of Environmental Health Services at Washoe County Health District.

Across the U.S., environmental health agencies are navigating mounting workloads and competing priorities. As part of the trend across public health fields, many environmental health agencies are understaffed and forced to either cut back on services or devise increasingly creative programs to address community needs (Leider et al., 2023). For food safety departments, active managerial control (AMC) programs are a practical and proactive approach to support widespread food safety practices with limited staff and resources. AMC is the "purposeful incorporation of specific actions or procedures by industry management to attain control over foodborne illness risk factors" (Food and Drug Administration [FDA], 2023a). AMC programs facilitate better food safety outcomes by providing the necessary information and tools for food establishment operators to achieve AMC.

In 2022, Environmental Health Services within the Washoe County Health District (WCHD) in Northern Nevada received a 3-year National Environmental Health Association (NEHA)–Food and Drug Administration (FDA) Retail Flexible Funding Model grant to fund the implementation of an AMC program. The success achieved by the WCHD Food Safety and Consumer Protection Program during the first year of the grant period encompassed gathering information and building the crucial components of an AMC program. WCHD will begin offering the AMC program starting in July 2023. Implementation of AMC programs can vary among jurisdiction; however, sharing the experiences of WCHD might help guide other jurisdictions through the process.

In spring 2022, members of the WCHD Food Safety and Consumer Protection Program visited the Maricopa County Environmental Services Department (MCESD) to learn from their experience implementing an AMC program. The broad success of the AMC program offered by MCESD contributed to the department receiving the 2018 Samuel J. Crumbine Consumer Protection Award for Excellence in Food Protection (Shapiro, 2018). WCHD staff were able to attend an AMC class, share and review guidance documents and standard operating procedures, and ask questions on lessons learned

Image © Adobe Stock: auremar.

by MCESD to inform a clear and compelling vision for its own program to be instituted in Washoe County.

Results of a self-assessment conducted in 2021 for the Voluntary National Retail Food Regulatory Program Standards (FDA, 2023b) determined that WCHD does not possess adequate resources to enact its proposed compliance strategy of providing on-site food safety training to operators outside of the corrective actions required during routine inspections. Akin to many jurisdictions nationwide, the food safety enforcement policy at WCHD embodied the historically reactive nature of food safety regulation. Washoe County food establishments with multiple and/or repeat critical violations observed during routine inspections are subject to reinspection. If additional reinspections are warranted, each is associated with a fee to be paid by the food establishment operator. Despite sporadic success in reducing observed violations, the inspection and reinspection enforcement cycles introduce a wide margin of opportunity for foodborne illnesses to occur due to underemphasizing the development of preventive food safety policies and long-term compliance with regulations (FDA, 2023a). Identifying the simultaneous need for a more efficient use of agency resources and proactive approaches to achieving compliance guided WCHD's development of AMC program components that ensure success.

Modeled after MCESD, the AMC program for WCHD (2023) is comprised of a training course and online toolbox geared toward establishment managers or those individuals with the ability to enact change in a facility. When used in conjunction, the AMC training course and toolbox provide instruction and resources for creating meaningful food safety management systems—called AMC policies—that lead to sustained AMC. In an analysis conducted by FDA (2018), food establishments with well-developed food safety management systems were associated with fewer risk factor violations than those establishments with underdeveloped food safety management systems. Well-developed and effective food safety management systems generally consist of detailed food safety procedures, along with consistent training and monitoring practices (Brown, 2021).

The AMC program training course instructs establishment operators on use of the procedures, training, and monitoring structure to create AMC policies that are specific to their facilities. AMC toolbox materials and worksheets—including an editable policy template and sample policy language—guide operators through the procedures, training, and monitoring structure, further empowering operator confidence in developing AMC policies. As a whole, the AMC program is designed to support AMC policies developed by managers that are informed by input from staff stakeholders, specific to operations of the facility, and adaptable to change as necessary (Maricopa County Environmental Services Department, n.d.). Through facilitating policy development, AMC programs support operators in taking responsibility for long-term AMC and creating a culture of food safety at their establishments.

By empowering operators to attain AMC, the AMC program is structured to interrupt a reactive enforcement cycle through program enrollment as an alternative to paying reinspection fees and as an extension of time to implement new policies before the facility's next inspection. Overall, MCESD reported a 41% decrease in enforcement actions taken following the institution of their AMC program. This result indicates preventative actions as not only a more successful compliance strategy but also a more efficient use of department resources (Shapiro, 2018). The county resources saved by reducing the number of reinspections per establishment can be allocated to a risk-based frequency of routine inspections, which are more comprehensive and more efficient in responding to violations (Leinwand et al., 2017).

Aside from the proactive protection of public health and improved efficiency of environmental health agency resources, AMC program implementation can have significant collateral benefits for communities and business owners, which are important when considering public support of the program. WCHD inspects approximately 3,500 food establishments annually, a number that continues to increase alongside the thriving food culture of the area. AMC program implementation supports the unique qualities of the community, such as local business ownership and diverse food offerings. Incorporation of the AMC program in enforcement policy provides a more financially accessible and feasible solution for operators of nonchain establishments who are typically not supported by the same internal food safety protocols and economies of scale associated with chain establishments (Leinwand et al., 2017).

By offering AMC program training courses and toolbox materials in languages other than English, AMC policies can encompass cultural food practices that might not be otherwise captured and can improve public health equity across jurisdictional demographics. Like most of the country, food establishments in Washoe County have felt the financial pressure of rising food costs.

Food waste data indicate that, when combined, the food service and food retail sectors accounted for 60% of food waste generated by the U.S. in 2019, amounting to a massive financial burden for business owners within these sectors (U.S. Environmental Protection Agency, 2023). Successful AMC policies can reduce food waste through proper food storage, prevention of contamination, and proper food handling—practices that are beneficial to consumers and businesses.

Implementing a new regulatory program can be a daunting task when confronted with limited staff and agency resources. In the first year of AMC program implementation, WCHD's experience has been greatly aided by sharing information with other jurisdictions regarding established programs, matching possible program outcomes with agency needs, and embracing the unique qualities of the community. It is the intention of WCHD that these insights spur confident first steps for jurisdictions that are starting to implement AMC programs.

Corresponding Author: Olivia Alexander-Leeder, Environmental Health Specialist, Food Safety and Consumer Protection Program, HACCP Review and Program Standards Subprogram, Environmental Health Services, Washoe County Health District, 1001 East 9th Street, Building B, Reno, NV 89512.
Email: oalexander@washoecounty.gov.

References

Brown, L. (2021). Using data to improve practice: Looking back on 20 years of restaurant food safety research. *Journal of Environmental Health*, *83*(7), 40–42. https://neha.org/sites/default/files/jeh/JEH3.21-Column-Direct-From-CDC-EHS.pdf

Food and Drug Administration. (2018). *Technical report: FDA report on the occurrence of foodborne illness risk factors in fast food and full-service restaurants (2013–2014)*. https://www.fda.gov/media/117509/download

Food and Drug Administration. (2023a). *2022 Food Code*. U.S. Department of Health and Human Services, Food and Drug Administration, U.S. Public Health Service. https://www.fda.gov/media/164194/download

Food and Drug Administration. (2023b). *Voluntary National Retail Food Regulatory Program Standards*. https://www.fda.gov/food/retail-food-protection/voluntary-national-retail-food-regulatory-program-standards

Leider, J.P., McCullough, J.M., Singh, S.R., Sieger, A., Robins, M., Fisher, J.S., Kuehnert, P., & Castrucci, B.C. (2023). Staffing up and sustaining the public health workforce. *Journal of Public Health Management and Practice*, *29*(3), E100–E107. https://doi.org/10.1097/PHH.0000000000001614

Leinwand, S.E., Glanz, K., Keenan, B.T., & Branas, C.C. (2017). Inspection frequency, sociodemographic factors, and food safety violations in chain and non-chain restaurants, Philadelphia, Pennsylvania, 2013–2014. *Public Health Reports*, *132*(2), 180–187. https://doi.org/10.1177/0033354916687741

Maricopa County Environmental Services Department. (n.d.). *A retail food service manager's guide: Active managerial control—Why you should consider active managerial control to manage food safety risk*. https://www.maricopa.gov/DocumentCenter/View/32061/AMC-Overview-Guidance-PDF

Shapiro, M. (2018, September 4). 2018 Crumbine Award: A collaborative food safety effort. *NACCHO Voice*. https://www.naccho.org/blog/articles/2018-crumbine-award-a-collaborative-food-safety-effort

U.S. Environmental Protection Agency. (2023). *2019 Wasted Food Report: Estimates of generation and management of wasted food in the United States in 2019* (EPA 530-R-23-005). https://www.epa.gov/system/files/documents/2023-03/2019%20Wasted%20Food%20Report_508_opt_ec.pdf

Washoe County Health District, Environmental Health Services. (2023). *Active Managerial Control (AMC) Program*. https://www.washoecounty.gov/health/programs-and-services/environmental-health/food-protection-services/AMC%20Program%20.php

Do you have a success story to share with our readership? We are looking for stories that highlight successes across all areas of environmental health—from air quality to zoonoses—that represent the different sectors of our profession. If interested, please contact Kristen Ruby-Cisneros at kruby@neha.org for column guidelines.

Show them you are an expert.
You are dedicated to environmental health. Earn the **Registered Environmental Health Specialist/ Registered Sanitarian (REHS/RS)** credential to let your community and employer know just how much. The REHS/RS credential is the gold standard in environmental health.
Learn the requirements:
neha.org/rehs-rs-credential
neha National Environmental Health Association

Accela
THE HEART OF GOVERNMENT

We know Environmental Health

And we can show you at the NEHA 2023 AEC!

Accela's software empowers environmental health professionals to focus on the purpose of their work, not the pressures. Come by our **booth 305** and visit with Darryl, Diana, and Matt. We'll share our expertise on how you can modernize your processes.

Accela is proud to sponsor the AEC's Technology Educational Track to support the continued advancement of technology in the environmental health practice. Visit accela.com/eh

Your Ad Here

- **20,000+ readers**
- **Delivered directly to email inboxes**
- **Clickable and trackable links**

Contact sales@neha.org or 303-802-2133

neha
National Environmental Health Association

ENVIRONMENTAL HEALTH **CALENDAR**

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCES

July 31–August 3, 2023: NEHA 2023 Annual Educational Conference & Exhibition, Hilton New Orleans Riverside, New Orleans, LA, https://www.neha.org/aec

July 15–18, 2024: NEHA 2024 Annual Educational Conference & Exhibition, David L. Lawrence Convention Center, Pittsburgh, PA

NEHA AFFILIATE AND REGIONAL LISTINGS

Colorado
October 11–13, 2023: 67th Annual Education Conference, Colorado Environmental Health Association, Estes Park, CO, https://ceha49.wildapricot.org

Florida
October 1–7, 2023: 75th Annual Education Meeting (AEM), Florida Environmental Health Association, Crystal River, FL, https://feha.org

Georgia
September 20–22, 2023: 77th Interstate Environmental Health Summit in Conjunction With the GEHA Annual Educational Conference, Georgia Environmental Health Association (GEHA), Jekyll Island, GA, https://geha-online.wildapricot.org

Illinois
November 8–9, 2023: Annual Educational Conference, Illinois Environmental Health Association, Oglesby, IL, https://www.iehaonline.org

Indiana
September 24–27, 2023: Fall Educational Conference, Indiana Environmental Health Association, Muncie, IN, https://www.iehaind.org

Nebraska
October 24, 2023: Annual Education Conference, Nebraska Environmental Health Association, Mahoney State Park, NE, https://www.nebraskaneha.com

North Carolina
September 27–29, 2023: Fall Educational Conference, North Carolina Public Health Association, Concord, NC, https://ncpha.memberclicks.net

North Dakota
October 17–19, 2023: NDEHA–NCAFDO–Region 4 NEHA Regional Education Conference, North Dakota Environmental Health Association (NDEHA), North Central Association of Food and Drug Officials (NCAFDO), and NEHA Region 4 Affiliates, West Fargo, ND, https://ndeha.org

Oregon
October 24–26, 2023: Annual Education Conference, Oregon Environmental Health Association, Newport, OR, https://www.oregoneha.org/about-1

Texas
October 16–20, 2023: 67th Annual Educational Conference, Texas Environmental Health Association (TEHA), Georgetown, TX, https://myteha.org

December 6–8, 2023: 20th Annual TEHA-STC Educational Conference, South Texas Chapter (STC) of TEHA, South Padre Island, TX, https://myteha.org/page/SouthTexas

Wisconsin
September 13–15, 2023: Educational Conference, Wisconsin Environmental Health Association, Appleton, WI, https://weha.net/events

TOPICAL LISTINGS

Food Safety
July 16–19, 2023: IAFP 2023 Annual Meeting, International Association for Food Protection (IAFP), Toronto, ON, Canada, https://www.foodprotection.org/annualmeeting

One Health
October 2–6, 2023: One Health Conference: One Health | One Global Environment, Jamaica Association of Public Health Inspectors, Montego Bay, Jamaica, https://www.onehealthconference.com

Water Quality
November 13–15, 2023: World Aquatic Health Conference, presented by the Pool & Hot Tub Alliance, Las Vegas, NV, https://www.phta.org

Did You Know?

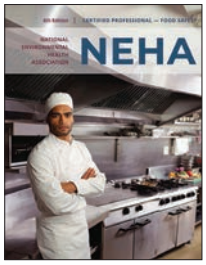
You can share your educational events on our website at www.neha.org/education/events. Events should be educational and should specifically benefit the environmental health workforce. Just fill out the submission form with your event information (e.g., title, location, dates, website, description, environmental health topics covered, and sponsor information) and we will review the submission for posting. If we are unable to post your educational event, we will let you know.

RESOURCE CORNER

Resource Corner highlights different resources the National Environmental Health Association (NEHA) has available to meet your education and training needs. These resources provide you with information and knowledge to advance your professional development. Visit our online bookstore at www.neha.org/store for additional information about these and many other pertinent resources!

CP-FS Study Guide (4th Edition)

National Environmental Health Association (2022)

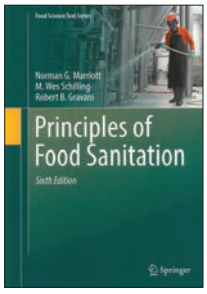


The National Environmental Health Association (NEHA) has released an updated edition of the *Certified Professional–Food Safety (CP-FS) Study Guide*. The fourth edition of the study guide has been updated to the current FDA *Food Code* and includes information and requirements from the Food Safety Modernization Act. It was developed by retail professionals to help prepare candidates for the NEHA CP-FS credential exam with in-depth content, an examination blueprint, practice test, and many helpful appendices. The study guide is the go-to resource for students of food safety and food safety professionals in both regulatory agencies and industry. Chapters in the new edition include causes and prevention of foodborne illness, HACCP plans, cleaning and sanitizing, facility and plan review, pest control, inspections, foodborne illness outbreaks, sampling food for laboratory analysis, food defense, responding to food emergencies, and legal aspects of food safety. Also now available as an e-book!

358 pages, spiral-bound paperback
Member: $199/Nonmember: $229

Principles of Food Sanitation (6th Edition)

Norman G. Marriott, M. Wes Schilling, and Robert B. Gravani (2018)

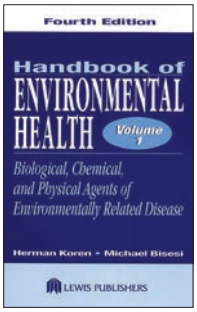


Now in its 6th edition, this highly acclaimed book provides sanitation information needed to ensure hygienic practices and safe food for food industry professionals and students. It addresses the principles related to contamination, cleaning compounds, sanitizers, and cleaning equipment. It also presents specific directions for applying these concepts to attain hygienic conditions in food processing or preparation operations. The new edition includes updated chapters on the fundamentals of food sanitation, as well as new information on contamination sources and hygiene, HACCP, waste handling disposal, biosecurity, allergens, quality assurance, pest control, and sanitation management principles. Study reference for the NEHA Registered Environmental Health Specialist/Registered Sanitarian and Certified Professional–Food Safety credential exams.

437 pages, hardback
Member: $84/Nonmember: $89

Handbook of Environmental Health, Volume 1: Biological, Chemical, and Physical Agents of Environmentally Related Disease (4th Edition)

Herman Koren and Michael Bisesi (2003)

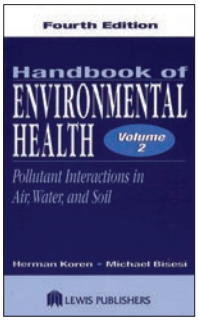


A must for the reference library of anyone in the environmental health profession, this book focuses on factors that are generally associated with the internal environment. It was written by experts in the field and copublished with NEHA. A variety of environmental issues are covered such as food safety, food technology, insect and rodent control, indoor air quality, hospital environment, home environment, injury control, pesticides, industrial hygiene, instrumentation, and much more. Environmental issues, energy, practical microbiology and chemistry, risk assessment, emerging infectious diseases, laws, toxicology, epidemiology, human physiology, and the effects of the environment on humans are also covered. Study reference for the NEHA Registered Environmental Health Specialist/Registered Sanitarian credential exam.

790 pages, hardback
Member: $215/Nonmember: $245

Handbook of Environmental Health, Volume 2: Pollutant Interactions With Air, Water, and Soil (4th Edition)

Herman Koren and Michael Bisesi (2003)



A must for the reference library of anyone in the environmental health profession, this book focuses on factors that are generally associated with the outdoor environment. It was written by experts in the field and copublished with NEHA. A variety of environmental issues are covered such as toxic air pollutants and air quality control; risk assessment; solid and hazardous waste problems and controls; safe drinking water problems and standards; onsite and public sewage problems and control; plumbing hazards; air, water, and solid waste programs; technology transfer; GIS and mapping; bioterrorism and security; disaster emergency health programs; ocean dumping; and much more. Study reference for the NEHA Registered Environmental Health Specialist/Registered Sanitarian credential exam.

876 pages, hardback
Member: $215/Nonmember: $245

Author, Title, and Subject Index

Code	Author(s)/Title	Volume/Issue	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
1	**Acharya, S., & Nummer, B.A.** Survival of *Listeria monocytogenes* in Commercially Available Refrigerated Cold-Brewed Coffee	85.2 Sept 2022 pp. 18–22	Food	Microbiology			
2	**Aguilera, J., Jeon, S., Raysoni, A.U., Li, W.-W., & Whigham, L.D.** Decreased Moderate to Vigorous Physical Activity Levels in Children With Asthma Are Associated With Increased Traffic-Related Air Pollutants	85.8 Apr 2023 pp. 16–24	Ambient Air	Children's Environmental Health	Environmental Justice	Indoor Air	Institutions and Schools
3	**Amery, R.W.** Federal Meat and Poultry Inspection Duties and Requirements—Part 1: History and Current Responsibilities	85.9 May 2023 pp. 22–25	Food				
4	**Amery, R.W.** Federal Meat and Poultry Inspection Duties and Requirements—Part 2: The Public Health Inspection System, Marks of Inspection, and Slaughter Inspections	85.10 June 2023 pp. 16–19	Food				
5	**Ames, A., Steiner, V., Konopka, A., Ward, M., & Zgodzinski, E.J.** Identifying Public Perceptions of Information on Harmful Algal Blooms to Guide Effective Risk Communication	85.7 Mar 2023 pp. 26–31	Education/ Training	Public Health/ Safety	Water Pollution Control/Water Quality		
6	**Banerjee, S.N.** Estimation of High Blood Lead Levels Among Children in Georgia: An Application of Bayesian Analysis	85.3 Oct 2022 pp. 8–15	Children's Environmental Health	Hazardous Materials/Toxic Substances	Lead		
7	**Berman, L., Morar, C., DeGrane, L., Unkart, S., & Erdal, S.** Brownfields in Romania and the United States: A Visual Tour	85.5 Dec 2022 pp. 28–38	Environmental Justice	Hazardous Materials/Toxic Substances	International	Land Use Planning/ Design	Public Health/ Safety
8	**Bird, C.T., & Westgard, B.C.** Risks and Understanding of Carbon Monoxide Poisoning in an Ice Fishing Community	85.4 Nov 2022 pp. 16–20	Community Nuisances/ Safety	Hazardous Materials/Toxic Substances	Indoor Air	Public Health/ Safety	Recreational Environmental Health
9	**Bishop, H.F.J., & Bornioli, A.** Effectiveness of London's Ultra Low Emission Zone in Reducing Air Pollution: A Pre- and Post-Comparison of NO_2 and PM_{10} Levels	85.1 July/Aug 2022 pp. 16–23	Ambient Air	International	Land Use Planning/ Design	Management/ Policy	Public Health/ Safety
10	**Boyapalli, S., DeJarnett, N., Latshaw, M., & Jagai, J.S.** Increasing Diversity in Environmental Health Graduate Programs	85.9 May 2023 pp. 26–29	Education/ Training	Environmental Justice	Institutions and Schools	Workforce Development	
11	**Brooks, L., Caccone, A., Cooper, M., Knauf, D., & Pascucilla, M.A.** Microbial Source Tracking in the Sasco Brook, Lower Farm River, and Goodwives River Watersheds of Long Island Sound	85.5 Dec 2022 pp. 8–16	Microbiology	Water Pollution Control/Water Quality			
12	**Brown, J.S., Byrd, B.D., Connelly, C.R., & Richards, S.L.** Operational Insights Into Mosquito Control Disaster Response in Coastal North Carolina: Experiences With the Federal Emergency Management Agency After Hurricane Florence	85.2 Sept 2022 pp. 24–31	Disaster/ Emergency Response	Vector Control			

Code	Author(s)/Title	Volume/Issue	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
13	**Del Rio, M., Lasley, P., Tallon, L., Kauth, J.-M., Bare, G., McCurdy, L.E., & Etzel, R.A.** Critical Competencies in Children's Environmental Health	85.6 Jan/Feb 2023 pp. 26–29	Children's Environmental Health	Education/ Training	Management/ Policy	Workforce Development	
14	**Del Rio, M., Sobin, C., & Hettiarachchi, G.** Biological Factors That Impact Variability of Lead Absorption and Blood Lead Level Estimation in Children: Implications for Child Blood Lead Level Testing Practices	85.5 Dec 2022 pp. 18–26	Children's Environmental Health	Hazardous Materials/Toxic Substances	Lead		
15	**Eddy, C., & Sase, E.** The COVID-19 Pandemic, Fukushima Nuclear Disaster, and Commonalities and Public Health Threat Complexities: A Public Health, Healthcare, and Emergency Management Command and Support Supersystem Model	85.7 Mar 2023 pp. 16–25	Disaster/ Emergency Response	International	Radiation/ Radon	Risk Assessment	Terrorism/ All-Hazards Preparedness
16	**Egan, C.D., Sargeant, J.M., Weese, J.S., Jones-Bitton, A., & Zentner, S.E.** Role of the Household Environment in Transmission of *Clostridioides difficile* Infection: A Scoping Review	85.6 Jan/Feb 2023 pp. 8–14	Children's Environmental Health	Education/ Training	Emerging Pathogens	Public Health/ Safety	Research Methods
17	**Gamboa, D., Barber, C., Sheehy, E., Ayele, S., & Gerstenberger, S.L.** Lead-Based Paint and Other In-Home Health Hazards in Las Vegas, Nevada: Findings of the Las Vegas Lead Hazard Control and Healthy Homes Program	85.3 Oct 2022 pp. 24–30	Children's Environmental Health	Hazardous Materials/Toxic Substances	Lead	Public Health/ Safety	Risk Assessment
18	**Goncalves, J.** A Call for Action to Increase the Scrutiny of Surface Cleaning and Cleaning Agents in Retail Food Establishments	85.9 May 2023 pp. 20–21	Food				
19	**Hodges, J.R., Lee, M., DeFranco, A., & Sirsat, S.A.** Exploring Foodborne Illness and Restaurant Cleanliness Reporting in Customer-Generated Online Reviews Using Business Analytics	85.3 Oct 2022 pp. 16–22	Education/ Training	Food	Technology		
20	**Hudak, P.F.** Long-Term Trends of Fine Particulate Matter in the Dallas–Fort Worth Metropolitan Area	85.2 Sept 2022 pp. 8–16	Ambient Air	Hazardous Materials/Toxic Substances	Public Health/ Safety		
21	**Khan, M., Chaudhry, M.N., Anwar, M., Ashraf, U., & Ali, H.** Effect of Lockdown on the Air Quality of Four Major Cities in Pakistan During the COVID-19 Pandemic	85.6 Jan/Feb 2023 pp. 16–25	Ambient Air	Emerging Pathogens	International	Management/ Policy	Public Health/ Safety
22	**Miller, G.Z., & Gearhart, J.** A Rapid Screening Method for Detecting Hazardous Chemicals in Consumer Products, Food Contact Materials, and Thermal Paper Receipts Using ATR-FTIR Spectroscopy	85.4 Nov 2022 pp. 8–15	Children's Environmental Health	Hazardous Materials/Toxic Substances	Occupational Health/Safety	Research Methods	
23	**Mohammad, Z.H., Little, T.A., & Sirsat, S.A.** Coronavirus Surrogate Persistence and Cross-Contamination on Food Service Operation Fomites	85.10 June 2023 pp. 8–14	Emerging Pathogens	Food	Microbiology	Public Health/ Safety	

Author, Title, and Subject Index

Code	Author(s)/Title	Volume/Issue	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
24	**Morrison, T.J., Roseveare, C.A., & Palmer, B.R.** Unfolding Outbreak Scenarios Can Be a Bite-Size Treat and Other Lessons From New Zealand's First Online Environmental Health Conference	85.10 June 2023 pp. 20–23, 32	Education/ Training	Epidemiology	Institutions and Schools	International	Workforce Development
25	**Nakayama, J.Y., Surasi, K., Owen, L.R., Johnson, M., Martell, S., Kittler, K., Lopatin, P., Patrick, S., Mertzlufft, C., Horton, D.K., & Orr, M.** Assessment of Chemical Exposures Investigation After Fire at an Industrial Chemical Facility in Winnebago County, Illinois	85.7 Mar 2023 pp. 8–15	Disaster/ Emergency Response	Epidemiology	Hazardous Materials/Toxic Substances	Public Health/ Safety	Risk Assessment
26	**Noh, Y., Shannahan, J.H., Hoover, A.G., Pennell, K.G., Weir, M.H., & Whelton, A.J.** Bystander Chemical Exposures and Injuries Associated With Nearby Plastic Sewer Pipe Manufacture: Public Health Practice and Lessons	85.4 Nov 2022 pp. 22–31	Disaster/ Emergency Response	Hazardous Materials/Toxic Substances	Occupational Health/Safety	Public Health/ Safety	Water Pollution Control/Water Quality
27	**Ramsden, D., Esenther, S., Marks, B., Lehane, A., Chen, R., Dubrow, R., & Pascucilla, M.A.** Bacterial Contamination in Long Island Sound: Using Preemptive Beach Closure to Protect Public Health	85.8 Apr 2023 pp. 26–29	Microbiology	Public Health/ Safety	Recreational Environmental Health	Risk Assessment	Water Pollution Control/Water Quality
28	**Shaw, S., Scott, S., Pell, M., Raiche-Gill, J., Tomasallo, C., & Meiman, J.** Lead Source Attribution by Stable Isotope Analysis in Child Risk Assessment Investigations	85.9 May 2023 pp. 8–19	Children's Environmental Health	Hazardous Materials/Toxic Substances	Lead	Risk Assessment	Technology
29	**Suppes, L., Johnson, T., Sanderson, S., Vitale, S., & Boerner, A.** Occurrence of Nitrate and Indicators of Agricultural and Septic System Contamination in a West Central Wisconsin Sand Aquifer	85.1 July/Aug 2022 pp. 8–14	Drinking Water	Wastewater	Water Pollution Control/Water Quality		
30	**Torok, M.R., White, A.E., Thompson, S., Pugh, S., Garman, K., Anand, M., Booth, H., & Scallan Walter, E.J.** Competencies for Environmental Health Professionals Who Detect, Investigate, and Respond to Foodborne Illness Outbreaks	85.1 July/Aug 2022 pp. 24–32	Education/ Training	Food	Workforce Development		
31	**Wooden, A., Bare, G., Bliss, J.C., & Dyjack, D.T.** American Indian/Alaska Native Environmental Health Programs and Strategies	85.4 Nov 2022 pp. 32–36	Education/ Training	Public Health/ Safety	Workforce Development		
32	**Yelton, S., George, A., Tomlinson, M.S., Bommarito, P.A., Fry, R.C., & Gray, K.M.** Communicating Results of Drinking Water Tests From Private Wells: Designing Report-Back Materials to Facilitate Understanding	85.8 Apr 2023 pp. 8–14	Drinking Water	Education/ Training	Hazardous Materials/Toxic Substances	Public Health/ Safety	Workforce Development

Printed back issues are available for $15 each. To order, contact us at (303) 802-2200 or support@neha.org.

CROSS-REFERENCE

Subject	Author/Title Code
Ambient Air	2, 9, 20, 21
Children's Environmental Health	2, 6, 13, 14, 16, 17, 22, 28
Community Nuisances/Safety	8
Disaster/Emergency Response	12, 15, 25, 26
Drinking Water	29, 32
Education/Training	5, 10, 13, 16, 19, 24, 30, 31, 32
Emerging Pathogens	16, 21, 23
Environmental Justice	2, 7, 10
Epidemiology	24, 25
Food	1, 3, 4, 18, 19, 23, 30
Hazardous Materials/Toxic Substances	6, 7, 8, 14, 17, 20, 22, 25, 26, 28, 32
Indoor Air	2, 8
Institutions and Schools	2, 10, 24
International	7, 9, 15, 21, 24
Land Use Planning/Design	7, 9
Lead	6, 14, 17, 28
Management/Policy	9, 13, 21
Microbiology	1, 11, 23, 27
Occupational Health/Safety	22, 26
Public Health/Safety	5, 7, 8, 9, 16, 17, 20, 21, 23, 25, 26, 27, 31, 32
Radiation/Radon	15
Recreational Environmental Health	8, 27
Research Methods	22
Risk Assessment	15, 16, 17, 25, 27, 28
Technology	19, 28
Terrorism/All-Hazards Preparedness	15
Vector Control	12
Wastewater	29
Water Pollution Control/Water Quality	5, 11, 26, 27, 29
Workforce Development	10, 13, 24, 30, 31, 32

SPECIAL **LISTING**

The National Environmental Health Association (NEHA) Board of Directors includes 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.

Tom Butts, MSc, REHS
President

National Officers

www.neha.org/governance

President—Tom Butts, MSc, REHS
President@neha.org

President-Elect—CDR Anna Khan, MA, REHS/RS
PresidentElect@neha.org

First Vice-President—Larry Ramdin, MPH, MA, REHS/RS, CP-FS, HHS, CHO
FirstVicePresident@neha.org

Second Vice-President—Scott E. Holmes, MS, REHS
SecondVicePresident@neha.org

Immediate Past-President—D. Gary Brown, DrPH, CIH, RS, DAAS
ImmediatePastPresident@neha.org

Regional Vice-Presidents

www.neha.org/governance

Region 1—William B. Emminger, Jr., REHS, CPM
Region1RVP@neha.org
Alaska, Idaho, Oregon, and Washington. Term expires 2026.

Region 2—Michele DiMaggio, REHS
Region2RVP@neha.org
Arizona, California, Hawaii, and Nevada. Term expires 2024.

Region 3—Rachelle Blackham, MPH, REHS
Region3RVP@neha.org
Colorado, Montana, Utah, Wyoming, and members residing outside of the U.S (except members of the U.S. armed services). Term expires 2024.

Region 4—Kim Carlton, MPH, REHS/RS
Region4RVP@neha.org
Iowa, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin. Term expires 2025.

Region 5—Jaime Estes, MS, CP-FS, PCQI
Region5RVP@neha.org
Arkansas, Kansas, Louisiana, Missouri, New Mexico, Oklahoma, and Texas. Term expires 2026.

Region 6—Nichole Lemin, MEP, RS/REHS
Region6RVP@neha.org
Illinois, Indiana, Kentucky, Michigan, and Ohio.
Term expires 2025.

Region 7—M.L. Tanner
Region7RVP@neha.org
Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee. Term expires 2026.

Region 8—CDR James Speckhart, MS, REHS, USPHS
Region8RVP@neha.org
Delaware, Maryland, Pennsylvania, Virginia, Washington, DC, West Virginia, and members of the U.S. armed services residing outside of the U.S. Term expires 2024.

Region 9—Robert Uhrik
Region9RVP@neha.org
Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. Term expires 2025.

NEHA Staff

www.neha.org/staff

Seth Arends, Senior Graphic Designer, NEHA EZ, sarends@neha.org

Rance Baker, Director, NEHA EZ, rbaker@neha.org

Gina Bare, RN, Associate Director, PPD, gbare@neha.org

Kate Beasley, Digital Communications Specialist, kbeasley@neha.org

Jesse Bliss, MPH, Director, PPD, jbliss@neha.org

Faye Blumberg, Instructional Designer, NEHA EZ, fblumberg@neha.org

Nick Bohnenkamp, Senior Program and Operations Manager, PPD, nbohnenkamp@neha.org

Trisha Bramwell, Sales and Training Support, NEHA EZ, tbramwell@neha.org

Amy Chang, Senior Program Analyst, Environmental Health, PPD, achang@neha.org

Renee Clark, Director, Finance, rclark@neha.org

Holly Cypress, Administrative Support, PPD, hcypress@neha.org

Joetta DeFrancesco, Retail Program Standards Coordinator, NEHA-FDA RFFM, jdefrancesco@neha.org

Kristie Denbrock, MPA, Chief Learning Officer, kdenbrock@neha.org

Rosie DeVito, MPH, Program and Operations Manager, rdevito@neha.org

David Dyjack, DrPH, CIH, Executive Director, ddyjack@neha.org

Doug Farquhar, JD, Director, Government Affairs, dfarquhar@neha.org

Soni Fink, Sales Manager, sfink@neha.org

Anna Floyd, PhD, Senior Instructional Designer, EZ, afloyd@neha.org

Heather Folker, Director, Member Services and Credentialing, hfolker@neha.org

Nathan Galanos, Contracts Administrator, ngalanos@neha.org

Adrienne Gothard, Senior Program Coordinator, PPD, agothard@neha.org

Chana Goussetis, MA, Marketing and Communications Director, cgoussetis@neha.org

Elizabeth Grenier, Senior Project Coordinator, egrenier@neha.org

Thyra Kimbell, Project Coordinator, tkimbell@neha.org

Nicole Kinash, Administrative and Logistical Support, NEHA EZ, nkinash@neha.org

Becky Labbo, MA, Senior Evaluation Coordinator, PPD, rlabbo@neha.org

Terryn Laird, Public Health Communications Specialist, tlaird@neha.org

Melodie Lake, Editor/Copy Writer, NEHA EZ, mlake@neha.org

Angelica Ledezma, AEC Manager, aledezma@neha.org

Stephanie Lenhart, MBA, Senior Accountant, slenhart@neha.org

Matt Lieber, Database Administrator, mlieber@neha.org

Dillon Loaiza, Accounts Payable Specialist, dloaiza@neha.org

Laura Manes, HR Manager, lmanes@neha.org

Bobby Medina, Credentialing Specialist, bmedina@neha.org

Somara Mentley, Project Coordinator, PPD, smentley@neha.org

Danci Miles, Senior Accountant, dmiles@neha.org

Eileen Neison, Credentialing Manager, eneison@neha.org

Nick Ogg, Media Production Specialist, NEHA EZ, nogg@neha.org

Shahzad Perez, IT Manager, sperez@neha.org

Kavya Raju, Public Health Associate, kraju@neha.org

Daniela Ramirez, Project Coordinator, NEHA-FDA RFFM, dramirez@neha.org

Kristen Ruby-Cisneros, Managing Editor, *JEH,* kruby@neha.org

Michéle Samarya-Timm, MA, HO, REHS, MCHES, DLAAS, Membership and Affiliate Engagement Manager, msamaryatimm@neha.org

Katherine Sheppard, Executive Assistant, ksheppard@neha.org

Sadie Shervheim, Public Health Associate, sshervheim@neha.org

Chintan Somaiya, MBA, MS, Senior Project Coordinator, NEHA-FDA RFFM, csomaiya@neha.org

Jordan Strahle, Marketing and Communications Manager, jstrahle@neha.org

Reem Tariq, MSEH, Senior Project Coordinator, PPD, rtariq@neha.org

Christl Tate, Associate Director, Programs, NEHA EZ, ctate@neha.org

Sharon Unkart, PhD, Associate Director, Education, NEHA EZ, sdunkart@neha.org

Melissa Vaccaro, Senior Food Safety Program Specialist, NEHA EZ, mvaccaro@neha.org

Gail Vail, CPA, CGMA, Associate Executive Director, gvail@neha.org

Alfonso Valadez, Membership Services Representative, avaladez@neha.org

Christopher Walker, MSEH, REHS, Senior Program Analyst, Environmental Health, PPD, cwalker@neha.org

Laura Wildey, CP-FS, Senior Program Analyst, Food Safety, PPD, lwildey@neha.org

2022–2023 Technical Advisors

www.neha.org/governance

CLIMATE & HEALTH

David Gilkey, PhD
dgilkey@mtech.edu

Steven Konkel, PhD
steve.konkel@gmail.com

DATA & TECHNOLOGY

Chirag Bhatt, RS, CCFS
chirag.bhatt@hscloudsuite.com

Timothy Callahan, MPH
tim.callahan@dph.ga.gov

John Dodson-Will
johndodson@hedgerowsoftware.com

Michael Hicks
mhicks@relaventsystems.com

EMERGENCY PREPAREDNESS

Krista Ferry
krista.ferry@fda.hhs.gov

Luis Rodriguez, MS, REHS/RS, CP-FS, CPO, DAAS
ved8@cdc.gov

Jill Shugart
ahe8@cdc.gov

FOCUSED POPULATIONS

Welford Roberts, MS, PhD, REHS/RS, DAAS
welford@erols.com

Amir Tibbs
tibbsa@stlouis-mo.gov

FOOD SAFETY

Eric Bradley, MPH, REHS, CP-FS, DAAS
ericbradley30252@gmail.com

Tracynda Davis, MPH
tracynda.davis@fda.hhs.gov

Zachary Ehrlich, MPA, REHS
zachary.ehrlich@doh.nj.gov

Adam Kramer, MPH, ScD, MPH, RS
akramer2@cdc.gov

Cindy Rice, MSPH, RS, CP-FS, CEHT
cindy@easternfoodsafety.com

Christine Sylvis, REHS
sylvis@snhd.org

Andrew Todd
andrew.todd@fda.hhs.gov

GENERAL ENVIRONMENTAL HEALTH

Michael Crea, MS
crea@zedgepiercing.com

Tara Gurge, MS, RS, CEHT, MS
tgurge@needhamma.gov

Summer Jennings
jennings.s@sno-nsn.gov

Evan La Plant
evan.laplant@co.waupaca.wi.us

Greg Kearney, MPH, DrPH, REHS
kearneyg@ecu.edu

Adam Mannarino
adam.mannarino@gmail.com

Clint Pinion, Jr., DrPH, RS, CIT
clint.pinion@sw.edu

HEALTHY COMMUNITIES

Claudia Meister
cmeister@city.cleveland.oh.us

M.L. Tanner
tannerml@dhec.sc.gov

Robert Washam, MPH, RS, DAAS
b_washam@hotmail.com

INFECTIOUS & VECTORBORNE DISEASES

Broox Boze, PhD
bboze@vdci.net

Frank Meek
fmeek@rollins.com

WATER QUALITY

Ivars Jaunakais
ivars@sensafe.com

Sarah Mack
sarah.mack@enthalpy.com

Jason Ravenscroft, MPH, REHS, CPO
jravensc@marionhealth.org

Besty Seals
sealskj@dhec.sc.gov

Andrew Whelton, MPH
awhelton@purdue.edu

Steve Wilson
sdwilson@illinois.edu

WORKFORCE & LEADERSHIP

Bob Custard, REHS, CP-FS
bobcustard@comcast.net

Carly Hegarty
chegar@milwaukee.gov

Affiliate Presidents

www.neha.org/affiliates

Alabama—Russell Harry
russell.harry@adph.state.al.us

Alaska—Joy Britt
jdbritt@anthc.org

Arizona—Andres Martin
andres.martin@maricopa.gov

Arkansas—Richard McMullen
richard.mcmullan@arkansas.gov

Business and Industry—Michael Crea
nehabia@outlook.com

California—Linda Launer
president@ceha.org

Colorado—Conner Gerken
connerg@nchd.org

Connecticut—Thomas Stansfield, MPH, RS
tstansfield@tahd.org

Florida—Edward Bettinger
info@feha.org

Georgia—Melinda Knight
gehaonline@gmail.com

Idaho—Carolee Cooper
carolee.cooper@dhw.idaho.gov

Illinois—Justin Dwyer
jadwyer84@gmail.com

Indiana—Jennifer Heller
bcenvironmental@browncounty-in.us

Iowa—Jared Parmater
jparmater@blackhawkcounty.iowa.gov

Jamaica (International Partner Organization)—Michael Myles
info@japhi.org.jm

Kansas—Perry Piper
kehaorgus@gmail.com

Kentucky—Brittany Wells, RS
kentuckyeha@gmail.com

Louisiana—Carolyn Bombet
carolyn.bombet@la.gov

Massachusetts—William (Bill) Murphy, MS, RS, CHO
murphyb@sudbury.ma.us

Michigan—David Peters
board@meha.net

Minnesota—Sophia Walsh, REHS
president@mehaonline.org

Missouri—Leah Ferris
lferris@clayhealth.com

Montana—Dustin Schreiner
dustin.schreiner@montana.edu

National Capital Area—Julia Balsley, REHS
NCAEHA.President@gmail.com

Nebraska—Harry Heafer, REHS
hheafer@lincoln.ne.gov

Nevada—Tara Edwards
edwards@snhd.org

New Jersey—Virginia Wheatley
info@njeha.org

New Mexico—Kellison Platero
kplatero@bernco.gov

New York State Conference of Environmental Health—Isaiah Sutton
isaiahs@co.chenango.ny.us

North Carolina—Angela Sowers
angela9247@me.com

North Dakota—Julie Wagendorf, MS, REHS/RS, CP-FS
admin@ndeha.org

Northern New England Environmental Health Association—Brian Lockard

Ohio—Steve Ruckman, MPH, RS
mphosu@gmail.com

Oklahoma—Aaron Greenquist
agreenquist@tulsa-health.org

Oregon—Sarah Puls
sarah.puls@co.lane.or.us

Past Presidents—Sandra Long, REHS, RS
slong@addisontx.gov

Rhode Island—Dottie LeBeau, CP-FS
deejaylebeau@verizon.net

South Carolina—M.L. Tanner, HHS
tannerml@dhec.sc.gov

Tennessee—Kimberly Davidson
kimberly.davidson@tn.gov

Texas—Kacey Roman
kroman@freeport.tx.us

Uniformed Services—MAJ Nathaniel Sheehan
nathaniel.sheehan@outlook.com

Utah—Abby Weymouth
aweymouth@co.weber.ut.us

Virginia—David Fridley
board@virginiaeha.org

Washington—Susan Shelton
susan.shelton@doh.wa.gov

West Virginia—Jennifer Hutson
jennifer.eb.hutson@wv.gov

Wisconsin—Carrie Pohjola
carrie.pohjola@wisconsin.gov

Wyoming—Derek Hensley
derek.hensley@wyo.gov

86th Annual Educational Conference & Exhibition

AEC 2023

neha National Environmental Health Association

presents

July 31 – August 3 | New Orleans, LA

You Belong With Us

...at the 2023 AEC in historical New Orleans

July 31 – August 3

neha National Environmental Health Association

...and in Pittsburgh for the

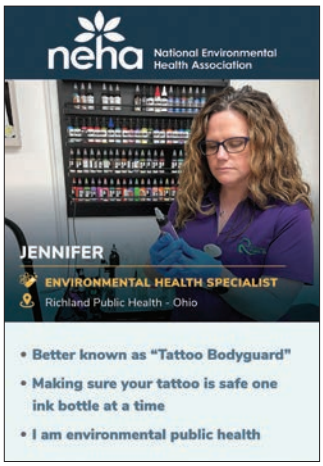
NEHA 2024 AEC

July 15 – July 18

From steel to sustainable, you'll be surprised at how much you love this city!

NEHA **NEWS**

Environmental Health Workforce Campaign



In 2022, the National Environmental Health Association (NEHA) Board of Directors shared concerns they had heard from members—and had experienced themselves—about how invisible and undervalued they felt as a profession. This concern was particularly true among environmental health professionals who work in governmental public environmental health, and especially throughout the COVID-19 pandemic.

In response, we have developed a campaign to raise the visibility and appreciation of our important workforce among decision makers and the public. The campaign strategy is fourfold and focuses on addressing the complex issues that influence the environmental health workforce. The campaign strategies include:

- **Self-Promotion Materials:** Most environmental health work is done at the state, local, tribal, and territorial level. To that end, we are developing tool kits, templates, and messaging for environmental health organizations to help promote the success and expertise of our workforce.
- **Advertising Campaign:** We have developed the Swipe Right advertising campaign that tells your story and expresses the value of environmental health professionals. This strategy primes and builds on the work of self-promotion. The advertising will target individuals who make decisions that impact the environmental health workforce.
- **Leadership Discussions:** This strategy brings together environmental health leaders from across the country to create a united vision for the environmental health profession in the U.S. We will serve as the catalyst and facilitator of discussions on key issues of concern.
- **Community Outreach:** This strategy involves the identification of organizations and initiatives across the country where environmental health representation is needed and creates a process for ongoing representation at state, local, ttribal, and territorial levels.

The advertising campaign portion of the larger initiative—**Swipe Right for Environmental Health**—launched as a pilot in Ohio during May and June 2023, and will advertise again in September. The advertising targeted decision makers at and around the Ohio Statehouse. The campaign ads feature three environmental health professionals from Ohio and urge viewers to support environmental health.

In September, we invite you and your organization to amplify the campaign by sharing the messages on your social media channels. The more of us who share the message, the more it will spread. Here are options to share the message:

- Visit any of our social media accounts and repost/share/retweet to your audience.
- Download the videos and share them on your website or in a newsletter.
- Post the videos on your social media with the accompanying text: If you care about clean air and water, safe food, and healthy schools, you've got a match with an environmental health specialist ["near you" or "at name of your organization"].
- Boost any of these messages on your social media channels to reach even more people.

We are here to help. If you or your communication staff need assistance, email communications@neha.org and we will do all we can to assist.

The campaign website and ads can be viewed at www.neha.org/swipe-right. After the pilot in Ohio is complete, we will analyze the results and make adjustments as needed. Our Board Marketing Committee will determine the next areas of focus following the pilot.

Grant Portal for the NEHA-FDA Retail Flexible Funding Model Grant Program Opens in August

NEHA and the Food and Drug Administration (FDA) work in partnership to administer the NEHA-FDA Retail Flexible Funding Model (RFFM) Grant Program. The program provides funding to state, local, tribal, and territorial retail food regulatory agencies as they advance conformance with the FDA Voluntary National Retail Food Regulatory Program Standards (Retail Program Standards). FDA is utilizing our strength to assist retail food safety programs in their efforts to reduce the occurrence of foodborne illness risk factors and implement and attain conformance with the Retail Program Standards.

The grant portal for Year 3 of the NEHA-FDA RFFM Grant Program will open on **August 16**. Retail food safety programs can apply for a base grant (through one of two tracks) and up to three additional add-on grants for Track 2 applicants and Track 3 grantees. Interested programs can apply for:

- A Track 1 Development Base Grant with options to be a mentee and/or attend a self-assessment and verification audit (SA/VA) workshop.

- A Track 2 Development Base Grant with options to be a mentee, work on Standard 9, and/or attend retail training courses.
- Optional Add-On Grants:
  - » In addition to the options above, Track 2 applicants may also apply to be a mentor (instead of a mentee) and/or apply for a Special Projects Grant.
  - » Existing Track 3 Maintenance and Advancement Base Grantees may apply to be a mentor or a mentee, request funds for retail training courses, and/or apply for a Special Projects Grant.

The grant portal will close on October 11. Learn more at www.neha.org/retail-grants.

Government Affairs Updates

By Doug Farquhar (dfarquhar@neha.org)

Photo courtesy of Doug Farquhar.

We continue to advocate for the environmental health profession at the federal and state levels. Here is a summary of our recent activities to promote the interests of our members and the environmental health workforce. Learn more about our activities through our Government Affairs webpage at www.neha.org/advocacy.

Support of FDA Food Safety Efforts

We met with congressional appropriators at the end of April to discuss the importance of FDA budgets for food safety to state, local, tribal, and territorial environmental health agencies. Our delegation was led by our director of Government Affairs and included staff who have worked within local and state health and agriculture agencies. We emphasized the value of the FDA *Food Code* and Voluntary National Retail Food Regulatory Program Standards in decreasing the occurrence of foodborne illness outbreaks. These programs make FDA one of the foremost federal agencies promoting public health. We met with 17 congressional offices from 13 different states.

Support for the Environmental Health Profession

We were back at the nation's capital in early May to advocate for the inclusion of the environmental health workforce in the Public Health Workforce Loan Repayment Program. We met with office staff of Representative Haley Stevens (D-MI) to encourage her to sign on to the letter we are currently circulating through Congress that seeks support for our profession in the loan repayment program. We also spoke with office staff of Representative Rosa DeLauro (D-CT). Furthermore, we have reached out to several congressional offices from both parties and chambers to let the Health Resources & Services Administration know that Congress intended for environmental health to be included in the federal loan repayment for public health workers.

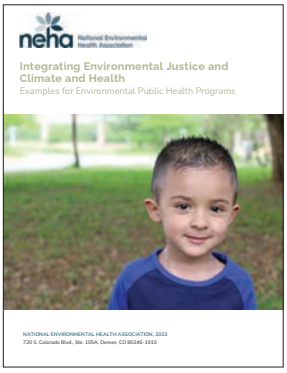
Blog Posts in May

We also posted a blog in mid-May about the markup of the fiscal year 2024 appropriations bill by the U.S. House Appropriations Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies. The blog explores the differing views of both political parties regarding the budget, as well as areas where they are in agreement. Specifically, both parties agree there is a need to increase funding for food safety.

Finally, we posted another blog in mid-May about the redesign of public health agencies within two states. States are beginning to recognize that public health is not meeting its goals and missions. One state, Iowa, is seeking to remedy this situation by combining its public health agencies. South Carolina, on the other hand, is trying a solution that divides its main public health agency. Both efforts impact the environmental health programs in these states.

You can read these blogs, as well as all our past blogs, at www.neha.org/government-affairs-blog.

Climate and Health Guides for Environmental Public Health Programs



State, local, tribal, and territorial environmental public health professionals play a critical role in addressing the health and well-being of their communities and environment. They are also well-positioned to address health inequities that are exacerbated by climate change and environmental injustice. Climate change impacts the health and well-being of humans, with the most vulnerable populations bearing a large portion of the burdens. Environmental public health professionals can directly engage with at-risk communities to integrate climate change and environmental justice considerations into their core programs and services. Our new climate and health guide—Integrating Environmental Justice and Climate and Health: Examples for Environmental Public Health Programs—provides examples of how to integrate environmental justice and climate and health to improve health outcomes.

The guide briefly explores the impact of climate change and on human health and environmental justice on health equity. It provides information on how to incorporate environmental justice into core programs and services, including use of the CORE (Cultivate comprehensive health equity science, Optimize interventions, Reinforce and expand robust partnerships, and Enhance capacity and workforce engagement) Health Equity Science and Intervention Strategy from the Centers for Disease Control and Prevention and our Climate Health Adaptation and Mitigation Partnership (CHAMP) framework.

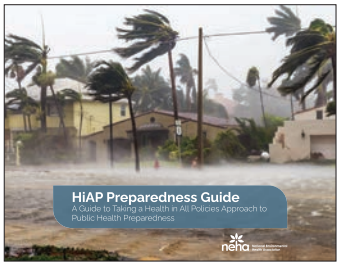
The guide also provides specific information related to air quality (ambient and indoor), emergency preparedness and response,

food safety, hazardous materials and waste management, water quality, and vector control. Each topic section covers the following:

- Climate change impact
- Health equity impact
- Examples of integrating environmental justice and climate and health considerations regarding assessment and policy, cross-sectoral engagement, and education and outreach

Rounding out the guide are relevant definitions and resources that can support these efforts. Access the guide at www.neha.org/climate-change.

Health in All Policies Preparedness Guide



Our new Health in All Policies (HiAP) Preparedness Guide provides a framework to take a HiAP approach to public health preparedness to improve the depth and effectiveness of collaboration at all stages of response. According to the World Health Organization (2014), HiAP is an "approach to public policies across sectors that systematically takes into account the health implications of decisions, seeks synergies, and avoids harmful health impacts in order to improve population health and health equity."

Public health is impacted by policies, plans, programs, and projects across private, public, and community-based organizations. Healthcare professionals and public health officials alone do not have the tools, knowledge, or capacity to address the root causes of all health and equity challenges, so collaboration with other sectors is essential. Many health departments already employ these strategies in their day-to-day operations, though they might not describe these strategies as HiAP.

Public health officials can use the HiAP framework detailed in our guide to create a multisector approach to disaster preparedness. While disasters have large-scale impacts on community health, safety, and well-being, they can also be inflection points to examine policies and practices, develop and deepen partnerships, engage the community around public health issues, and collect and use public health data to forge a healthier community.

Each of the seven HiAP strategies can be integrated into disaster preparedness activities. The seven strategies include:

- Develop and form cross-sector collaborations
- Incorporate health into decision making
- Enhance workforce capacity
- Coordinate funding and investments
- Integrate research, evaluation, and data systems
- Synchronize communication and messaging
- Implement accountability structures

The Disaster Management Cycle aims to guide disaster management before, during, and after a disaster. During the four phases of the disaster cycle, the model proposes specific actions that, when executed properly, can reduce loss of life and property and help expedite recovery efforts. These actions can be integrated into a HiAP framework. As such, our guide is organized using the four phases of the disaster management cycle: mitigation, preparedness, response, and recovery. Each section begins with a description of the disaster cycle activities that take place and the partners that could provide support during each phase.

The guide also provides:

- An introduction to HiAP
- Examples of how to implement the framework
- How preparedness activities map to the HiAP framework
- How one or more HiAP tools can be applied in each phase
- Worksheets for every stage of the response

Visit www.neha.org/hiap-preparedness-guide to view the guide and download the available worksheets.

Reference

World Health Organization. (2014). *Health in All Policies: Helsinki statement. Framework for country action*. https://www.who.int/publications/i/item/9789241506908

Water Webinar Series

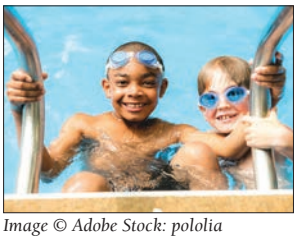


Image © Adobe Stock: pololia

In April, May, and June 2023, we offered a 4-part Water Webinar Series that highlighted recreational water illness, changes to the Model Aquatic Health Code (MAHC) from the Centers for Disease Control and Prevention, and implementation of the new edition of the MAHC.

- The first webinar on April 27 explored what the latest national surveillance data tells us about the state of design, construction, operation, and management of U.S. public aquatic venues and underscored the need for the MAHC.
- The second webinar on May 11 provided a brief background on the MAHC and an overview of the recently released and updated edition of the MAHC. The presenters also highlighted expected changes to be addressed during the next update cycle.
- The third webinar on May 25 focused on the experiences of a health department in Colorado to implement new state regulations related to recreational aquatic facilities in response to the state's recent adoption of the MAHC. The presentation spotlighted the journey and lessons learned as this health department worked to implement new regulations.
- The fourth webinar on June 8 described our current understanding of the public health consequences associated with exposure to cyanobacteria harmful algal blooms (HABs) in freshwater. It also provided an overview of emerging issues related to HABs.

You can view full webinar descriptions, presenter biographies, and the recorded webinars at www.neha.org/water-webinar-series.




Now Available!

Updated Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) Study Guide, 5th Edition

- Fresh visual layout to enhance reading and studying experience
- 15 chapters covering critical exam content
- Insights from 29 experts

Helps you identify where to focus your studying so you can pass the exam!

neha.org/rehs-study-materials

neha National Environmental Health Association

NEHA MEMBER SPOTLIGHT

Cheryl Parker, MPH, REHS/RS
Houston County Health Department

The National Environmental Health Association (NEHA) is shining a spotlight on the people within our membership through this new feature in the *Journal*. This month we are pleased to introduce you to Cheryl Parker, an environmental health specialist III who works in the Environmental Health Section of the Houston County Health Department in Warner Robins, Georgia. Her work includes:

- Serving as the standardized body art representative for the North Central Health District on the Georgia Body Art Committee Team, which is responsible for advising and consulting with other county managers on any body art issues, program policies, procedures, and activities, as well as assisting the committee team with planning and developing the new body art rules and regulations for the state.
- Being the lead environmental health specialist responsible for conducting construction plan reviews and performing quarterly in-depth routine inspections, complaint investigations, and other duties for the Body Art Program in Houston County.
- Serving as the standardized food service establishment inspection officer and being responsible for performing quarterly in-depth routine risk-based inspections and complaint investigations in food service establishments, as well as performing temporary and nonprofit temporary inspections.

Parker attended the University of South Carolina Aiken and earned a bachelor of science in biology. She earned her master of public health in environmental health from Fort Valley State University. Parker has been in the environmental health profession for 12 years.

Why did you join NEHA and what aspects of membership have you found most valuable to your career?
I joined NEHA to learn more on how I can perform my environmental health duties proficiently and be able to share what I learn with others. The aspects of membership I have found most valuable to my career are obtaining credentials, taking continuing education courses, and speaking with colleagues and other environmental health professionals in the NEHA online Community.

Why did you choose the environmental health field?
I chose the environmental health field because I love to help others by educating the public about environmental health issues. I love to perform inspections and explain to business owners, managers, and artists the importance of managerial control in their establishments to prevent contamination, foodborne illnesses, bloodborne illnesses, and unsanitary conditions in food service and body art establishments.

If you were not an environmental health professional, what other profession would you like to work in?
If I was not an environmental health professional, I would like to work in the epidemiology area. I prefer, however, being an environmental health professional.

What is your favorite vacation spot and why?
I do not have a favorite vacation spot but I traveled to Ghana for the first time in December 2020. This trip was my first time traveling internationally.

What accomplishment are you most proud of?
I recently passed the Registered Environmental Health Specialist/Registered Sanitarian credential exam. I am very proud of this major accomplishment.

Who do you look up to and why?
I look up to older adults because I am able to learn more about life lessons. I also look up to environmental health professionals because I am able to learn from them so I can perform my environmental health duties better and educate the public. I am always welcome to guidance and encouragement from others.

Is there a resource that you use frequently for your work that you would recommend for other environmental health professionals?
NEHA has a great website to help environmental health professionals in their job duties. Also, state public health websites are great. Both websites are great to help environmental health professionals.

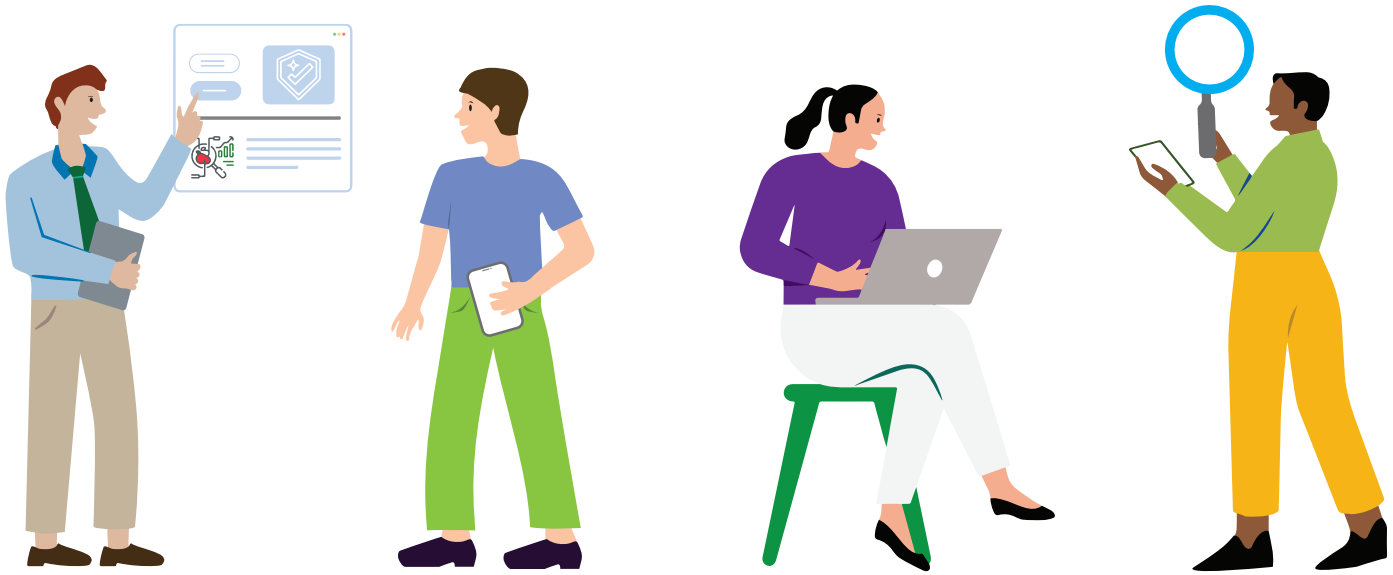
What was the best professional advice given to you?
No good deed goes unpunished was a saying I was told while being in the profession. We are always performing our environmental health duties to help others. Performing our duties, however, can backfire on us because we are doing our part to educate others but some people do not want to follow the rules or regulations, which can cause more issues. We have to continue to educate and perform our duties correctly.

Is there anything else that we did not ask that you would like to share?
I thank Houston County Environmental Health in Warner Robins, Georgia, and the North Central Health District in Macon, Georgia, for giving me the opportunity to volunteer and become an intern before becoming a full-time employee as an environmental health specialist.

We thank Cheryl Parker for sharing with us! You can read a full version of this spotlight at www.neha.org/membership/spotlights.

Hedgerow

EHS Technology



The Complete Agency Solution

- *Inspectors*
- *Supervisors*
- *Back Office*
- *Community*

LEARN MORE

Why Switch to Spike?

- *30 Years Working with Agencies*
- *Seamless Implementations*
- *Stellar Support*

www.HedgerowSoftware.com

Taking environmental health agencies Beyond Data Management

Premier Solutions Provider

HS GovTech™ is a leading provider of SaaS applications for government and the largest provider of Environmental Health Data Management Solutions in North America. We are committed to helping government agencies operate more efficiently through the use of our revolutionary cloud platform, and making information digitally accessible to their citizens and the businesses they regulate.

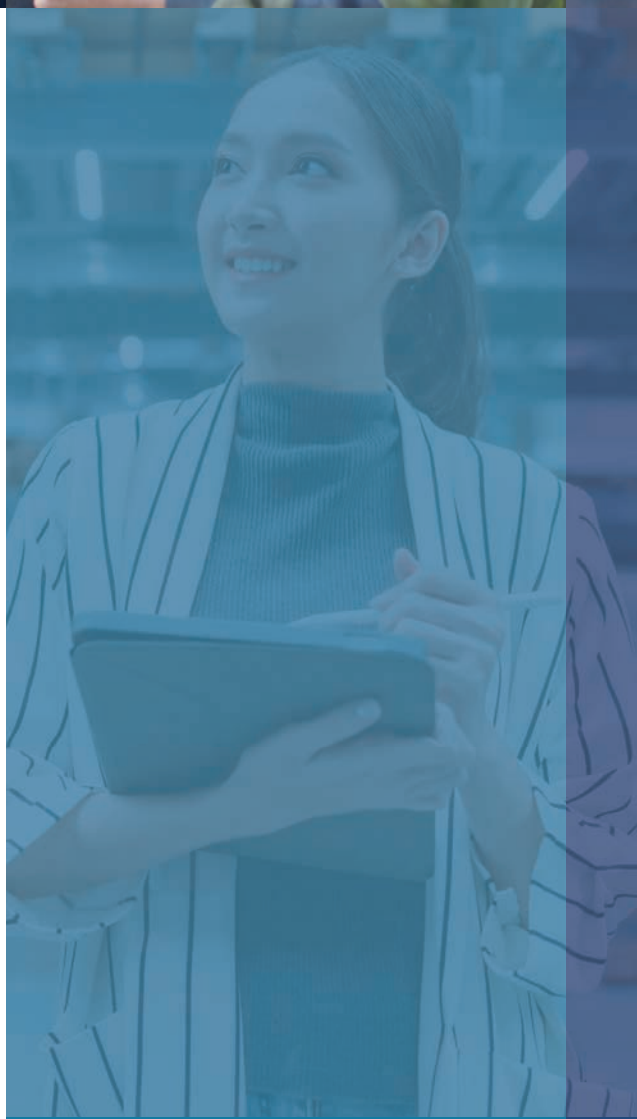
Our cloud-based and mobile platforms help to revolutionize every aspect of government regulatory work. Creating ease in every facet of government workflow, from licensing and permitting, to inspections, to invoicing and accounting, even disease surveillance.

Find out how we can transform your agency.

Get in Touch

980.375.6060
info@hscloudsuite.com
hsgovtech.com

HS GOVTECH™



Scan to visit
hsgovtech.com