JOURNAL OF

Environmental Health

fifteen covers

Dedicated to the advancement of the environmental health professional

Volume 84, No. 9, May 2022

Brownfields Redevelopment

A FOCUS ON REGULATORY, PUBLIC HEALTH, AND SUSTAINABILITY FRAMEWORKS

Published by the National Environmental Health Association

www.neha.org

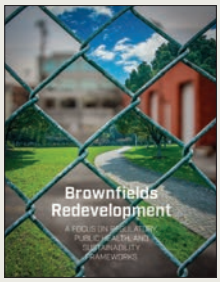
Software For Retail Food Standards

Inspect2GO

WWW.INSPECT2GO.COM/FOOD • INFO@INSPECT2GO.COM • (949)429-4620

JOURNAL OF
Environmental Health
Dedicated to the advancement of the environmental health professional
Volume 84, No. 9 May 2022

ABOUT THE COVER



The U.S. Environmental Protection Agency estimates that there are 450,000 brownfield sites in the U.S. Less than 7% of the estimated brownfields in the U.S. have undergone assessment and only a fraction have been cleaned up. This low percentage highlights the challenges associated with brownfield sites from economic, regulatory, environmental, and public health perspectives. This month's cover article provides an overview of brownfields redevelopment in the U.S. with a focus on regulatory, public health, and sustainable development frameworks. A broader focus on brownfields redevelopment could reduce the inequity and health disparities typically seen in areas with distressed environments, as well as improve population health and the environment over the long term.

See page 8.

Cover image © iStockphoto: Meg Tyo/BIN WANG

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*

- Awareness of Business Owners and Environmental Health Officers Regarding Health Risks Associated With the Use of Water Mist Systems
- Community Outbreak of Legionellosis Associated With an Indoor Hot Tub
- Healthcare Visits and Summertime Heat Index in Virginia: An Analysis of Syndromic Surveillance Data

Official Publication

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

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) 756-9090; Fax: (303) 691-9490; Internet: www.neha.org. E-mail: kruby@neha.org. Volume 84, Number 9. 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. CPM Sales Agreement Number 40045946.

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

All technical manuscripts submitted for publication are subject to peer review. Contact the 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

PRESIDENT'S MESSAGE

Roy Kroeger, REHS

War Is Hell

As I sit here pondering what to write about for this month's column, I am watching one of the long-running news stations and have been entrenched with the Russian attacks on Ukraine. The attacks are a horrendous act of aggression on a neighbor that poses no threat. Watching the attacks, I also wonder about all the environmental health issues. Please do not take this column as some kind of treatise that environmental health is the most critical concern in any war because it is not. I could never imagine what the residents of Ukraine are going through and the death and destruction occurring throughout their country.

In the context of this column, however, I cannot help but wonder what long-term effects will be left behind. Obviously, there have been wars for as long as we have had people on the planet, but you would think we could rise above these aggressions at some point. Each of these wars must have created untold environmental health degradation—water and air pollution, toxics released into the environment, disease spread, greenhouse gas emissions, and so much more.

The migration of refugees trying to get out of Ukraine and the deliberate attacks on their camps create significant environmental health challenges. People are congregating by the tens of thousands, fleeing to any safety they can find. Temperatures rise to near freezing during the day and fall well below freezing at night. As these refugees travel across their country, they create temporary camps that do not have the resources necessary to create a sanitary situation. Each winter, bacteria and viruses are transmitted among populations, which amplify conditions that are favorable to the development of additional disease. During the winter, diseases like flu and tuberculosis will turn to malaria in the summer. Essential services such as drinking and cooking water will not be available as many attacks target infrastructure. Human and solid wastes are accumulating and are not disposed of properly. As many refugees make it to a neighboring border, they cannot cross, creating more extensive and long-term camps without resources. Once refugees are allowed to cross into neighboring countries, they will most likely end up in shelters for some time.

Are we prepared for disasters of this magnitude?

Bombings create additional environmental health concerns. Conventional weapons contain many toxic chemicals such as phosphorous and heavy metals. These chemicals do not just disappear after the conflict ends; they can remain as pollutants for decades after a war has ended. Weapons such as mines, cluster munitions, and other explosives can keep people out of areas that would otherwise be valuable for relocation or farming after the conflict.

If radiological weapons are used, the damage could be much more severe, and the impact could last much longer. Radiation is a big concern in this current battle as the aggressors appear to have targeted the Zaporizhzhia Nuclear Power Plant in southeastern Ukraine. We all remember the damage from the Chernobyl Nuclear Power Plant on April 26, 1986. Chernobyl is also located in Ukraine, and the area around that plant is still not inhabitable 36 years after the disaster. Zaporizhzhia is the largest nuclear plant in Europe, and according to news reports, a catastrophe at this plant would be 10 times worse than Chernobyl. Ukraine has 14 additional nuclear reactors throughout the country that could become targets of Russian aggression.

These attacks should be a wake-up call for all countries worldwide, including our own. Are we so ignorant to think that no one will ever attack us? What if one of our enemies decided to attack the U.S. with biological or chemical weapons? Are we prepared for disasters of this magnitude? Environmental health has been part of public health preparedness and response training since 2001. I question if we are prepared to respond to war-like conditions. Public and environmental health struggled to provide a unified message during a worldwide pandemic in which six million worldwide and one million in our country have died due to a virus. That virus, though devastating, did not damage the built environment as a war could.

Our country is much different than Ukraine, and outside of the 9/11 attacks, we have never experienced an attack or other event that caused such widespread damage. We have been able to supply water when public water systems are damaged due to flooding. We have rebuilt or temporarily provided power when localized damage occurs from hurricanes or tornadoes. Do we have the capacity to provide

safe drinking water to millions if either coast was attacked? How would we keep food cold if power was out for weeks or months in the summer? Our country has many places to provide shelters if needed, but are we prepared to provide food, water, and sanitary conditions in these shelters?

Environmental health and emergency management have prepared to house many people from small areas during natural disasters, but what would it look like if millions were permanently displaced from their homes? Where would we relocate survivors if a large city or even numerous towns were destroyed? How would we care for people with damage to multiple hospitals? Are continuity plans sufficient for large-scale attacks?

Additionally, suppose more of Europe is attacked. In that case, we might see a significant influx of refugees here in the U.S. Neighboring countries have promised to supply jets to Ukraine. The aggressors have said they will be treated as combatants if they do, possibly escalating the attacks. Most of the Ukrainian refugees are headed to Poland. Our vast country can absorb thousands into our country with little concern but what if that becomes millions? Emigration could cause the spread of disease, water shortages, and vector and waste management issues throughout our country.

Recovery will be another significant environmental health challenge, regardless of if the war remains in Ukraine or spreads to other parts of the world. The war-torn areas will be faced with controlling increased rodent and other vector populations. Evaluating water quality supplies and rebuilding water infrastructure will be crucial as residents return home. Soils must be assessed before new crops can be planted for human and animal food. Reopening grocery stores, restaurants, and schools all require environmental health expertise.

War requires a response and environmental health is the response profession for public health.

President@neha.org

SUPPORT THE NEHA ENDOWMENT FOUNDATION

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

Individuals who have contributed to the foundation are listed below by club category. These listings are based on what people have actually donated to the foundation—not what they have pledged. Names will be published under the appropriate category for 1 year; additional contributions will move individuals to a different category in the following year(s). For each of the categories, there are a number of ways NEHA recognizes and thanks contributors to the foundation. If you are interested in contributing to the Endowment Foundation, please call NEHA at (303) 756-9090. You can also donate online at www.neha.org/donate.

Thank you.

DELEGATE CLUB

($1–$99)

Name in the Journal for 1 year.

Tunde M. Akinmoladun
Mary A. Allen
Steven K. Ault
Michael E. Bish
Logan Blank
Glenn W. Bryant
Kimberley Carlton
Deborah Carpenter
James G. Cortelyou
Natasha Crawford
Lawrence Cyran
Kristen Day
Thomas P. Devlin
James M. Dodd
Samantha Donahue
Wendy L. Fanaselle
Shelby Foerg
Christopher J. Foster
Mary K. Franks
Debra Freeman
Abdelrahim Gador
Catherine Hefferin
Scott E. Holmes
Jamison S. Honeycutt
Douglas J. Irving
Lamin Jadama
Samuel J. Jorgensen
Leila Judd
Bonnie Koenig
Robert W. Landry
Richard Lavin
Allan R. Levesque
Ann M. Loree
Stephanie Mach
James C. Mack
Patricia Mahoney
Patrick J. Maloney
Alan Masters
Kaiser Milo
Peter J. Mitchell
Derek Monthei
Naing Myint
John A. Nakashima
Sylvester Ndimele
Brion A. Ockenfels
Daniel B. Oerther
Christopher B. Olson
Joe Otterbein
Kathryn Pink
Jeffrey A. Priebe
Mike K. Pyle
Jeremiah Ramos
Evangeline Reaves
Roger T. Reid
Catherine Rockwell
Dora Rodriguez
Edyins Rodriguez Millan
Luis O. Rodriguez
Anthony Sawyer
Philip H. Scharenbrock
Karla Shoup
Christopher J. Smith
Robert A. Stauffer
Tamika Thompson
Jeffrey A. Wangsao
James M. White
Christian Witkovskie

HONORARY MEMBERS CLUB

($100–$499)

Letter from the NEHA president and name in the Journal for 1 year.

Kenneth C. Danielson
Michele DiMaggio
Ana Ebbert
Annette Eshelby
Michael G. Halko
Donna K. Heran
Ayaka Kubo Lau
Philip Leger
Sandra M. Long
Robert A. Maglievaz
John A. Marcello
Wendell A. Moore
Victoria A. Murray
Susan V. Parris
James E. Pierce
Larry A. Ramdin
Jonathan P. Rubingh
Joseph W. Russell
Michéle Samarya-Timm
Vickie Schleuning
Mario Seminara
John H. Shrader
Joshua R. Skeggs
Dorothy A. Soranno
Jacqueline Taylor
Linda Van Houten
Tom A. Vyles
Lisa Whitlock

21st CENTURY CLUB

($500–$999)

Name submitted in drawing for a free 1-year NEHA membership and name in the Journal for 1 year.

Thomas J. Butts
T. Stephen Jones
Ned Therien

SUSTAINING MEMBERS CLUB

($1,000–$2,499)

Name submitted in drawing for a free 2-year NEHA membership and name in the Journal for 1 year.

James J. Balsamo, Jr.
Brian K. Collins
Peter H. Sansone
Peter M. Schmitt
James M. Speckhart

AFFILIATES CLUB

($2,500–$4,999)

Name submitted in drawing for a free AEC registration and name in the Journal for 1 year.

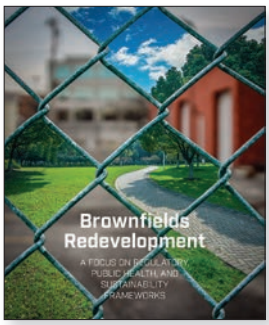
Robert W. Custard
Timothy N. Hatch
Welford C. Roberts

EXECUTIVE CLUB AND ABOVE

(>$5,000)

Special invitation to the AEC President's Reception and name in the Journal for 1 year.

Vincent J. Radke



An Overview of Brownfields Redevelopment in the United States Through Regulatory, Public Health, and Sustainability Lenses

Laurel Berman, PhD
Agency for Toxic Substances and Disease Registry

Cezar Morar, PhD
University of Oradea, Romania

Sharon Unkart, PhD
National Environmental Health Association

Serap Erdal, PhD
University of Illinois Chicago

Abstract **This second article in a series of three on land reuse highlights brownfields redevelopment in the U.S., focusing on regulatory frameworks, public health, policy, and sustainable development. The main regulatory agency in the U.S. involved in brownfields is the U.S. Environmental Protection Agency (U.S. EPA). Many other state and federal agencies have brownfield or brownfield-supporting programs. Apart from the Agency for Toxic Substances and Disease Registry, few agencies have programs fully dedicated to public health protection related to brownfields. Sustainable development, defined in this article as development that minimizes use of nonrenewable resources, is recognized as a component of redevelopment and is generally promoted by U.S. EPA and through other sustainable development initiatives. A broader focus on sustainable development and public health improvement could reduce the inequity and health disparities typically seen in areas with distressed environments. Such a focus could be implemented globally to improve population health and the environment over the long term.**

Introduction

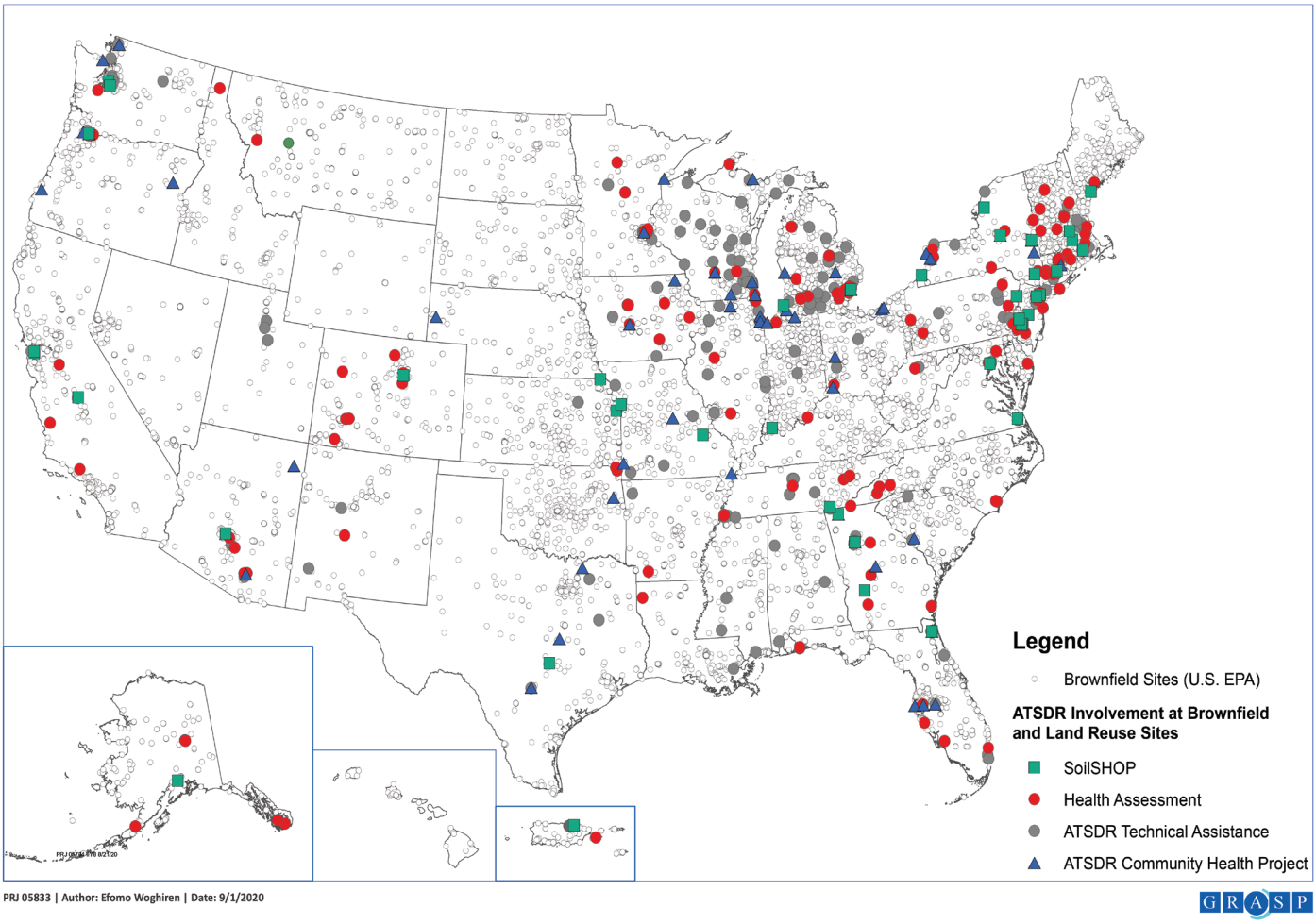
We authors are part of the U.S.–Eastern European Brownfields Working Group. The working group is a special initiative of the Brownfields & Reuse Opportunity Working Network (BROWN) of the Agency for Toxic Substances and Disease Registry (ATSDR, 2020a). The working group is investigating reuse and redevelopment of potentially contaminated properties in Europe and the U.S. Through this mutually beneficial perspective, we are particularly interested in regulations and policies in Europe and the U.S. that either promote or hinder brownfields redevelopment. In our first article (Morar et al., 2021), we examined sustainable redevelopment in Europe through funding and policy perspectives. In this article, we focus on brownfields redevelopment in the U.S. through regulatory frameworks, public health, policy, and sustainable development.

In the U.S., brownfield sites make up much of a larger group of sites that ATSDR identifies as land reuse sites. These sites are potentially contaminated sites that could be reused or redeveloped; sites include previous industrial sites that are now vacant, incompatibly located sites, landfills, and sites that might be on the U.S. Environmental Protection Agency (U.S. EPA) National Priorities List—commonly referred to as Superfund sites (ATSDR, 2020b). The different types of land reuse sites have different regulatory steps for redevelopment. For example, Superfund sites (not considered brownfield sites) are prioritized and undergo rigorous investigation under the U.S. EPA Superfund program, but this step often requires years of litigation and remediation before reuse can be achieved. Some brownfield sites, such as former industrial sites, have a more complex contamination footprint than others but are not designated Superfund sites. These sites often need varied and costly remediation, requiring more resources and time than less contaminated sites. In contrast, some brownfields have little contamination and can be productively reused in a short amount of time. In one U.S. EPA study, approximately 30% of brownfields had contamination that was below regulatory concern levels (Jenkins et al., 2006).

U.S. EPA (2021a) estimates that there are 450,000 brownfields in the U.S. Figure 1 shows the extent and location of nearly 30,000 known brownfields in 2020 that was compiled from information from past U.S. EPA brownfields grantees. Figure 1 also highlights ATSDR activities in brownfields, which include performing public health assessments (red circles), implementing community health projects (blue triangles), providing technical assistance (gray circles), and conducting special initiatives such as soil sampling (green squares). Less than 7% of the estimated brownfields in the U.S.,

FIGURE **1**

Map of Brownfield Sites and Agency for Toxic Substances and Disease Registry (ATSDR) Projects on Brownfield and Land Reuse Sites in the United States



Note. GRASP = Geospatial Research, Analysis, and Services Program; SoilSHOP = Soil Screening, Health, Outreach, and Partnership; U.S. EPA = U.S. Environmental Protection Agency.
Source: Efomo Woghiren (9/1/2020, PRJ 05833), GRASP, ATSDR.

however, have undergone assessment and only a fraction of these have been cleaned up with U.S. EPA funding. This low percentage illuminates the challenges associated with brownfield sites from economic, regulatory, environmental, and public health perspectives. Figure 2 depicts examples of typical U.S. brownfield sites.

U.S. Brownfields Regulatory Infrastructure

The U.S. EPA Brownfields Program began in 1995. The program includes funding for environmental assessment, cleanup, and job training. The program also provides educational resources related to brownfields and sustainable reuse for states, tribes, communities, and other stakeholders (U.S. EPA, 2021a).

Federal Brownfield Programs

Shortly after U.S. EPA established its Brownfields Program, many other federal agencies established their own programs focused on brownfields. The U.S. EPA *2019 Brownfields Federal Programs Guide* highlighted 22 agencies with brownfield focus areas, with activities ranging from funding to resources (U.S. EPA, 2019). Example agencies include the Appalachian Regional Commission, U.S. Department of Agriculture, U.S. Department of Commerce, U.S. Department of Defense, U.S. Department of Energy (U.S. DOE), U.S. Department of Health and Human Services (HHS), and many others.

Each agency provides a wide range of programs and resources that can enhance national brownfields redevelopment efforts. For example, since the 1990s, ATSDR (an

FIGURE **2**

Images of Brownfield Sites in the United States

Photos were taken in 2014 and are courtesy of Lloyd DeGrane.

HHS agency) has funded several brownfield and community health initiatives. Currently, ATSDR has a public health-focused program to improve health outcomes and reduce contaminant exposures related to land reuse and brownfield sites. ATSDR creates resources to spur health-focused redevelopment and offers training and technical assistance to communities (ATSDR, 2020b).

Other agencies fund economic or energy projects. The U.S. Economic Development Administration, for example, funds public works and infrastructure enhancement, provides local technical assistance, and encourages economic development by capitalizing revolving loan funds to attract private sector investment in redevelopment (U.S. EPA, 2019). Similarly, U.S. DOE offers financial and technical assistance for brownfield environmental cleanup and stabilization, transfer of property for public purposes, green energy parks at U.S. DOE facilities, and evaluation for renewable energy technologies (U.S. EPA, 2019).

State and Tribal Brownfield Programs

Annually, the U.S. EPA Brownfields Program funds state and tribal response programs through $50 million in cooperative agreements, referred to as Section 128(a) funding. The funding can be used for site assessment or cleanup of brownfields that could be lower risk and not of federal interest (U.S. EPA, 2021b).

States that are in Section 128(a) cooperative agreements operate under memoranda of agreements (MOAs) with U.S. EPA regional offices to implement state voluntary cleanup programs (VCPs), also called state response programs. MOAs help promote coordination and define roles related to site cleanup. Through VCPs, states can provide guidance and oversight related to risk-based cleanups, clean-up levels, and long-term monitoring of institutional controls. Institutional controls are practices to protect the public from exposure, such as zoning or deed restriction notices (e.g., commercial use only and not residential use). State VCPs also provide some liability protection to site owners by providing "no further action" or "no further remediation" letters to indicate that a site poses no unacceptable risks to human health or the environment (U.S. EPA, 2016).

Tribes also use Section 128(a) U.S. EPA Brownfields Program funding. There are 573 federally recognized Indian Nations in the U.S. that function as independent and sovereign nations (National Congress of American Indians, 2022). Tribes use Section 128(a) funding to inventory and assess properties and for tribal education about natural resources and community health, among other activities (U.S. EPA, 2021b).

A Problem of Complexity

A total of 10 U.S. EPA regional offices award and oversee the Section 128(a) cooperative agreements with states and tribes (U.S. EPA, 2021b). These site remediation programs vary by region and state, resulting in a complex regulatory environment with a myriad of approaches to site remediation. This regulatory environment adds complexity to site remediation and can also add potential impediments to a comprehensive national approach.

In addition to complexity, many states do not require the results of environmental assessments or clean-up data to be made public. When states do make such information available, there can be multiple analytical laboratory reports—showing hundreds of data points for dozens of chemicals—from multiple environmental samples and locations (e.g., surface soil, subsurface soil, groundwater). Oftentimes the data are not summarized statistically (e.g., minimum, median, or maximum concentrations of specific contaminants) or presented to enable quantification of exposures or health risks without significant background knowledge regarding the contaminants. This lack of clarity prevents interested parties, such as nearby residents or workers engaged in site cleanup or construction activities, from evaluating their own risks—and also complicates the implementation of environmental and public health tracking or monitoring programs based on consistent benchmarks or indicators.

Public Health and Brownfields

Brownfields can pose environmental exposure risks to community members via access to the sites or contamination of soil, air, and/or water at the site. Site contaminants can migrate on-site and off-site, such as from vapor intrusion, surface runoff, or fugitive dust. This exposure to harmful contaminants from a brownfield site can occur before, during, or after redevelopment via numerous exposure pathways (e.g., inhalation of vapors or dusts emanating from the site or drinking groundwater that is contaminated by the site). Common brownfield contaminants, such as lead-based paint, asbestos, or petroleum-based products (e.g., gasoline, diesel, or jet fuel) can have serious health implications. Lead poisoning in children, for example, can cause intelligence deficits (ATSDR, 2020c); inhalation of asbestos fibers can increase the risk of mesothelioma or other lung diseases later in life (ATSDR, 2016).

Brownfields can also have negative health, economic, and social implications for communities. The U.S. has increasing numbers of vacant and blighted properties, of which brownfields can be part of the overall burden. The Northeast-Midwest Institute described and summarized the impacts of blighted properties: increased crime, drug activity, and risks to public health and welfare, along with decreased public safety and lower surrounding property values (Cain, 2016). Similarly, the U.S. Government Accountability Office (2011) described community challenges associated with the dramatic increase in blighted properties including decreased property values, increased crime, threats to public safety, and general neighborhood decline. In addition, a study of impacts of vacant properties by de Leon and Schilling (2017) noted various conditions—such as radon, cockroach and rodent infestation, cold and damp, and proximity to vacant properties—as detrimental to health.

U.S. EPA estimates that since the inception of its Brownfields Program, there have been 32,292 properties assessed, 2,094 properties cleaned up, 168,494 jobs leveraged, $33,327 billion leveraged, and 130,099 acres readied for anticipated reuse (U.S. EPA, 2021c). While U.S. EPA does quantify some limited economic benefits of brownfields redevelopment, the full picture of community health outcomes is not included. ATSDR's Land Reuse Team reviewed public health assessment activities conducted through 2020. Of thousands of public health assessment activities, ATSDR conducted over 400 public health assessments on brownfield sites, of which over 40% were found to pose risks to public health. Despite the potential contaminant exposure hazards posed by brownfield sites, few agencies besides ATSDR have brownfield programs fully dedicated to public health protection.

Based on our review of the literature, few frameworks exist that measure public health impacts associated with land reuse and brownfield sites. U.S. EPA does allow local government recipients of U.S. EPA brownfield grants, however, to allocate up to 10% of their funding for health monitoring activities (U.S. EPA, 2021d), and those activities have been successful among the grantees who have implemented them. For example, the 2008 Ringling Riverfront Redevelopment Project in Baraboo, Wisconsin, created 33 indicators of community health related to redevelopment that showed positive changes over a 5-year period, such as reducing the number of contaminated sites and preventing pollutant runoff into the Baraboo River (ATSDR, 2010). In Blue Island, Illinois, the community established the Blue Island Community Health Coalition to increase access to recreation and healthy foods, among other activities, to improve community health throughout the city over the course of redevelopment. Within 1 year, the coalition was able to highlight outcomes such as six new community gardens and nearly a 10-fold increase in programming in the local Blue Island Park District (Rampersad, 2020).

To holistically quantify community health impacts, ATSDR (2019a) consolidated a data set of public health indicators from 40 communities that used the ATSDR Action Model to track changes in environmental and public health over the course of redevelopment. ATSDR published these indicators to help communities track progress in nine community health categories and to evaluate the effectiveness of land reuse and redevelopment efforts for public health improvement (ATSDR, 2019b; Berman et al., 2019). Successful changes in Action Model indicators from different communities include the outcomes discussed previously in Baraboo and Blue Island. In other communities, successful changes include leveraging $300,000 of federal brownfield funding into $50,000,000 in private investment, cleaning up 50% of contaminated sites, receiving $500,000 in federal development funds for revitalization planning, and providing increased tax revenues for the city, among many other examples. Such positive changes can draw development interest and increase access to community amenities and services.

Sustainable Development and Brownfields

In 2006, U.S. EPA produced a brochure, *Sustainable Reuse of Brownfields: Resources for Communities*, which emphasized sustainable brownfields redevelopment; green infrastructure; and resources at the federal, state, and local levels (U.S. EPA, 2006). In 2009, U.S. EPA highlighted 16 Brownfields Sustainability Pilots in 15 U.S. communities. These projects implemented green and sustainable practices in brownfields redevelopment, such as green roofs, green building designs, stormwater management, and streetscape designs (U.S. EPA, 2009).

In 2011, U.S. EPA developed the Building Blocks for Sustainable Communities program (U.S. EPA, 2021e). This program a) employs tools that have demonstrated successful results and widespread application to implement sustainable development approaches and b) provides quick and targeted technical assistance to selected communities. U.S. EPA launched 200 Building Blocks projects in 47 states. Subsequently, from 2012 to 2017, U.S. EPA funded nonprofit organizations to provide similar technical assistance to communities (U.S. EPA, 2021e).

U.S. EPA (2013) also published the report, *Equitable Redevelopment of Petroleum Brownfields for Zuni Pueblo and Other Tribal Communities,* through their Smart Growth program. The report emphasized sustainable smart growth and equitable redevelopment to meet broad community needs through redevelopment, with the opportunity for all community members to participate in decisions affecting their neighborhoods (U.S. EPA, 2013).

While U.S. EPA generally promotes sustainable practices, it currently does not provide funding specifically to support sustainable brownfields redevelopment. There are other programs, however, that support sustainable redevelopment: Smart Growth America and Leadership in Energy and Environmental Design (LEED) are two programs focused on sustainable development and redevelopment. Smart Growth America is a nonprofit organization that empowers communities to build economically prosperous, socially equitable, and environmentally sustainable communities (Smart Growth America, 2022). LEED is a green rating system that is available for all types of buildings, communities, and homes. An LEED designation is globally recognized as a symbol of achieving sustainability (U.S. Green Building Council, 2021).

Discussion: Regulatory and Policy Implications

In our first collaborative article, we found that Europe has a high level of commitment to sustainable development, which is maintained through diverse funding sources and a supportive policy framework (Morar et al., 2021). Unlike Europe, which has a strong policy framework that can support cleanup and redevelopment of brownfields, the U.S. relies on regulatory frameworks for land reuse that tend to focus primarily on economic development. While there are a handful of national efforts for sustainable brownfields redevelopment, few national, regional, state, or local policies exist to advocate for public health-focused brownfields redevelopment. To broadly promote public health and sustainability in brownfields redevelopment, existing brownfield inventory tools could be enhanced to include public health and sustainable development benchmarks and end points. An enhanced inventory tool could tabulate quantitative contaminant data. As previously mentioned, these data often are not publicly available or statistically analyzed in an efficient format to enable exposure and health risk assessment as a component of public health evaluation and tracking.

Currently there are two popular, free brownfield inventory tools online: The Kansas State University Technical Assistance to Brownfields (TAB) Brownfield Inventory Tool (BiT) (Kansas State University, n.d.) and the ATSDR Brownfields/Land Reuse Site Tool (ATSDR, 2020d). The BiT resource was designed for U.S. EPA brownfields grantees and aligns with reporting requirements of the Assessment, Cleanup, and Redevelopment Exchange System (ACRES), an online database that does not have a public health focus (U.S. EPA, 2021f). The ATSDR Brownfields/Land Reuse Site Tool can cross-reference with the ATSDR Comparison Value Viewer, which provides protective screening levels for regulatory and public health contaminants. If contaminant levels are found to be at or above screening levels, further investigation or action could be taken at the site to prevent potential human exposure to chemicals.

Neither BiT nor the ATSDR Brownfields/Land Reuse Site Tool are required for use by U.S. EPA grantees or other regulatory agencies. Either tool could be modified, augmented, or combined to create a simple data entry system (i.e., site inventory) that quantifies and documents brownfield contaminant levels and catalogs public health and sustainability plans or efforts. An enhanced tool ultimately could enable robust estimates of health risk reduction associated with site cleanup. This information could inform developers, environmental and health agencies, researchers, and policy makers about optimum conditions for maximum health risk reduction at brownfields and other hazardous waste sites for different types of brownfield sites (e.g., former dry cleaners, former gasoline stations). In addition, public health (e.g., risk-based) indices could be integrated with other social and economic indicators to obtain more reliable and comprehensive monitoring and assessment of community health improvement in areas affected by brownfields.

U.S. EPA and other regulatory bodies in charge of brownfields redevelopment could support and expand methods to allow public health, sustainability, and economic evaluation for brownfields redevelopment using qualitative and quantitative techniques. For example, the U.S. EPA EJScreen tool (U.S. EPA, 2022) employs GIS techniques, demographic information from the U.S. Census Bureau, and limited county-level health statistics to highlight potential environmental justice areas. EJScreen also highlights spatial relationships between proximity to hazardous waste sites and many demographic or social indicators.

In the absence of a national epidemiological surveillance program in the U.S., only limited community-level health effects data are available to support observational epidemiological investigations. Having local health data could help define risks and spur risk-ranked redevelopment while at the same time increasing public awareness and advocacy for site development that improves the environment and health of the community.

Conclusion

U.S. EPA and other federal agencies have made significant strides in funding the redevelopment of brownfields. Redevelopment has turned vacant, potentially contaminated, and underutilized sites into public assets that contribute to improvements to the economy

and to health. Using U.S. EPA Brownfields Program funding, over 30,000 sites that reported to ACRES have been assessed for environmental contaminant status and reuse potential, but only 6.5% of these have been cleaned up (U.S. EPA, 2021f). With an estimated 450,000 brownfields in the U.S., there is potential to discover, inventory, assess, cleanup, and redevelop the remaining sites using the accumulated technical and regulatory knowledge gained to date. At the same time, environmental and public health benefits of site redevelopment can be assessed and quantified.

There are few policies or programs dedicated to incorporating public health improvements and sustainability through brownfields redevelopment. The focus in the U.S. is still largely on economic development. Areas with multiple brownfields or high rates of vacant properties can experience disinvestment, crime, environmental injustice, and poorer health status in general (Cain, 2016; Lee & Mohai, 2011; U.S. Government Accountability Office, 2011). A broader focus on public health improvement and sustainability could reduce the inequity and health disparities typically seen in areas with distressed environments.

To increase redevelopment of brownfields and protect public health, more consistency across state and federal programs to release comprehensive and summarized site contaminant information could provide accurate, risk-based, quantitative information to development entities and the public. The data could also contribute to a national data bank to fully quantify contaminant risks of brownfields. Funding for brownfields redevelopment is essential to clean up brownfield sites across the nation, revitalize the economy and health and well-being of communities, and reduce or eliminate inequities and disparities in pollution burden. At the same time, funding for research that leads to better understanding of the public health indicators and measurable outcomes of community-level public health impact can help drive sustainable community redevelopment efforts, ultimately leading to improved health equity and overall healthier communities.

Editor's Note: This review article is the second in a series of three that examine brownfields redevelopment as a subset of overall land use and reuse practices in Europe and the U.S. The first article presented the European landscape of brownfields redevelopment through policy and funding frameworks. This article examined brownfields redevelopment in the U.S. through regulatory, public health, and sustainability lenses. The third article is a comparative analysis of brownfields in the U.S. and Romania.

Acknowledgement and Disclaimer: We confirm that all authors made an equal contribution to the development of this study. The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of ATSDR.

Corresponding Author: Laurel Berman, Agency for Toxic Substances and Disease Registry, 77 West Jackson Boulevard, Suite 433, ATSD-4J, Chicago, IL 60604. Email: laberman@cdc.gov.

References

Agency for Toxic Substances and Disease Registry. (2010). *Community health monitoring: The Baraboo Ringling Riverfront Redevelopment*. https://www.atsdr.cdc.gov/sites/brownfields/docs/Final_Baraboo_032911.pdf

Agency for Toxic Substances and Disease Registry. (2016). *Toxicological profile for asbestos*. https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=30&tid=4

Agency for Toxic Substances and Disease Registry. (2019a). *ATSDR action model*. https://www.atsdr.cdc.gov/sites/brownfields/model.html

Agency for Toxic Substances and Disease Registry. (2019b). *Build your own community health and land reuse scorecard toolkit*. https://www.atsdr.cdc.gov/sites/brownfields/reusescorecard.html

Agency for Toxic Substances and Disease Registry. (2020a). *Brownfields & Reuse Opportunity Working Network (BROWN)*. https://www.atsdr.cdc.gov/sites/brownfields/stakeholders.html

Agency for Toxic Substances and Disease Registry. (2020b). *ATSDR land reuse health program*. https://www.atsdr.cdc.gov/sites/brownfields/

Agency for Toxic Substances and Disease Registry. (2020c). *Toxicological profile for lead*. https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=96&tid=22

Agency for Toxic Substances and Disease Registry. (2020d). *ATSDR Brownfields/Land Reuse Site Tool*. https://www.atsdr.cdc.gov/sites/brownfields/site_inventory.html

Berman, L., Hall, E., & Omoh, E. (2019). Part 3: Public health indicators associated with land reuse and redevelopment: Results of a 40-community analysis. *Journal of Environmental Health*, *82*(5), 34–37. https://www.neha.org/sites/default/files/jeh/JEH12.19-Integrating-Public-Health-in-Land-Reuse-Part-3.pdf

Cain, C. (2016). *Fighting blight in the Northeast-Midwest region: Assessing the federal response to vacant and abandoned properties*. Northeast-Midwest Institute. https://www.nemw.org/wp-content/uploads/2016/05/2016-Fighting-Blight-in-NEMW.pdf

de Leon, E., & Schilling, J. (2017). *Urban blight and public health: Addressing the impact of substandard housing, abandoned buildings, and vacant lots*. Urban Institute. https://www.urban.org/research/publication/urban-blight-and-public-health/view/full_report

Jenkins, R., Kopits, E., & Simpson, D. (2006). *Measuring the social benefits of EPA land cleanup and reuse programs*. U.S. Environmental Protection Agency, National Center for Environmental Economics. https://www.epa.gov/sites/default/files/2014-12/documents/measuring_the_social_benefits_of_epa_land_cleanup_and_reuse_programs.pdf

continued on page 14

References *continued from page 13*

Kansas State University. (n.d.). *TAB program*. https://www.ksutab.org/

Lee, S., & Mohai, P. (2011). Research article: Racial and socioeconomic assessments of neighborhoods adjacent to small-scale brownfield sites in the Detroit region. *Environmental Practice*, *13*(4), 340–353. https://doi.org/10.1017/S1466046611000366

Morar, C., Berman, L., Unkart, S., & Erdal, S. (2021). Sustainable brownfields redevelopment in the European Union: An overview of policy and funding frameworks. *Journal of Environmental Health*, *84*(4), 24–31.

National Congress of American Indians. (2022). *Tribal governance*. http://www.ncai.org/policy-issues/tribal-governance

Rampersad, G. (2020). Community health coalitions: A tool for creating sustainable health improvement initiatives through land redevelopment. In L. Berman (Ed.), *Land reuse and redevelopment: Creating healthy communities* (pp. 219–223). Agency for Toxic Substances and Disease Registry. https://www.atsdr.cdc.gov/sites/brownfields/classroom_training/Creating_Healthy_Communities.pdf

Smart Growth America. (2022). *Home page*. https://smartgrowthamerica.org

U.S. Environmental Protection Agency. (2006). *Sustainable reuse of brownfields: Resources for communities* (EPA 560-F-06-247). https://www.epa.gov/sites/default/files/2015-09/documents/bf_sustain_trifold.pdf

U.S. Environmental Protection Agency. (2009). *Building a sustainable future: A report on the Environmental Protection Agency's Brownfields Sustainability Pilots*. https://www.epa.gov/sites/production/files/2015-09/documents/sustain_report_web_final.pdf

U.S. Environmental Protection Agency. (2013). *Equitable redevelopment of petroleum brownfields for Zuni Pueblo and other tribal communities*. https://www.epa.gov/sites/production/files/2014-02/documents/zuni-guide1.pdf

U.S. Environmental Protection Agency. (2016). *Cleaning up brownfields under state response programs—Getting to "no further action"* (EPA 560-K16-002). https://www.epa.gov/sites/default/files/2016-08/documents/final_nfa_document_layout_8-1-16.pdf

U.S. Environmental Protection Agency. (2019). *2019 brownfields federal programs guide* (EPA 560-B-19-001). https://www.epa.gov/sites/production/files/2017-06/documents/final_2017_bf_fed_guide_5-8-17.pdf

U.S. Environmental Protection Agency. (2021a). *Overview of EPA's brownfields program*. https://www.epa.gov/brownfields/overview-epas-brownfields-program

U.S. Environmental Protection Agency. (2021b). *State and Tribal Response Program grants*. https://www.epa.gov/brownfields/state-and-tribal-response-program-grants

U.S. Environmental Protection Agency. (2021c). *Brownfields program accomplishments and benefits*. https://www.epa.gov/brownfields/brownfields-program-accomplishments-and-benefits

U.S. Environmental Protection Agency. (2021d). *Health monitoring & brownfield grants* (EPA 560-F-21-202). https://www.epa.gov/system/files/documents/2021-10/bf-health-monitoring-fs-10-25-21.pdf

U.S. Environmental Protection Agency. (2021e). *Building blocks for sustainable communities*. https://www.epa.gov/smartgrowth/building-blocks-sustainable-communities

U.S. Environmental Protection Agency. (2021f). *Brownfields grantee reporting using the Assessment, Cleanup and Redevelopment Exchange System (ACRES)*. https://www.epa.gov/brownfields/brownfields-grantee-reporting-using-assessment-cleanup-and-redevelopment-exchange-system

U.S. Environmental Protection Agency. (2022). *EJScreen: Environmental justice screening and mapping tool*. https://www.epa.gov/ejscreen

U.S. Government Accountability Office. (2011). *Vacant properties: Growing number increases communities' costs and challenges* (GAO-12-34). https://www.gao.gov/products/gao-12-34

U.S. Green Building Council. (2021). *LEED rating system*. https://new.usgbc.org/leed

Association Between Equipment Maintenance Violations in Food Service Establishments and Their Risk Level According to the Ohio Administrative Code in Cincinnati, Ohio

Mario Keko
Joana Tome
William A. Mase, DrPH
Haresh Rochani, DrPH
Jiann-Ping Hsu College of Public Health, Georgia Southern University

Abstract **This study analyzed food service inspection data from July 2015–June 2016 for the food safety program of the Cincinnati Health Department to evaluate the presence of significant differences on equipment maintenance violations (EMVs) by geographic location. The primary research question was: Do food service establishments (FSEs) vary in their odds of incurring an EMV depending upon their risk level when compared across the socioeconomic status of their physical location? We used a chi-square test to check if there was a difference in the distribution of EMVs regarding the risk class of FSEs and performed a logistic regression analysis to reveal the effect of risk class and socioeconomic status in FSEs receiving EMVs. We found a significant difference in the distribution of businesses receiving an EMV among different risk class categories. Moving from the highest to lowest risk class, the proportion of FSEs that have received at least one EMV decreases steadily. Compared with risk class 4 (the highest), the odds ratio of receiving an EMV for risk class 1 was 0.12, risk class 2 was 0.13, and risk class 3 was 0.41. Geographical mapping of risk class and receiving an EMV showed the same pattern in which census tracts with a higher proportion of risk class 4 FSEs have a higher percentage of receiving EMVs.**

Introduction

Foodborne illnesses are a serious public health concern, with the annual burden estimated to be 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths in the U.S. in 2011 (Leinwand et al., 2017). Scharff (2015) estimated that the aggregated annual cost of foodborne illness to the U.S. economy was $55.5 billion. Epidemiological research has indicated that the majority of reported foodborne illness outbreaks originate in food service establishments (FSEs) and case control studies have shown that eating meals outside the home is a risk factor for obtaining a foodborne illness (Green & Selman, 2005).

Federal responsibility for food safety rests primarily with the Food and Drug Administration (FDA) and the U.S. Department of Agriculture. FDA is responsible for safeguarding the nation's food supply and routinely inspecting food facilities. In addition to conducting its own inspections, FDA relies on state agencies to conduct inspections on its behalf (Agnew & Yokley, 2013).

In an effort to meet FDA Voluntary National Retail Food Regulatory Program Standards, the Cincinnati Health Department (CHD) in Ohio instituted a staff training program in 2012 for improving food safety within restaurant operations under its jurisdiction (National Environmental Health Association, 2007). Through homogeneous staff training, the CHD workforce is expected to have a more consistent methodology for conducting inspections of FSEs and other retail food establishments within the Cincinnati area (Kaml et al., 2013). CHD inspections of FSEs and retail food establishments use an electronic inspection program (Sharkey et al., 2012). Inspectors electronically record their inspection reports and violations. When they return to their offices, they upload the gathered information to the Cincinnati Area GIS, where all data are stored for CHD.

Food from an unsafe source, inadequate cooking time/temperature control for safety (TCS) of food, inadequate hot/cold holding of TCS food, employee hygiene, and contamination are the most common causes of foodborne illnesses (Sharkey et al., 2012), which is why inspectors evaluate the performance of FSEs based on these measures. One important and common type of violation that presents a risk factor for foodborne illnesses is equipment maintenance violations (EMVs). Pathogens that cause foodborne illnesses, pesticides, and chemicals can contaminate equipment that is used to prepare food.

GIS analysis of critical health code violations, rates, and inspection frequency showed that, overall, FSEs in higher poverty areas had a greater number of facilities with at least one

TABLE **1**

Risk Class Category Descriptions

Risk Class	Definition	Example
1	Poses potential risk to the public in terms of sanitation, food labeling, food source, storage practices, or expiration dates.	• Coffee, self-service fountain drinks, prepackaged non-TCS beverages and foods • Baby food or formula
2	Poses a higher potential risk to the public than risk level 1 because of hand contact or employee health concerns, but minimal possibility of pathogenic growth exists.	• Handling, heat treating, or preparing non-TCS foods
3	Poses a higher potential risk to the public than risk level 2 because of the proper cooking/holding temperatures, cooling procedures, contamination issues, etc.	• Handling, cutting, or grinding raw meat products or cheeses • Operating a heat treatment dispensing freezer • Heating of a product from an intact, hermetically sealed package and holding it hot, or reheating a product in individual portions only
4	Poses a higher potential risk to the public than risk level 3 because of concerns associated with reheating, using freezing as a means to achieve parasite destruction, high-risk clientele, etc.	• Reheating leftover TCS foods more than once every 7 days • Caterers or other similar food service operations that transport food

Note. Not all food service establishments fall entirely into a single individual risk class category. TCS = time/temperature control for safety.
Source: The Ohio Legislature, 2010.

critical health code violation (Darcey & Quinlan, 2011). In the U.S., few studies are available that examine the relationship between incidence of foodborne illnesses and socioeconomic status. To the best of our knowledge, no study has ever investigated the relationship between socioeconomic status and EMVs in Cincinnati. Diseases transmitted through food or water constitute the fourth most commonly reported category of communicable diseases in Cincinnati (Cincinnati Health Department, 2017). Seeing the considerable number of foodborne illnesses, it is interesting to understand where EMVs are more predominant. In order to make recommendations for preventing and controlling foodborne disease outbreaks, public and environmental health professionals must understand what factors contribute to these restaurant-associated foodborne diseases (Gould et al., 2013).

To facilitate the understanding of what factors can contribute to restaurant-associated foodborne diseases and to promote uniform and standardized inspections, the FDA model *Food Code* provides scientific standards and guidelines that states and localities can adopt for food safety in restaurants and institutional food settings (Institute of Medicine & National Research Council, 1998). Ohio has developed the Ohio Uniform Food Safety Code based on the 2017 FDA *Food Code*, which is updated every 4 years. The Ohio Uniform Food Safety Code is administered by the Food Safety Program of the Ohio Department of Health and the Division of Food Safety of the Ohio Department of Agriculture.

The Ohio Uniform Food Safety Code includes criteria for:

- sanitation and equipment,
- review of facility layout and equipment specifications in FSEs and retail food establishments,
- evaluation of the primary business of a person or government entity for purposes of determining whether the person or entity should be licensed as an FSE or retail food establishments, and
- the definition of "potentially hazardous" as it pertains to food (The Ohio Legislature, 2018).

The Ohio Department of Health and Ohio Department of Agriculture have classified FSEs and retail food establishments into four risk categories in Section 3717 of the Ohio Revised Code and in Rule 3701 of the Ohio Administrative Code (The Ohio Legislature, 2010, 2018; Sharkey et al., 2012). The four risk categories represent increasing potential hazard to the public based on the types of foods served and preparation methods used. EMVs could differ depending upon the four risk categories, geographical disparities, or socioeconomic status levels. Therefore, the main objective of this study was to determine if the odds of an FSE incurring an EMV violation was dependent on a) the risk level of FSEs and retail food establishments and b) socioeconomic status factors.

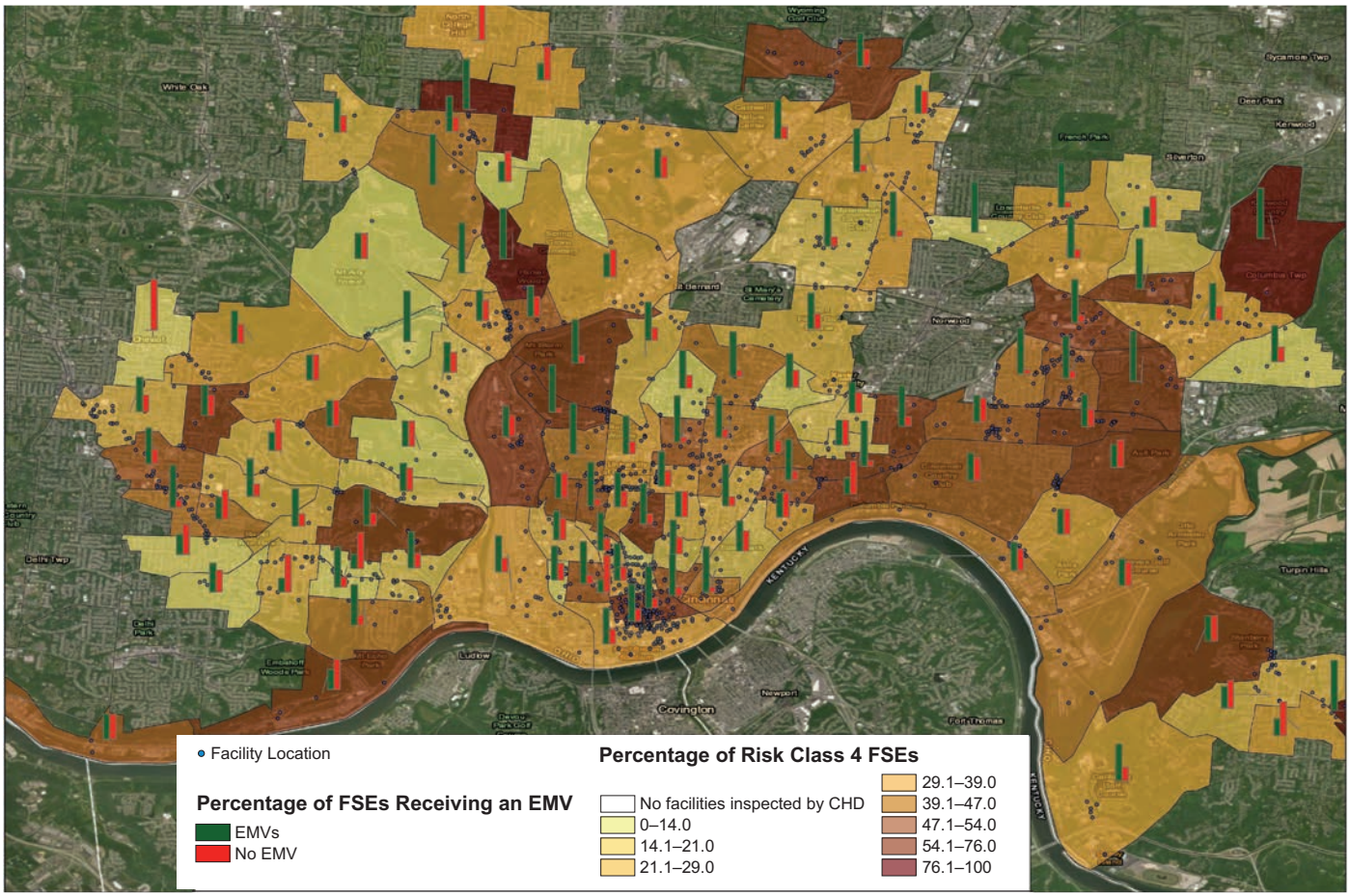
Methods

Data Source

CHD conducts inspections of retail food establishments and records the occurrence of violations in review years, with each review year running from July to June. In this study, our focus was on exploring the association between FSE and retail food establishment risk class categories and socioeconomic status with EMVs on the most recent review year of available data (July 2015–June 2016). These records were collected from CHD inspectors during inspection time and stored in the Cincinnati Area GIS. The inspection data set contains variables such as business name, type of violation (see https://codes.ohio.gov/ohio-revised-code/chapter-3717 for a list of violations), risk classification categories (Table 1), address, census tract number, and business geographic coordinates. According to CHD inspection data, EMVs are coded as 3717.1-04 on the Ohio Uniform Food Safety Code categories and encompass violations related to equipment, utensils, and linens (i.e., all factors related to location, installation, maintenance, and operation).

FIGURE **1**

Distribution of Food Service Establishments (FSEs) Receiving Equipment Maintenance Violations (EMVs) Based on Risk Classification Level 4 by Census Tract



Note. CHD = Cincinnati Health Department.

Data Cleaning

The data set we obtained from CHD consisted of 15,578 food notations issued from July 2015–June 2016. For each notation, we recorded information about all the variables described in the data source section. Within the data set, census tract numbers were missing for 69 notation records. In addition, 224 other notations corresponded to mobile food operations (i.e., FSEs without a fixed location) and vending machines, which pose a low risk. Therefore, we did not include these 293 records in our analysis. After removing 293 records, we had a total of 15,285 notations for 1,695 businesses. A binary variable was created for the 1,695 businesses with a value of 0 if the FSE did not receive an EMV and 1 if the FSE received at least one EMV between July 2015–June 2016.

Based on the geographic coordinates, the 1,695 FSEs were plotted into ArcMap GIS version 10.6. We corrected discrepancies in the data set regarding census tract numbers accordingly using a U.S. census tract map. We double-checked all the corrections using the API Documentation for Developers of the Federal Communications Commission program. Using the 2010 U.S. Census Bureau database (most recent information available), we obtained variables of median age and median income of inhabitants and indicators of unemployment rate, poverty rate, diversity index (i.e., a measure of racial diversity that consists in the probability that two people chosen at random are of different races), and female head of household rates for each census tract.

We obtained information on the distribution of education based on census tracts from the American Community Survey for 2012–2016. The original education variables were merged into four levels (less than high school, high school graduate, some college classes/associate degree, and bachelor's/graduate degree) where each level reflects the census tract percentage of inhabitants >25 years within the corresponding education category. The final data set for analysis was created by merging the FSE data set with the socieconomic status data set based on census tract numbers, along with other variables

TABLE **2**

Distribution Among Risk Classification Levels of Equipment Maintenance Violations (EMVs) for Food Service Establishments (FSEs)

Level	FSEs Not Receiving an EMV # (%)	FSEs Receiving at Least One EMV # (%)	Total # (%)	Chi-Square Value	*p*-Value
Risk class 1	95 (56.6)	72 (43.4)	166 (9.8)	222.7	<.001
Risk class 2	149 (53.7)	130 (46.6)	279 (16.5)		
Risk class 3	158 (13.3)	420 (72.7)	578 (34.1)		
Risk class 4	90 (13.4)	582 (86.4)	672 (39.6)		
Total	491 (29.0)	1,204 (71.0)	1,695 (100)	–	

such as risk classification, presence of EMVs, and socieconomic status indicators.

Statistical Methods

We used a chi-square test of independence to check if there was an association between EMV with regard to the risk class of the FSE. Furthermore, we performed logistic regression to evaluate the effect of risk classification categories on EMV by adjusting for socioeconomic status indicators. We used the following logistic regression model to analyze the data:

$$\text{Logit}(Y) = \beta_0 + \beta_1(\text{risk class}) + \beta_2(\text{median age}) + \beta_3(\text{median income}) + \beta_4(\text{unemployment rate}) + \beta_5(\text{education level}) + \beta_6(\text{female head of household})$$

The model compares the odds of receiving an EMV for risk class 1–3 categories with risk class 4 (i.e., the highest risk class and the risk class used as the reference). Median age, income, unemployment rate, education level, and the percentage of female head of households were considered to reflect the socieconomic status of the census tract—and are included in the model to adjust the association of risk class and occurrence of a violation. Figure 1 presents important findings of our logistic regression model in geographical context using ArcMap GIS, version 10.6. The census tracts map of Hamilton County, Ohio, is color coded accordingly to represent the percentage of businesses classified as risk class 4 located in each census tract; the bars show the percentage of businesses that have or have not received at least one EMV.

Results

A total of 1,695 FSEs in Hamilton County were visited by CHD in the 2015–2016 review year. Of those FSEs, 1,204 (71.0%) received at least one EMV during that time period. There was a total of 4,602 EMV notations issued with a mean of 3.8 (*SD* = 3.5) per FSE. Considering risk classification, 9.8% of FSEs belong to risk class 1, 16.5% to risk class 2, 34.1% to risk class 3, and 39.6% to risk class 4 (Table 2). The frequency analysis of distribution of FSEs receiving EMVs with regard to census tracts shows that, on average, 68.6% of FSEs in each census tract had at least one EMV, with a median of 70.0% (*SD* = 19.1%, Figure 1).

There was a statistically significant difference in the distribution of FSEs that have received or have not received an EMV among different risk classification categories (p = <.001). Risk class 4 category had the highest number of FSEs that received at least one EMV during the time period (86.4%); while moving from this category toward lower risk, the proportion of FSEs that had received at least one EMV decreased steadily. The lowest percentage for an FSE receiving an EMV was risk class 1 (43.4%, Table 2).

For socioeconomic status, logistic regression showed that lower potential risk categories have lower odds of receiving an EMV. Specifically, when compared with risk class 4, FSEs that belong to risk class 1 had an odds ratio (*OR*) of 0.12, risk class 2 had an *OR* of 0.13, and risk class 3 had an *OR* of 0.41 of receiving at least one EMV. The *p*-value was <.001 for all the comparisons, showing that risk category is a significant factor in the model for predicting EMVs. The odds of receiving an EMV are lower in lower risk categories and increase constantly as risk classification moves from 1 to 4, showing a positive relationship between them. We also found that all socioeconomic status indicators (excluding median income, which has a negligible effect with a β estimate of -0.00002) do not significantly influence the relationship between risk category and EMVs (Table 3).

The findings of this prediction model regarding the odds an FSE has of receiving an EMV based on risk classification are also consistent with their geographical distribution based on census tract numbers. The map of these plotted variables of interest shows the census tracts that have a higher percentage of FSEs belonging to risk class 4 have a higher percentage of FSEs that have received an EMV. Figure 1 highlights this finding: as the brown color representing the risk class 4 percentage in one particular census tract gets darker, the green bar representing the percentage of EMVs gets higher, while the red bar that represents the percentage of FSEs that have not received an EMV gets lower.

Discussion

The inspection process of FSEs and other retail food establishments is the primary assurance function of the nation's local public health departments—an intervention that is intended to prevent and control foodborne illnesses. The results from our analysis of inspection records generated by CHD inspectors serve as indicators that can be used to identify risk factors, highlight current or trending situations of assuring food safety levels by FSEs or retail food establishments, and evaluate the effectiveness of interventions. The understanding of factors that increase the risk of developing a foodborne illness and the need to increase awareness of foodborne illness hazards can improve the capacity of local public health departments to successfully intervene, prevent, and control foodborne illnesses.

Some studies have shown that low-income populations have a higher probability of gastrointestinal illnesses; in addition, racial and ethnic minorities have higher rates of foodborne illnesses (Quinlan, 2013). Moreover, spacial analysis of health code violations in Philadelphia, Pennsylvania, showed that census tracts with a lower socioeconomic status have a higher percentage of food safety violations (Darcey & Quinlan, 2011). Using the conclusions provided by our literature review, as well as evidence provided by similar studies, we evaluated the presence of simi-

TABLE **3**

Analysis of the Prediction of Equipment Maintenance Violations Based on Risk Classification Levels While Adjusting for Socioeconomic Status Indicators

Parameter	β	*SE*	Wald	*df*	*p*-Value	*OR*	95% CI
Intercept	-7.9	11.2	0.5	1	.48		
Risk class 1	-0.84	0.13	42.8	1	<.001	0.12	[0.08, 0.18]
Risk class 2	-0.76	0.11	50.8	1	<.001	0.13	[0.10, 0.19]
Risk class 3	0.36	0.09	15.2	1	<.001	0.41	[0.31, 0.55]
Median age	0.006	0.01	0.39	1	.53	1.007	[0.99, 1.03]
Median income	-0.00002	5.61	15.1	1	.0001	1.000	[1.0, 1.0]
Unemployment rate	-0.005	0.01	0.2	1	.64	0.99	[0.98, 1.01]
Diversity index	-0.0006	0.004	0.03	1	.87	0.99	[0.99, 1.007]
Education level 1	9.3	11.6	0.64	1	.42	>999	[<0.001, >999]
Education level 2	9.3	11.1	0.70	1	.40	>999	[<0.001, >999]
Education level 3	8.2	11.4	0.51	1	.47	>999	[<0.001, >999]
Education level 4	10.4	11.2	0.86	1	.35	>999	[<0.001, >999]
Female head of household	-0.005	0.004	2.1	1	.14	0.99	[0.98, 1.002]

Note. For risk class, the reference was risk class 4. CI = confidence interval; education level 1 = less than high school; education level 2 = high school graduate; education level 3 = some college classes/associate degree; education level 4 = bachelor's/graduate degree.

lar relationships for the Cincinnati area. The data, however, failed to reveal the existence of a similar pattern. A probable reason could be that the Philadelphia study took into consideration a 4-year period (2005–2008) and had a sample size of 15,859 facilities compared with our study that used 1 year of data and had a sample size of 1,695 facilities. Our hypothesis is that applying the same model we developed to a larger sample size generated from a longer data collection time would suffice in establishing the same conclusion about the relationship of socioeconomic status with EMVs.

Our methods showed a positive relationship between risk class and the odds of receiving an EMV, which is consistent with previous published literature. This finding presents local health departments with potential opportunities whereby resource allocations could be increased and more attention could be paid to higher risk class FSEs. This potential would make the use of time and resources more efficient and, at the same time, address food safety issues in a more timely manner. As a result, food safety for the public could be improved, which would increase the protection level of the health of the populations who consume food from these FSEs.

One limitation of our study is considering the socioeconomic status variables to be distributed equally among each individual census tract. We assumed that the socioeconomic status of the area where an FSE was located was the same as that of the other FSEs, as long as they belong physically to the same census tract. Even among the census tracts, however, the distribution of these factors might be different and we did not address this potential variation in our study.

Conclusion

The importance of food safety policy, assurance functions within public health, and evidence-based decision making has a direct impact on the health of populations. Our study demonstrates that both food class and geographic distribution of FSEs are statistically significant and that FSEs with a higher risk class are more likely to have an EMV. Moreover, the probability of incurring at least one EMV increases consistently in moving from lower risk class level FSEs to higher risk class level FSEs.

We think it would be useful to explore if the socioeconomic factors of the area where a business is located are uniformly distributed. We believe future work that takes into consideration more area-specific measurements of socioeconomic status (i.e., in the census block level, which is smaller than census tracts) would be better able to explore the presence of differences in distribution of socioeconomic status measurements in the same census tract and detect if this would have an effect on the associations observed in our current analysis.

Acknowledgements: The authors would like to thank CHD for sharing the data and providing support and explanations where needed.

Corresponding Author: William A. Mase, Associate Professor, Department of Health Policy and Community Health, Jiann-Ping Hsu College of Public Health, Georgia Southern University, 501 Forest Drive, Statesboro, GA 30458-8015.
Email: wmase@georgiasouthern.edu.

References

Agnew, G., & Yokley, D. (Eds.). (2013). *Food safety: Developments, policies, programs, and research* (Vol. 1). Nova Science Publishers, Inc.

Cincinnati Health Department. (2017). *City of Cincinnati: Community health assessment*. https://www.cincinnati-oh.gov/sites/health/assets/File/EDIT%20THIS%20CHA_12_21_17%20FINAL.pdf

Darcey, V.L., & Quinlan, J.J. (2011). Use of geographic information systems technology to track critical health code violations in retail facilities available to populations of different socioeconomic status and demographics. *Journal of Food Protection*, *74*(9), 1524–1530. https://doi.org/10.4315/0362-028X.JFP-11-101

Gould, L.H., Rosenblum, I., Nicholas, D., Phan, Q., & Jones, T.F. (2013). Contributing factors in restaurant-associated foodborne disease outbreaks, FoodNet sites, 2006 and 2007. *Journal of Food Protection*, *76*(11), 1824–1828. https://doi.org/10.4315/0362-028X.JFP-13-037

Green, L.R., & Selman, C. (2005). Factors impacting food workers' and managers' safe food preparation practices: A qualitative study. *Food Protection Trends*, *25*(12), 981–990.

Institute of Medicine, & National Research Council Committee to Ensure Safe Food From Production to Consumption. (1998). *Ensuring safe food : From production to consumption*. National Academies Press. https://doi.org/10.17226/6163

Kaml, C., Fogarty, K.J., Wojtala, G., Dardick, W., Bateson, A., Bradsher, J.E., & Weiss, C.C. (2013). The development of a standards-based national curriculum framework for regulatory food safety training in the United States. *Journal of Environmental Health*, *76*(2), 38–42.

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

National Environmental Health Association. (2007). EH update: FDA reports high enrollment in Voluntary National Retail Food Regulatory Program Standards. *Journal of Environmental Health*, *70*(1), 68. https://www.jstor.org/stable/26327334

The Ohio Legislature. (2010). *Ohio administrative code: Rule 3701-21-02.3, risk level of food service operations*. https://codes.ohio.gov/oac/3701-21-02.3

The Ohio Legislature. (2018). *Ohio revised code: Section 3717.05, uniform food safety code*. https://codes.ohio.gov/orc/3717.05

Quinlan, J.J. (2013). Foodborne illness incidence rates and food safety risks for populations of low socioeconomic status and minority race/ethnicity: A review of the literature. *International Journal of Environmental Research and Public Health*, *10*(8), 3634–3652. https://doi.org/10.3390/ijerph10083634

Scharff, R.L. (2015). State estimates for the annual cost of foodborne illness. *Journal of Food Protection, 78*(6), 1064–1071. https://doi.org/10.4315/0362-028X.JFP-14-505

Sharkey, K.W., Alam, M., Mase, W., & Ying, J. (2012). An investigation to determine the association between foodborne illness and number of citations in a food establishment. *Journal of Environmental Health*, *75*(2), 8–11.

Spatial Analysis of the Impact of "Do Not Spray" Areas on Mosquito Adulticiding in the Suburbs of Northwest Chicago, Illinois

Patrick Irwin, PhD
Northwest Mosquito Abatement District
University of Wisconsin–Madison

Dan Bartlett
Northwest Mosquito Abatement District

Kristina Lopez
University of Wisconsin–Madison

Abstract **Mosquito adulticides are tools to manage populations and reduce human disease risks. We examined the spatial impact of policies that affect the ability to conduct adult mosquito control. We used the Northwest Mosquito Abatement District (NWMAD) to illustrate how various constraints can impact vector control. Almost 12.7% of the 233 mi² covered by NWMAD is owned by the Forest Preserve District (FPD) or has been designated as a Nature Preserve Area (NPA). Pesticide application is prohibited in both FPDs and NPAs. Additionally, NWMAD allows residents to opt out of having their property parcel sprayed for mosquitoes by being placed on a "do not spray" (DNS) list. As of February 2019, 162 residential and beehive parcels encompassing 1,059.2 acres are listed. As a result of this policy, 2,686 residential and beehive parcels (1.3% of all parcels) received reduced or no mosquito adulticide sprays in 2018. These parcels were distributed unevenly across the district's eight townships, with approximately 90% of residential DNS acreage in two townships. Nearly 14% of all NWMAD acreage is exempt from treatment, which could affect the ability to respond effectively to disease outbreaks.**

Introduction

West Nile virus (WNV) was first discovered in 1937 as a new neuroinvasive virus in a febrile woman in the West Nile region of Uganda (Smithburn et al., 1940). In North America, WNV infections were first detected in 1999, with an outbreak among birds and humans in the Queens section of New York City (Nash et al., 2001). Since then, WNV has spread westward across the U.S. and is now found in every state in the continental U.S. (Brownstein et al., 2004). According to the Centers for Disease Control and Prevention (CDC, 2021), a total of 52,532 human cases of WNV infection, including 2,456 fatalities, were reported from 1999–2020. These cases represent only a fraction of the total persons exposed, as many cases are asymptomatic (Mostashari et al., 2001). Even apparently mild cases can have long-term deleterious effects on human health (Carson et al., 2006). Thus, the transmission of WNV is an important public health issue for the U.S.

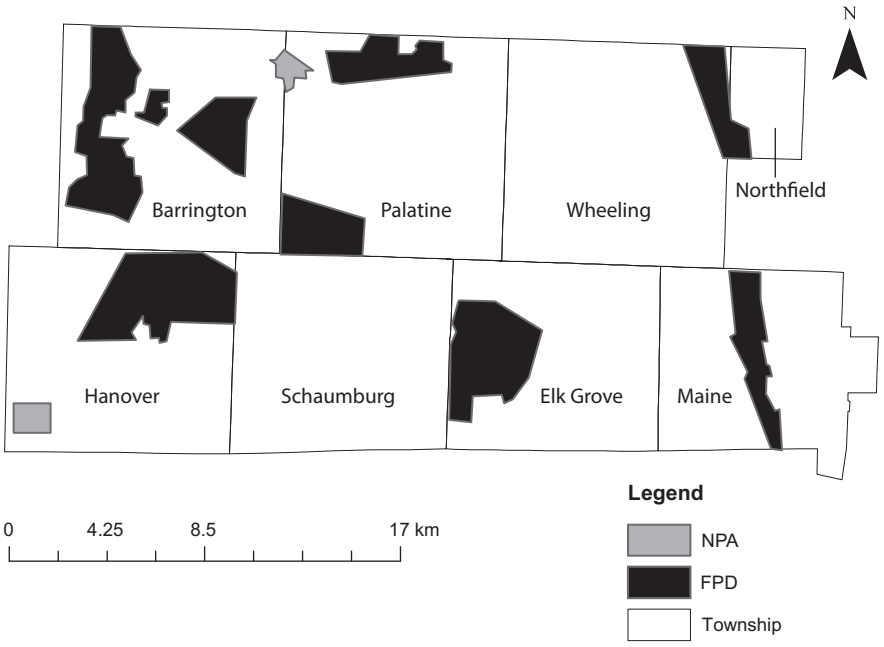
Cook County, Illinois, is considered a hot spot for human WNV infection, having had 1,202 human cases reported during 2002–2020 (Bertolotti et al., 2008; Cook County Department of Public Health, 2021). It is the only county east of the Mississippi River to have an annual human WNV case count of >21 every year from 2012–2018 (CDC, 2022).

Adult mosquito control using ground-based, ultra-low volume (ULV) pesticide application is one tool that mosquito abatement districts and public health agencies use to control WNV-infected mosquitoes (CDC, 2020). Adulticide application is an effective tool to reduce mosquito populations and the spread of WNV, especially when transmission could be at an outbreak level (Bellini et al., 2014; Lothrop et al., 2007; Mutebi et al., 2011).

In Cook County, there are five major mosquito abatement districts (MADs) or programs that cover Chicago and the surrounding suburbs. MADs are tasked with monitoring and abating mosquitoes to control human WNV transmission. All these agencies can conduct adult mosquito control but are committed to using it as a last resort, preferring to focus on larval control, breeding source reduction, and public education. Most of these programs offer the opportunity for residents to opt out of adult mosquito control on or near their property using a "do not spray" (DNS) list. Policies governing inclusion on the DNS list and size of the buffer around properties on a DNS list vary among the five MADs.

FIGURE **1**

Map of the Northwest Mosquito Abatement District and Its Townships



Note. FPD = Forest Preserve District; NPA = Nature Preserve Area.

An informal survey of other MADs and one national mosquito abatement company with locations in the Midwest and West Coast found that most have some mechanism for residents to opt out of adult mosquito control that would impact their property. Other reasons that allow one to opt out of adult vector control include having a nature preserve that does not allow adult mosquito control and/or having a registered organic farm. The buffer size around these DNS areas vary depending on the type of property and by the organization conducting the mosquito control.

The Northwest Mosquito Abatement District (NWMAD) encompasses 233 mi^2 (603 km^2) in the suburbs northwest of Chicago, Illinois. This MAD serves approximately 759,000 residents and comprises more than 282,000 households (U.S. Census Bureau, 2021). Land use varies across NWMAD, with urban residential and industrial uses dominating the eastern two thirds, whereas residential, forest preserves, and agricultural lands are predominant in the western one third of the district. The current NWMAD DNS policy for residents includes anyone who makes a personal request, regardless of the reason. During adult mosquito sprays, NWMAD staff turn off the sprayer 150 ft before a DNS residence and leave it off for 150 ft past the residence. The DNS list is continuously updated with resident requests. A DNS request for a residence is removed when the resident no longer lives at the address.

For comparison, two other Chicago-area MADs, the North Shore Mosquito Abatement District (NSMAD) and Desplaines Valley Mosquito Abatement District (DVMAD), require a letter of exemption from a medical professional prior to placing a property on the DNS list. The letter must state that a resident has a medical condition that could be exacerbated by adulticiding activities; the medical condition does not need to be revealed (M. Tomek, personal communication, March 1, 2018; D. Zazra, personal communication, March 1, 2018). NSMAD turns off sprayers at the DNS property boundary, while DVMAD turns off sprayers for an approximately one-half block radius around the DNS property. The South Cook County Mosquito Abatement District has DNS policies similar to NWMAD, including anyone who makes a personal request, regardless of reason (M. Slamecka, personal communication, March 5, 2018; J. Thennisch, personal communication, March 5, 2018). The program for the city of Chicago contracts a private company to do adulticide spraying and does not have a DNS list (C. Blanco, personal communication, March 14, 2018).

A concern with DNS policies is that these areas, coupled with other nonspray areas, could result in a significant reduction of the total area covered by adulticide. Ultimately, if the nonspray area is large enough, it could reduce the capacity of an agency to manage local mosquito populations and therefore disease transmission. The objective of our study was to use NWMAD data to quantify how much operational area was excluded by DNS sites, with the hope it would inform other agencies tasked with mosquito control of this issue. DNS sites include natural areas, residential properties, and beehive locations. The spatial analyses described here give perspective to the impact of DNS sites within the approximately 150,000 acres of NWMAD (Tables 1–4).

Methods

NWMAD uses GIS to maintain spatial integrity of mapping processes and to monitor mosquito control operations. The data used for GIS are gathered from county-level data, digitized from aerial imagery, or captured on field computers by district employees. For this study, GIS was used to accurately map and perform spatial analyses on parcels, DNS parcels, roadways, Forest Preserve Districts (FPDs), Nature Preserve Areas (NPAs), and district-defined sections based on the Public Land Survey System.

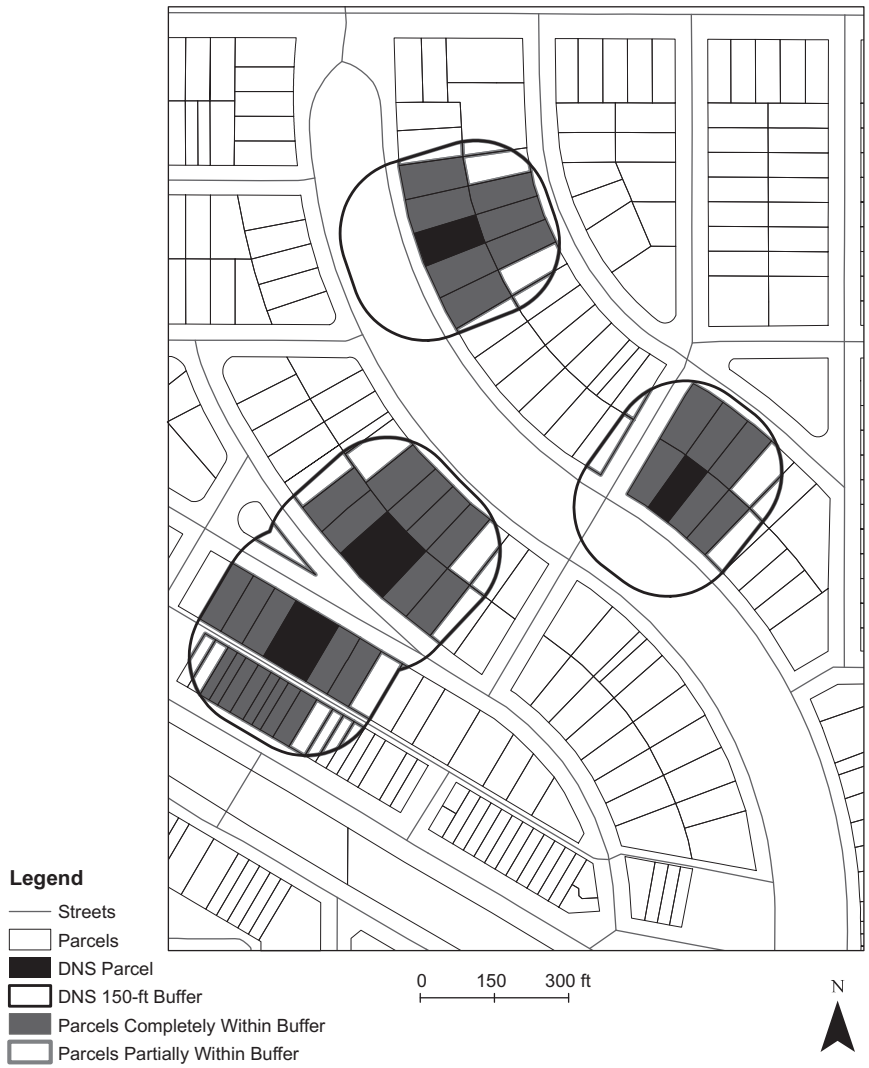
The nonresidential DNS areas within the district were mapped first using the two feature classes: FPDs and NPAs (Figure 1). These areas are not sprayed by the request of the managing agencies. The primary data source for FPDs was shapefiles (an Esri vector data storage format for storing the location, shape, and attributes of geographic features) from Cook Central, the online geospatial data hub for Cook County (Cook County Government, 2021). Additional areas managed by the Cook County FPD, but not included in the shapefile, were added by digitizing 2016 aerial imagery obtained from the

Cook County GIS Department (Cook County Government, n.d.). NPAs were mapped based on the parcel(s) they covered and the same aerial imagery.

We evaluated residential DNS areas using a multilevel approach based on acreage and parcels. First, we calculated the impact of residential DNS requests on the district acreage to be sprayed based strictly on the parcel(s) owned by the resident. We then calculated the impact of the 150-ft (45.72 m) buffer around those parcels (Figure 2). This buffer size was based upon the standard truck-mounted ULV sprayer swath (Armed Forces Pest Management Board, 2019) and extends 150 ft from the edge of the parcel extent. Second, we assessed the impact of the buffer around the residential DNS area on a) parcels completely within the buffer distance and b) parcels partially affected by the buffer distance. We assessed the effect of residential DNS areas at the township level in three ways: 1) the percentage of residential DNS parcels in the township, 2) the percentage of residential DNS acreage in the township, and 3) the percentage of each township occupied by DNS parcels.

FIGURE **2**

Impact of Single and Multiple Do Not Spray (DNS) Parcels



Results

We identified over 20,500 acres of FPDs and almost 140 acres of NPAs within NWMAD (Table 1). The total loss of acreage due to FPDs and NPAs is almost 18,950 acres. The total loss is less than the raw acreage of FPDs and NPAs due to treatment of these areas from nearby roadways.

At the time of this study (February 2019), NWMAD had 137 residential DNS parcels. The initial approach (based solely on the DNS parcel extent) determined that approximately 1,035 acres (0.7% of the potentially treatable area of the district) were eliminated from treatment, which is the minimum impact of the DNS policy. When the buffer is applied to each DNS parcel, however, the area affected increased by 580 acres, totaling approximately 1,600 acres (1% of the potentially treatable area of the district; Table 2). Within the 580 acres of the DNS buffer, 656 parcels were completely within the buffer and excluded from treatment. This finding brings the total to 793 parcels receiving no adulticide treatment. The buffer extends to include 1,491 parcels that receive partial treatment, which brings the total to 2,284 parcels receiving reduced or no adulticide treatment (Table 2).

In addition to the 137 residential DNS parcels, an additional 25 parcels were included in the DNS area because the residents housed beehives on the property (Table 3). The buffer around these areas included 83 parcels completely within the buffer and 294 parcels partially within the buffer, which totals 402 parcels receiving reduced or no adulticide treatment.

The total loss of acreage due to the DNS policy is 20,773 acres, almost 14% of the total area within NWMAD (Table 4). Most of the treatment area lost is due to FPDs and NPAs, but residential and beehive parcel loss is considerable.

NWMAD encompasses, either fully or partially, eight separate townships: Barrington, Elk Grove, Hanover, Maine, Northfield, Palatine, Schaumburg, and Wheeling (Figure 1). We used these data to determine where DNS parcels have a larger impact in more localized areas. We found 90% of the residential DNS acreage in two townships: Barrington and Hanover (Table 5).

Discussion

There is no statutory requirement for DNS lists (Mosquito Abatement District Act, 1925). Listing is offered to residents with health issues that could be exacerbated by

TABLE **1**

Forest Preserve Districts (FPDs) and Nature Preserve Areas (NPAs) in the Northwest Mosquito Abatement District (NWMAD)

Area	Acreage (Hectare)	% of NWMAD Acreage
NWMAD (total)	149,632.88 (60,554.28)	100
FPDs	20,552.04 (8,317.12)	13.73
NPAs	139.15 (56.31)	0.01
FPDs and NPAs (total)	20,691.19 (8,373.43)	13.83
FPDs and NPAs that received adulticide from roadway	1,749.67 (708.07)	1.17
Total loss from FPDs and NPAs	18,941.52 (7,665.36)	12.66

TABLE **2**

Residential Do Not Spray (DNS) Areas Within the Northwest Mosquito Abatement District (NWMAD)

Area	Acreage (Hectare)	% of NWMAD Acreage	Total # of Parcels	% of Parcels in NWMAD
NWMAD (total)	149,632.88 (60,554.28)	100	213,796	100
Residential DNS parcels	1,035.66 (418.85)	0.69	137	0.06
Non-DNS parcels completely within DNS buffer	140.68 (56.93)	0.09	656	0.31
Non-DNS parcels partially within DNS buffer	329.78 (133.78)	0.22	1,491	0.70
Total loss from residential DNS parcels	1,621.25 (656.09)	1.08	2,284	1.07

exposure to pesticide applications. There has been an increase in the public's concern over the past few decades regarding the use of pesticides in the environment (Kabat, 2017; Metcalf, 1993; Peterson, & Higley, 1993; Slovic, 1987). This concern extends to the use of adulticides to protect public health, including ground or aerial applications to prevent arboviral disease transmission (Cohen, 2003; Ziem, 2005). Even in the face of epidemic transmission of WNV in an area, some residents oppose spraying for adult mosquitoes (Haley, 2013).

The primary focus of NWMAD is the reduction of the two WNV vector mosquitoes, *Culex pipiens* (Linneaus) and *Cx. restuans* (Theobold) (Hamer et al., 2008; Hayes et al., 2005). Both species are peridomestic in nature and thus are more likely to be found in urban settings (Spielman, 2001; Vinogradova, 2000). Most of the mosquito disease vectors in the world, including in the U.S., are peridomestic and live near dwellings (Weaver, 2013). Data from historical NWMAD mosquito trapping show that *Cx. pipiens* and *Cx. restuans* are more likely to be found in urban and residential areas than in rural or FPD locations. The FPD locations, however, still produce WNV vector mosquitoes. Analysis of a 6-year data set of gravid trap collections on FPD land revealed capture of an average of approximately 17 *Cx. Pipiens* and *Cx. restuans* per trap night, compared with 21.6 for all district gravid traps (unpublished data, 2018).

We also evaluated WNV infection rates in these mosquitoes by examining a 6-year average of the percentage of WNV positive samples (*Culex* mosquitoes that are pooled from gravid traps) and found that FPD traps are positive 10% of the time over the season compared with the district average of 14%. The FPD land in Cook County is heavily used by residents who might be exposed to infected mosquitoes during their visits. In 2011, it was estimated that the 68,000 acres of FPD land has approximately 40 million visits (University of Illinois Chicago Library, 2021). Not spraying FPD lands could put visitors at risk, as infected mosquitoes are prevalent in these areas.

Beginning in 2015, NWMAD made it a priority to work with beehive owners located within the district. As of October 2018, there were 71 hive locations. After contacting the hive owners and explaining the district's mosquito adulticide program and the potential risk it posed to their bees, an additional 25 properties were added to the DNS list (Pokhrel et al., 2018; Rinkevich et al., 2015; Table 3). In some cases, due to hive location, it was recommended by district personnel that the property not be sprayed. Not all beehive locations, though, were added to the DNS list; this example highlights the importance of mosquito control districts conducting outreach and education to residents.

It is possible that the district would have more flexibility to treat all areas within its boundaries if a public health emergency for WNV or other vectorborne disease occurred. Since the introduction of WNV into Cook County and Illinois, however, there has never been a public emergency declared. Even in the WNV outbreak years of 2002, 2005, and 2012—when Cook County had 302, 135, and 174 reported human cases, respectively—a public health emergency was not declared (K. Beamis, personal communication, April 17, 2018)

The impact of residential DNS parcels extends far beyond each household; the DNS decision of 137 residents negatively affects 2,147 other residential homes that thereby receive reduced or no adulticide treatment. The number of parcels affected by the buffer is highly dependent on the size of the parcel. While some townships have a larger number of residential DNS parcels, most of the residential DNS acreage falls within the Barrington and Hanover townships. These townships have larger residential parcel size and more agricultural land, which increases the untreated area. Only 15% of the NWMAD total population live in these two townships. The number of individuals affected by DNS parcels increases proportionally with the number of individuals residing within each home.

NWMAD is observing an increasing trend in the number of people requesting to be placed on the DNS list. Between 2015 and 2018, 65 people requested to be added to the NWMAD DNS list, which represents a 42% increase since 2014. Discussions with other MADs suggest this trend might be due to the proliferation of social media neighborhood apps. Residents who live within a defined neighborhood can interact with their neighbors through online message boards and in this manner might be spreading information about the DNS list. Additionally, some social media sites have become the platform for the sharing of pseudoscience, which could contribute to misunderstandings of science, and by extension, mosquito control operations (Del Vicario et al., 2016). Without surveying these residents, we can only assume these are some of the reasons for the requests to be put on the DNS list. These assumptions might be inaccurate, however, or not representative of all MADs with DNS lists. If the frequency of residents requesting to be placed on the DNS list continues to increase, it could adversely affect the district's ability to manage the mosquito population and prevent human WNV transmission.

One way to address the growing trend of DNS requests is to conduct direct outreach to the residents currently on the DNS list. Educational outreach by NWMAD could alleviate fears based on inaccurate information about adult mosquito control. By having a discussion about our adult mosquito control operations and listening to resident concerns, we might be able to remove some residents from the DNS list. Further, a routine contact survey of these residents will be essential to ensure that any new residents at these addresses are not placed on the DNS list due to the request of the previous owner. Enacting a medical professional exemption requirement as other MADs do would further contribute to DNS list removal—but could damage relationships with residents if educational programs are not proactive.

TABLE **3**

Beehive Do Not Spray (DNS) Areas Within the Northwest Mosquito Abatement District (NWMAD)

Area	Acreage (Hectare)	% of NWMAD Acreage	Total # of Parcels	% of Parcels in NWMAD
NWMAD (total)	149,632.88 (60,554.28)	100	213,796	100
Beehive DNS parcels	58.22 (23.56)	0.04	25	0.01
Non-DNS parcels completely within DNS buffer	20.04 (8.11)	0.01	83	0.04
Non-DNS parcels partially within DNS buffer	102.63 (41.21)	0.07	294	0.14
Total loss from beehive DNS parcels	211.09 (85.43)	0.14	402	0.19

TABLE **4**

Total Impact of Do Not Spray (DNS) Areas Within the Northwest Mosquito Abatement District (NWMAD)

Area	Acreage (Hectare)	% of NWMAD Acreage	Total # of Parcels	% of Parcels in NWMAD
NWMAD (total)	149,632.88 (60,554.28)	100	213,796	100
Total loss from FPDs and NPAs	18,941.52 (7,665.36)	12.66	–	–
Total loss from residential DNS areas	1,621.25 (656.09)	1.08	2,284	1.07
Total loss from beehive DNS areas	211.09 (85.43)	0.14	402	0.19
Total loss from DNS areas in NWMAD	20,773.86 (8,406.88)	13.88	2,686	1.26

Note. FPDs = Forest Preserve Districts; NPAs = Nature Preserve Areas.

Conclusion

The amount of area that might be excluded from adult vector control due to opt-out policies, natural areas, organic farming, and beehives can be significant and negatively affect the ability to control mosquito-borne diseases. Currently, NWMAD has almost 2,300 residential parcels receiving no or reduced adult mosquito control due to DNS requests. Factoring in FPD and NPA areas, approximately 14% of our district get reduced or no adult mosquito control. Through educational outreach programs and surveys addressing concerns and reasons for DNS list requests, plus resident verification, future studies can

TABLE **5**

Do Not Spray (DNS) Areas by Townships Located Within the Northwest Mosquito Abatement District (NWMAD)

Township	Township Acreage (Hectare)	# of DNS Parcels	% of DNS Parcels	DNS Parcel Acreage (Hectare)	% of DNS Acreage	% of Township Acreage
Barrington	23,118.10 (9,355.56)	13	8.02	642.13 (259.86)	60.62	2.78
Elk Grove	18,367.35 (7,433.00)	33	20.37	8.79 (3.56)	0.83	0.05
Hanover	21,469.29 (8,688.31)	7	4.32	315.96 (127.86)	29.83	1.47
Maine	16,858.08 (6,822.22)	16	9.88	8.02 (3.25)	0.76	0.05
Northfield	3,839.72 (1,553.88)	9	5.56	4.16 (1.68)	0.39	0.11
Palatine	23,102.56 (9,349.27)	21	12.96	33.48 (13.55)	3.16	0.14
Schaumburg	19,775.31 (8,002.78)	9	5.88	6.44 (2.61)	0.61	0.03
Wheeling	23,102.46 (9,349.23)	54	33.33	40.25 (16.29)	3.80	0.17
NWMAD (total)	149,632.88 (60,554.28)	162	100	1,093.88 (442.41)	100	–

analyze the origin of DNS list requests and compare the impact of those programs on DNS list removals and new requests to show the benefit of adulticiding operations.

Acknowledgements: This article was supported in part by cooperative agreement number U01CK000505, funded by CDC. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC or the U.S. Department of Health and Human Services. The authors wish to thank Justin Harbison, assistant professor of public health at Loyola University in Chicago, Illinois, for his input on this article.

Corresponding Author: Patrick Irwin, Adjunct Assistant Professor, Department of Entomology, University of Wisconsin–Madison; Entomologist and Assistant Director, Northwest Mosquito Abatement District, 147 West Hintz Road, Wheeling, IL 60090.
Email: pirwin@nwmadil.com.

References

Armed Forces Pest Management Board. (2019). *Dispersal of ultra low volume (ULV) insecticides by cold aerosol and thermal fog ground application equipment* (Technical Guide No. 13). https://www.acq.osd.mil/eie/afpmb/docs/techguides/tg13.pdf

Bellini, R., Zeller, H., & Van Bortel, W. (2014). A review of the vector management methods to prevent and control outbreaks of West Nile virus infection and the challenge for Europe. *Parasites & Vectors*, 7, Article 323. https://doi.org/10.1186/1756-3305-7-323

Bertolotti, L., Kitron, U.D., Walker, E.D., Ruiz, M.O., Brawn, J.D., Loss, S.R., Hamer, G.L., & Goldberg, T.L. (2008). Fine-scale genetic variation and evolution of West Nile virus in a transmission "hot spot" in suburban Chicago, USA. *Virology*, *374*(2), 381–389. https://doi.org/10.1016/j.virol.2007.12.040

Brownstein, J.S., Holford, T.R., & Fish, D. (2004). Enhancing West Nile virus surveillance, United States. *Emerging Infectious Diseases*, *10*(6), 1129–1133. https://doi.org/10.3201/eid1006.030457

Carson, P.J., Konewko, P., Wold, K.S., Mariani, P., Goli, S., Bergloff, P., & Crosby, R.D. (2006). Long-term clinical and neuropsychological outcomes of West Nile virus infection. *Clinical Infectious Diseases*, *43*(6), 723–730. https://doi.org/10.1086/506939

Centers for Disease Control and Prevention. (2020). *West Nile virus: Aerial spraying*. https://www.cdc.gov/westnile/vectorcontrol/aerial-spraying.html

Centers for Disease Control and Prevention. (2021). *West Nile virus: Final maps & data for 1999–2020*. https://www.cdc.gov/westnile/statsmaps/final.html

continued on page 28

References *continued from page 27*

Centers for Disease Control and Prevention. (2022). *ArboNET: West Nile virus*. https://wwwn.cdc.gov/arbonet/maps/ADB_Diseases_Map/index.html

Cohen, M. (2003, April 21). Poisoning the Big Apple. *Synthesis/Regeneration*, *31*. http://www.greens.org/s-r/31/31-12.html

Cook County Department of Public Health. (2021). *Communicable disease data & reports: West Nile virus*. https://cookcountypublichealth.org/epidemiology-data-reports/communicable-disease-data-reports/

Cook County Government. (2021). *Cook Central: Centralizing maps, apps, and data*. http://hub-cookcountyil.opendata.arcgis.com

Cook County Government. (n.d.). *Geographic information systems (GIS)*. https://www.cookcountyil.gov/agency/geographic-information-systems-gis

Del Vicario, M., Bessi, A., Zollo, F., Petroni, F., Scala, A., Caldarelli, G., Stanley, H.E., & Quattrociocchi, W. (2016). The spreading of misinformation online. *Proceedings of the National Academy of Sciences of the United States of America*, *113*(3), 554–559. https://doi.org/10.1073/pnas.1517441113

Haley, R.W. (2013, August 27). *Can we prevent epidemics of West Nile encephalitis?* University of Texas Southwestern Medical Center. https://bit.ly/3ILwPLo

Hamer, G.L., Kitron, U.D., Brawn, J.D., Loss, S.R., Ruiz, M.O., Goldberg, T.L., & Walker, E.D. (2008). *Culex pipiens* (Diptera: Culicidae): A bridge vector of West Nile virus to humans. *Journal of Medical Entomology*, *45*(1), 125–128. https://doi.org/10.1093/jmedent/45.1.125

Hayes, E.B., Komar, N., Nasci, R.S., Montgomery, S.P., O'Leary, D.R., & Campbell, G.L. (2005). Epidemiology and transmission dynamics of West Nile virus disease. *Emerging Infectious Diseases*, *11*(8), 1167–1173. https://doi.org/10.3201/eid1108.050289a

Kabat, G.C. (2017). Taking distrust of science seriously. *EMBO Reports*, *18*(7), 1052–1055. https://doi.org/10.15252/embr.201744294

Lothrop, H., Lothrop, B., Palmer, M., Wheeler, S., Gutierrez, A., Gomsi, D., & Reisen, W.K. (2007). Evaluation of pyrethrin and permethrin ground ultra-low volume applications for adult *Culex* control in rural and urban environments of the Coachella Valley of California. *Journal of the American Mosquito Control Association*, *23*(2), 190–207. https://doi.org/10.2987/8756-971X(2007)23[190:EOPAPG]2.0.CO;2

Metcalf, R.L. (1993). An increasing public concern. In D. Pimentel & H.R. Lehman (Eds), *The pesticide question: Environment, economics, and ethics* (pp. 426–430). Chapman & Hall.

Mosquito Abatement District Act, 70 ILCS 1005 (1925). http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=890&ChapterID=15

Mostashari, F., Bunning, M.L., Kitsutani, P.T., Singer, D.A., Nash, D., Cooper, M.J., Katz, N., Liljebjelke, K.A., Biggerstaff, B.J., Fine, A.D., Layton, M.C., Mullin, S.M., Johnson, A.J., Martin, D.A., Hayes, E.B., & Campbell, G.L. (2001). Epidemic West Nile encephalitis, New York, 1999: Results of a household-based seroepidemiological survey. *The Lancet*, *358*(9278), 261–264. https://doi.org/10.1016/S0140-6736(01)05480-0

Mutebi, J.-P., Delorey, M.J., Jones, R.C., Plate, D.K., Gerber, S.I., Gibbs, K.P., Sun, G., Cohen, N.J., & Paul, W.S. (2011). The impact of adulticide applications on mosquito density in Chicago, 2005. *Journal of the American Mosquito Control Association*, *27*(1), 69–76. https://doi.org/10.2987/10-6045.1

Nash, D., Mostashari, F., Fine, A., Miller, J., O'Leary, D., Murray, K., Huang, A., Rosenberg, A., Greenberg, A., Sherman, M., Wong, S., Campbell, G.L., Roehrig, J.T., Gubler, D.J., Shieh, W.-J., Zaki, S., Smith, P., & Layton, M. (2001). The outbreak of West Nile virus infection in the New York City area in 1999. *New England Journal of Medicine*, *344*(24), 1807–1814. https://doi.org/10.1056/NEJM200106143442401

Peterson, R.K.D., & Higley, L.G. (1993). Communicating pesticide risks. *American Entomologist*, *39*(4), 206–211. https://doi.org/10.1093/ae/39.4.206

Pokhrel, V., DeLisi, N.A., Danka, R.G., Walker, T.W., Ottea, J.A., & Healy, K.B. (2018). Effects of truck-mounted, ultra low volume mosquito adulticides on honey bees (*Apis mellifera*) in a suburban field setting. *PLOS ONE*, *13*(3), e0193535. https://doi.org/10.1371/journal.pone.0193535

Rinkevich, F.D., Margotta, J.W., Pittman, J.M., Danka, R.G., Tarver, M.R., Ottea, J.A., & Healy, K.B. (2015). Genetics, synergists, and age affect insecticide sensitivity of the honey bee, *Apis mellifera*. *PLOS ONE*, *10*(10), e0139841. https://doi.org/10.1371/journal.pone.0139841

Slovic, P. (1987). Perception of risk. *Science*, *236*(4799), 280–285. https://doi.org/10.1126/science.3563507

Smithburn, K.C., Hughes, T.P., Burke, A.W., & Paul, J.H. (1940). A neurotropic virus isolated from the blood of a native of Uganda. *American Journal of Tropical Medicine and Hygiene*, *S1-20*(4), 471–492. https://doi.org/10.4269/ajtmh.1940.s1-20.471

Spielman, A. (2001). Structure and seasonality of Nearctic *Culex pipiens* populations. *Annals of the New York Academy of Sciences*, *951*(1), 220–234. https://doi.org/10.1111/j.1749-6632.2001.tb02699.x

University of Illinois Chicago Library. (2021). *Forest Preserve District of Cook County records: Home*. https://researchguides.uic.edu/fpdcc

U.S. Census Bureau. (2021). *2012–2016 ACS [American Community Survey] 5-year estimates*. https://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2016/5-year.html

Vinogradova, E.B. (2000). Culex pipiens pipiens *mosquitoes: Taxonomy, distribution, ecology, physiology, genetics, applied importance and control*. Pensoft Publishers.

Weaver, S.C. (2013). Urbanization and geographic expansion of zoonotic arboviral diseases: Mechanisms and potential strategies for prevention. *Trends in Microbiology*, *21*(8), 360–363. https://doi.org/10.1016/j.tim.2013.03.003

Ziem, G. (2005). Pesticide spraying and health effects [Letter]. *Environmental Health Perspectives*, *113*(3), A150. https://doi.org/10.1289/ehp.113-a150a

DIRECT FROM AAS

Vince Radke, MPH, RS, CP-FS, DLAAS, CPH

Two Stories on the Importance of Professional Relationships

Editor's Note: In an effort to provide environmental health professionals with relevant information and tools to further the profession, their careers, and themselves, the National Environmental Health Association has teamed up with the American Academy of Sanitarians (AAS) to publish two columns a year in the *Journal*. AAS is an organization that "elevates the standards, improves the practice, advances the professional proficiency, and promotes the highest levels of ethical conduct among professional sanitarians in every field of environmental health." Membership with AAS is based upon meeting certain high standards and criteria, and AAS members represent a prestigious list of environmental health professionals from across the country.

Through the column, information from different AAS members who are subject matter expects with knowledge and experience in a multitude of environmental health topics will be presented to the *Journal*'s readership. This column strengthens the ties between both associations in the shared purposes of furthering and enhancing the environmental health profession.

Vince Radke is vice chair of AAS and has been a diplomate since 2007.

What are professional relationships? Let's first look at the two words that make up that phrase:

1. **Professional**: What words come to mind when I say professional? I think of expert, subject matter expert, science, science based, degreed, licensed, and registered. In environmental health, I think of KSAs—knowledge, skills, and abilities. You may have your own words that come to mind.
2. **Relationships**: What words come to mind when I say relationships? I think of interaction, conduct (that conduct could be good, bad, or indifferent), trust or lack of trust, passion, emotion, and respect. You may have other words.

Professional relationships are relationships with individuals or groups of individuals, such as colleagues, partners, local officials, your boss, your employees, community leaders, and boards of health, as well as those we regulate and those who regulate us.

Here is my definition of professional relationships: How I, as a highly skilled individual, go about my environmental health work with those around me. I might include in my definition how I develop, maintain, improve, change, and evolve those professional relationships over time.

To illustrate my point on the importance of professional relationships I'm going to share two short, personal stories, one about ice hockey and the other about the *Food Code*. It is worth noting that I shared these stories in my President's Message column published in the October 2018 *Journal of Environmental Health* during my tenure as president of the National Environmental Health Association. Why am I sharing these stories again? First, the topic of professional relationships is still pertinent as it was 4 year ago and should still resonate with people. Second, it is proven that we learn through repetition and hopefully a second telling of these stories will continue our growth and learning processes.

First, the hockey story. I grew up in Detroit, Michigan, in the late 1940s–1960s. Back then there were three things that occupied my time outside of school: cars, Motown music, and sports (the Detroit Tigers, Lions, Pistons, and Red Wings). My dad, grandfather, and uncle would take me down to Olympia Arena to watch the Red Wings play hockey.

At the time, Detroit was synonymous with cars and the Big Three—Chrysler, Ford, and General Motors. My grandfather, who worked at the Ford Motor Company Rouge Plant in the Detroit area would talk about the production line. How many cars would come off the line in a day and his job on the line. There was, however, another production line in Detroit that had nothing to do with cars. Production Line was the nickname of the most prolific scoring line in the history of the National Hockey League (NHL) and it belonged to the Detroit Red Wings. When that front line stepped out on the ice for a game, they were going to score a goal—guaranteed. That front line consisted of Sid Abel (center), Ted Lindsay (left wing), and Gordie Howe (right wing).

They were the best of friends as well as colleagues who respected each other. Each member of the Production Line had their strengthens and weaknesses. Abel was older and slower but had the vision to see the play developing as they came down the ice. Lind-

say and Howe, being younger, had speed and agility but sometimes they could be inpatient. Abel would bring the puck up the ice, size up the position of the defense, and angle the puck so only Lindsay or Howe could get to it before the opposing team could.

Wayne Gretzky, a famous hockey player in the 1980s, when ask by a reporter what made him so great, replied, "I go where the puck is going to be." As the Production Line, Abel, Lindsay, and Howe were doing that 30 years earlier. In the 1949–1950 NHL hockey season, Able, Lindsay, and Howe would finish 1st, 2nd, and 3rd in NHL scoring, a feat that had never been done before and has never been done to this day.

In your professional relationships, are you setting up others to succeed and excel?

There were other aspects that made the Production Line great. Abel would say he knew what Howe and Lindsay were going to do before they did it. The three of them would hang together over beers after practice. Their families would get together for birthdays and special occasions.

In your professional relationships, do you sit down over coffee, tea, or a beer outside of work with your colleagues?

Howe was quoted as saying, "They used to say if you blindfolded us, we'd still be able to find one another on the ice. All of us knew where everyone else was at any given moment, maybe the closeness off the ice had something to do with it." But there was more that made the Production Line great. They would study their opponents—their strengthens, weaknesses, and tendencies.

How well do you know your opponents—those pathogens, hazardous wastes, safety hazards, etc. that we deal with every day—and just as important, what do you not know about them?

Finally, the Production Line would practice. They would practice with the rest of the team, but many times they would stay late and practice to not only improve their individual skills but also their skills and abilities as the Production Line. Abel, Lindsay, and Howe understood in their time that the goalie would not come out from the goalie crease and they took advantage of that. Today, that aspect of hockey has changed.

To maintain your edge in professional relationships, you must study, train, and practice. You must understand how the field is changing about you. And by the way, the Detroit Red Wings would go on win the Stanley Cup in 1950, 1952, 1954, and 1955.

Now, let's fast forward to the 1990s and my story about the *Food Code*. At that time, I was asked by the directors of health of three Northern Virginia jurisdictions to lead a group of environmental health specialist to study and make recommendations on whether to adopt the Food and Drug Administration (FDA) model *Food Code* as the food safety regulation in the area. Having developed professional relationships over time with environmental health specialist in the three jurisdictions and serving as president of the National Capital Area Environmental Health Association, I was able to form a committee to study the existing code at the time.

As part of that committee, I knew I needed to include not only environmental health specialists but also representatives from the local restaurant industry as we needed their support if we were going to get the *Food Code* adopted into local regulation. So, I reached out to members of the local restaurant association with whom I had a few professional relationships. Some of them agreed to participate in this endeavor, but over the months of work that participation became less and less. Still, I maintained communication with them and kept them apprised of the work the committee was doing as I knew we would need their help to get the *Food Code* adopted by the local jurisdictions.

In your professional relationships, do you keep the lines of communication open even under difficult circumstances?

Early in the process, I realized that the committee would need subject matter expertise and experience to understand the science behind the *Food Code*. Who better than FDA to consult as they had worked on the *Food Code* for one decade? We needed to understand the "why" behind the code. I had established professional relationships with several FDA colleagues and when those individuals agreed to give us a hand, it helped the committee tremendously.

In your professional relationships, do you reach out to others to provide subject matter expertise in areas that you are less familiar with?

During the entire process, I kept my local restaurant colleagues informed of our work. When the committee finished, I asked my restaurant colleagues to review the work we would put forward as regulation in our three local jurisdictions. They said they would and came back saying there were certain aspects they did not like and therefore, they would oppose adoption of the new code. Needless the say, I was not happy—indeed, I was angry.

In your professional relationships, do you work to keep your anger to a minimum?

I knew I would have to work with my local restaurant colleagues and the local restaurant association in the future. After a few days of cooling down, I went back to them and ask specifically what they did not like about the code. They mentioned two aspects they did not like, the consumer advisory and the certified food safety manager sections. We agreed that if I pulled those two sections out, they would not oppose local adoption of the code, which resulted in adoption in the three jurisdictions. We were able to add both removed sections a few years later through educational outreach with our local restaurants.

Professional relationships are key to our success as environmental health professionals and can pay dividends over time. Similar to hockey, they must be practiced and cultivated through study and training. And like my *Food Code* story, cultivating communications, reaching out for help, and having patience are important to professional relationships.

Corresponding Author: Vince Radke, Vice Chair, American Academy of Sanitarians. Email: vradke@bellsouth.net.

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES

CDR Joseph P. Laco, MSEH, REHS/RS, CPO

Samaria Aluko, MPH

Michele C. Hlavsa, MPH, RN

Tools From the Centers for Disease Control and Prevention to Help Prevent Pathogen Transmission in Increased Risk Aquatic Venues

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, NEHA features 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.

CDR Joseph Laco serves as an environmental health officer at the National Center for Environmental Health within CDC. Samaria Aluko is an Oak Ridge Institute for Science and Education (ORISE) fellow at the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) within CDC. Michele Hlavsa is chief of the Healthy Swimming Program in NCEZID.

Swimming is an exceptional way to get the physical activity and health benefits needed for a healthy life. In the U.S., bathers enjoy recreational water experiences in pools, hot tubs, and splash pads hundreds of millions of times each year, and most experiences are healthy, safe, and enjoyable. Swimming and other recreational water activities, however, do have some risks such as fatal and nonfatal drowning, disease outbreaks, and injuries associated with pool chemicals. Public pools, hot tubs, and splash pads should be designed, constructed, operated, managed, and inspected to help minimize risk of illness and injury.

In 2021, the Centers for Disease Control and Prevention (CDC) received reports of children becoming infected with pathogens, including *Naegleria fowleri* and *Shigella*, while playing in aquatic venues that spray water on bathers. *N. fowleri* (commonly referred to as the "brain-eating ameba") causes primary amebic meningoencephalitis (PAM), which is rare but almost always (>95%) fatal. *Shigella* bacteria cause shigellosis, which can result in diarrhea (sometimes bloody), fever, and stomach cramps. An additional case of PAM was reported in 2020 that was associated with a decorative fountain that the public had easy access to. Decorative fountains that spray water and are primarily designed to be part of the landscape architecture can be mistaken for splash pads. They are not regulated like aquatic venues and environmental health practitioners might not be required to disinfect the water. The CDC Model Aquatic Health Code (MAHC; www.cdc.gov/mahc) and other tools can help prevent pathogen transmission in aquatic venues including pools, hot tubs, and splash pads.

Some aquatic venues are increased risk aquatic venues. Two types of increased risk aquatic venues—splash pads and wading pools (see sidebar)—are at increased risk for microbial contamination as they are intended for young children ≤5 years.

Management of water in increased risk aquatic venues is challenging. Splash pads—also known as water playgrounds, interactive fountains, and spray pads—and wading pools are intended for young children. Young children are more likely to experience acute gastrointestinal illnesses, such as shigellosis, and contaminate the water. Swim diapers also do not prevent feces, urine, or pathogens from getting into the water. The oxidation of organic or nitrogenous compounds (e.g., feces, urine) released or rinsed into the water also depletes the disinfectant concentration. Finally, young children typically ingest more recreational water than adults, putting them at increased risk for infection if pathogens are present.

Splash pads also have diverse features and plumbing that biofilm-associated organisms, such as *N. fowleri*, can grow, especially when adequate disinfectant residuals are not maintained. Maintaining adequate disinfectant

Quick Links

- Model Aquatic Health Code (MAHC) guidance based on the latest science and best practices to help ensure healthy and safe experiences in public pools, hot tubs, and water playgrounds: www.cdc.gov/mahc/index.html
- MAHC-based operation and management recommendations to help prevent pathogen transmission in splash pads: www.cdc.gov/healthywater/swimming/swimmers/splash-pad-operation-and-management.html
- Steps the public can take to help stop the spread of germs in splash pad water: www.cdc.gov/healthywater/swimming/swimmers/water-play-areas-interactive-fountains.html
- Tools, forms, trainings, and protocols for public health officials and aquatic staff using MAHC recommendations or otherwise strengthening their aquatic health and safety programs: www.cdc.gov/mahc/networks-tools-forms.html

concentration in splash pad water is particularly challenging because splash pads typically aerosolize the water, which depletes the disinfectant concentration. Young children also sit on splash pad jets, another potential source for fecal contamination. Because wading pools are shallow, the sun's UV light degrades much of the disinfectant in water, which makes it challenging to maintain adequate disinfectant concentration.

CDC has tools to help prevent pathogen transmission in aquatic venues. Public health officials can use the MAHC to strengthen their aquatic health and safety programs. The MAHC is a guidance document based on the latest science and best practices to help local, state, territorial, and tribal public health officials and the aquatics sector make aquatic experiences healthy and safe for everyone. MAHC guidance is intended to prevent illness and injury through the design, construction, operation, and management of public aquatic venues.

The MAHC calls for secondary treatment (e.g., UV light or ozone) of increased risk aquatic venue water such as in splash pads and wading pools. Secondary treatment is not needed to inactivate *N. fowleri*, *Shigella*, and most pathogens that are sensitive to chlorine. Secondary treatment is needed, however, to inactivate chlorine-tolerate *Cryptosporidium*, the leading cause of outbreaks associated with pools and splash pads.

The first known PAM case associated with a splash pad in the U.S. was identified in 2021. CDC has tools to help jurisdictions prevent illness caused by *N. fowleri*, *Shigella*, and other pathogens associated with increased risk aquatic venues, such as splash pads and wading pools.

Visit the CDC Healthy Swimming website at www.cdc.gov/healthywater/swimming for tools, steps, and recommendations to prevent pathogen transmission in aquatic venues. Check out the Quick Links sidebar for resources from the MAHC, operation and management recommendations, tools to strengthen aquatic health and safety programs, and more.

Model Aquatic Health Code Definitions for Increased Risk Aquatic Venues

Splash Pad: Any indoor or outdoor installation that includes sprayed, jetted, or other water sources contacting bathers and not incorporating standing or captured water as part of the bather activity area.

Wading Pool: Any pool used exclusively for wading where the depth does not exceed 2 ft (0.6 m).

Corresponding Author: CDR Joseph P. Laco, Environmental Health Officer, National Center for Environmental Health, Centers for Disease Control and Prevention, 4770 Buford Highway, Atlanta, GA 30341.
Email: htr6@cdc.gov.

DIRECT FROM ecoAmerica

Building a More Inclusive Climate Movement: Climate Change and Disabilities

Laura N. Butler, MRC
Human Development Institute, University of Kentucky

Sue Wolf-Fordham, MPA, JD
Association of University Centers on Disabilities

Rebecca Rehr, MPH
ecoAmerica

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.

Laura Butler serves on multiple projects that work to improve the quality of life for people with disabilities at the Human Development Institute at the University of Kentucky. Rebecca Rehr is the director of climate policy and justice at the Maryland League of Conservation Voters and a Climate for Health Leadership Circle member. Sue Wolf-Fordham is a senior program manager for the Association of University Centers on Disability and an adjunct faculty member in public health at the Massachusetts College of Pharmacy and Health Sciences.

In November 2021, world leaders gathered at the 26th United Nations Climate Change Conference of the Parties (COP26) to discuss global climate policy and the urgent need to address harmful emissions that are accelerating global warming and extreme weather events devastating communities worldwide. Given the importance of this event and the need to hear from diverse voices, it was disappointing that the Israeli Energy Minister Karine Elharrar could not attend the first day of discussions because she uses a wheelchair and the meeting venue was not accessible (Franklin, 2021).

Climate change is accelerating with visible impacts around the world. Severe weather events such as heat waves, droughts, winter storms, floods, tornadoes, and other natural disasters are increasing in number and scale. Climate change can also cause increased disease and worsened physical, mental, and community health conditions (Clayton et al., 2021).

The 1 in 4 adults in the U.S. (approximately 61 million adults) with a disability and 15% of the world's population (approximately 1 billion people) with a disability are disproportionately impacted by disasters (Centers for Disease Control and Prevention, 2019; United Nations, 2014). The United Nations (2014) estimates that people with disabilities are 2 to 4 times more likely to die due to disasters than people without disabilities. In addition to more frequent and severe storms, disabled people also face compounding factors such as "poverty and other barriers that may make them less likely to be evacuated safely, more prone to health risks, and less likely to have insurance that protects their assets and homes" (Randall, 2021).

Exacerbating the outsized impact of climate change factors on people with disabilities is the fact that actions being pursued by those in the environmental and environmental justice movements can be at odds with the needs of people with disabilities. This disparity was on display with the COP26 incident and also was highlighted during the push to ban plastic straws in 2018. Activists were moved by photos of turtles with plastic straws embedded in their nostrils and swiftly pushed governments and corporations to remove, ban, or outlaw plastic straws. Lost in the discussion were the people who rely on plastic straws for their daily nourishment and independence. Disability rights activists had to embark on an education campaign of their own to explain why plastic straws are important to people with disabilities and why alternatives are not always a viable option (Ho, 2018; Smith, 2018).

Furthermore, people with disabilities experience other environmental injustices such as living near environmental pollution sources (Chakraborty, 2020). There are clearly opportunities to join forces and demonstrate stronger, compelling support for climate solutions that builds equity if the environmental justice and disability rights movements more closely align efforts.

Many organizations are already working to expand the diversity of their members, outreach, and impact, but disability is often not included in these efforts (Fleischer & Zames, 2005). This lack of inclusion is detrimental to not only people with disabilities but also organizations as research has shown that outcomes desirable to most organizations tend to improve with increased diversity (Valerio & Sawyer, 2016). People with disabilities have a lifetime of experience solving unique and often complex problems—just the type of problem-solving that environmental justice movements need.

The exclusion of people with disabilities also extends to academic writing and research in the environmental field, which seems to be due to the historic segregation of people with disabilities that continues in many areas of society today. For example, while involvement of young people in environmental justice is growing, this trend is not true of young people with disabilities. One reason is that young people tend to do what their peer group is doing and people with disabilities are often not included in these peer groups (Salvatore & Wolbring, 2021). This concept likely extends to post-school and community involvement, which is why efforts to increase the involvement of people with disabilities in environmental justice work must be very intentional.

ecoAmerica and the Association of University Centers on Disabilities (AUCD) recently announced a partnership to further the work to support communities that historically have been excluded from climate conversations and decision-making tables in leading the way to equitable climate solutions. "We look forward to partnering to proactively work on these issues. People with disabilities need to be engaged at every level of climate justice. We must work with climate and health partners to foster connections, build trust, and create sustainable relationships," stated John Tschida, executive director of AUCD. "The importance of partnership between the disability community and the work of building climate solutions is especially timely given the accessibility issues encountered during COP26. Those individuals who are most impacted by climate change should have the first seats at the table to plan solutions. We are excited about this new partnership and grateful to AUCD for their leadership," commented Meighen Speiser, executive director of ecoAmerica.

Call to Action

Climate justice must be an inclusive effort by a diverse group of stakeholders; alliances can be formed among individuals or groups who are active in climate justice initiatives and the disability justice movement. Whether you are active in the disability community or work in environmental advocacy, public health, or another aspect of environmental health, the following guidance can be used to build disability inclusion into your work.

Step 1: Create Spaces and Materials That Are Accessible to All People

In this context, space includes physical space, mental space, emotional space, and time. If environmental justice activities are happening inside, the building must be accessible, including ramps, wide doorways, accessible parking spots, and accessible restrooms. Once participants are in the door, they may need space to process new information and unexpected emotions, as well as time to share their thoughts in different formats.

In this context, materials include written and recorded materials as well as spoken materials. These materials need to be cognitively accessible (avoid jargon and acronyms) and provided in alternative formats such as Braille or sign language. Making sure there are plain language and easy to read versions of materials means that people with limited literacy will have access to them. Disability representation should also be present in images and videos so that people with disabilities know they are seen and recognized as part of the community.

Resources for more information about these accessibility features can be found at https://adasoutheast.org and https://hdi.uky.edu, as well as through the AUCD webpage on plain language at www.aucd.org/template/page.cfm?id=1207. A guide to respectful communication and disability etiquette can be found at www.respectability.org/inclusion-toolkits/etiquette-interacting-with-people-with-disabilities.

Step 2: Invite People With Disabilities to Be Involved in Environmental Justice Work

Conduct outreach to the disability community for participation and leadership. For example, there are Centers for Independent Living (CILs)—organizations that support community living and independence for people with disabilities—in every U.S. state and territory. A list of CILs can be found at https://acl.gov/programs/centers-independent-living/list-cils-and-spils. AUCD is a network of approximately 140 university training and research centers on disability. There is at least one in every state and territory. To find your closest AUCD network member, go to www.aucd.org/template/index.cfm and click on the map. These invitations should also extend to community-based organizations.

If conducting research, consider the importance of adding people with disabilities to the research team. There are commonalities between the disability justice movement and the environmental justice movement that should be emphasized during outreach.

Step 3: Examine the Potential Disability-Related Impact of Any Policy Proposal or Advocacy Campaign With Disability Partners

Share your research about the issue with disability partners. Whenever possible, get input from multiple people with disabilities, multiple groups, and/or cross-disability organizations. Different disability groups have different needs, perspectives, and priorities, and might not be privy to those of other groups. As you and your partners build equitable climate solutions, continue to ask, "Is what I'm doing **for all**?"

Step 4: Avoid Eco-Ableism

As shown with the examples of plastic straw bans and zero-waste movements, some environmental actions can be difficult and inadvertently harmful for people with disabilities. For this reason, it is important that members of environmental justice groups do not engage in rhetoric that can shame people with disabilities for not being "good" environmentalists. It is also important to make sure that

the language and images the group uses are not ableist. Avoid words and phrases such as "blind to," "deaf ear," "insane," or "crippled by." Stay away from depictions of disability as the object of charity or pity.

Step 5: Advocate for Disability Inclusion More Broadly in the Community

Disability exclusion is an issue in most if not all areas of community involvement. When the lack of disability involvement is recognized, speak up and provide examples of how to increase inclusion. Promote people with disabilities in leadership positions. Provide outreach to the disability community.

Inclusive movement building benefits the whole community and advances health equity. As the disability justice and environmental justice movements come closer together, moving from allies to collaborators and partners, they can better achieve a shared goal of a healthy environment **for all.**

Corresponding Author: Emily Hilton, Executive Assistant, ecoAmerica, 1730 Rhode Island Avenue NW, Suite 200, Washington, DC 20036. Email: emily@ecoamerica.org.

References

Centers for Disease Control and Prevention. (2019). *Disability impacts all of us*. https://www.cdc.gov/ncbddd/disabilityandhealth/documents/disabilities_impacts_all_of_us.pdf

Chakraborty, J. (2020). Unequal proximity to environmental pollution: An intersectional analysis of people with disabilities in Harris County, Texas. *The Professional Geographer*, *72*(4), 521–534. https://doi.org/10.1080/00330124.2020.1787181

Clayton, S., Manning, C., Speiser, M., & Hill, A.N. (2021). *Mental health and our changing climate: Impacts, inequities, responses* (2021 ed.). American Psychological Association and ecoAmerica. https://www.apa.org/news/press/releases/mental-health-climate-change.pdf

Fleischer, D.Z., & Zames, F. (2005). Disability rights: The overlooked civil rights issue. *Disability Studies Quarterly*, *25*(4). https://dsq-sds.org/article/view/629/806

Franklin, J. (2021, November 2). Israel's energy minister couldn't enter COP26 because of wheelchair inaccessibility. *National Public Radio*. https://www.npr.org/2021/11/01/1051225424/cop26-inaccessible-israeli-energy-minister-wheelchair

Ho, V. (2018, August 25). 'People need them': The trouble with the movement to ban plastic straws. *Guardian*. https://www.theguardian.com/us-news/2018/aug/25/plastic-straw-ban-california-people-with-disabilities

Randall, C. (2021, July 29). Eco ableism and the climate movement. *Friends of the Earth Scotland*. https://foe.scot/eco-ableism-and-the-climate-movement/

Salvatore, C., & Wolbring, G. (2021). Children and youth environmental action: The case of children and youth with disabilities. *Sustainability*, *13*(17), Article 9950. https://doi.org/10.3390/su13179950

Smith, S.E. (2018, July 19). Banning straws might be a win for environmentalists. But it ignores us disabled people. *Vox*. https://www.vox.com/first-person/2018/7/19/17587676/straws-plastic-ban-disability

United Nations. (2014, November 11). *Leave no one behind: Disability-inclusive disaster risk reduction*. https://www.un.org/disabilities/documents/events/wcdrr/overview_DiDRR.doc

Valerio, A.M., & Sawyer, K.B. (2016, December 7). The men who mentor women. *Harvard Business Review*. https://hbr.org/2016/12/the-men-who-mentor-women

DIRECT FROM U.S. EPA OFFICE OF RESEARCH AND DEVELOPMENT

Alice Gilliland, PhD

Tim Watkins

Wildfire Smoke and Public Health: Science and Technology Development to Reduce Risk

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, NEHA has partnered with the Office of Research and Development (ORD) within the U.S. Environmental Protection Agency (U.S. EPA) to publish two columns a year in the *Journal*. ORD is the scientific research arm of U.S. EPA. ORD conducts the research for U.S. EPA that provides the foundation for credible decision making to safeguard human health and ecosystems from environmental pollutants.

In these columns, authors from ORD will share insights and information about the research being conducted on pressing environmental health issues. The conclusions in these columns are those of the author(s) and do not necessarily represent the official position of U.S. EPA.

Alice Gilliland is the acting director of the Center for Environmental Measurement and Monitoring within the U.S. EPA ORD. Tim Watkins is the acting director of the Center for Public Health and Environmental Assessment within the U.S. EPA ORD.

Startling images of smoke-filled skies have pervaded the news and social media in recent years during major wildfires in the U.S. (Photo 1). In 2020, over 10 million acres burned from nearly 59,000 wildland fires, including wildfires and prescribed fires (National Interagency Fire Center, 2021). As wildfires burn, they generate smoke that contains substantial amounts of air pollutants (e.g., fine particulate matter [$PM_{2.5}$], carbon monoxide) that threaten the health of people nearby and sometimes at distances far from fire areas (Cascio, 2018; Jaffe et al., 2020; Reid et al., 2016). The continued growth of the wildland–urban interface amplifies risk of smoke exposure as more people relocate to fire prone areas; between 1990 and 2010, the wildland–urban interface area grew by 41% in terms of the number of new homes (Radeloff et al., 2018).

Wildfire prevalence and intensity are expected to worsen as climate change continues, with one report estimating that the Southwestern U.S. area burned by wildfire from 1984–2015 was twice what would have burned had climate change not occurred (Abatzoglou & Williams, 2016). The U.S. Environmental Protection Agency (U.S. EPA) Office of Research and Development (ORD)—in partnership with other federal agencies; states; localities; tribes; and state, local, and tribal organizations—conducts research and provides technical solutions to characterize wildfire smoke emissions and evaluate strategies to reduce health and environmental risks.

Monitoring Wildfire Smoke

To better understand how the combination of burned materials (including biomass and materials from burning structures and vehicles), fire intensity, and meteorology alter the amount and chemical composition of smoke, ORD has analyzed emissions from prescribed fire and wildfire emissions. Prescribed fire is an important land management activity that can be strategically conducted in periods that favor smoke dispersion and controlled burning rates to reduce exposures and public health risks. ORD collaborated with the U.S. Forest Service (USFS) Missoula Fire Sciences Laboratory in Missoula, Montana, to simulate burns and comprehensively measure smoke properties. ORD also collaborated with the U.S. Department of Defense, USFS, and other land managers to conduct in situ emission measurements in real-world prescribed burns, including deploying a custom developed aerial sampling platform to directly measure smoke plumes (Aurell et al., 2021). Results from this research can help local environmental health practitioners better understand the public health impacts associated with wildland fire smoke and evaluate their local conditions to predict the risk for specific harmful emissions.

Wildfire smoke production and ground-level air pollution concentrations can vary substantially as fire behavior and meteorology shift with time, complicating air quality assessment and public communications of risk during wildfire events. Through partnerships with other federal agencies, ORD has advanced strategies for wildfire smoke detection and risk communications (Table 1), including:

- Establishing a quality check and correction method for a widely used $PM_{2.5}$ air sensor (Barkjohn et al., 2021), which can help

Photo 1. *Wildland fire smoke from the Monument and McFarland Fires in California in August 2021. Photo courtesy of Ali Kamal, U.S. Environmental Protection Agency, Office of Air and Radiation.*

TABLE **1**

U.S. Environmental Protection Agency (U.S. EPA) Tools and Resources for Environmental Health Practitioners to Address Wildfire Smoke Challenges

Tool/Resource	Description
AirNow Fire and Smoke Map (AirNow, 2022)	View information on ground-level air quality monitors recording fine particulate matter ($PM_{2.5}$) from smoke and other sources, as well as information on fires, smoke plume locations, and special statements about smoke issued by various sources. This map is designed to allow users to browse current conditions and show information relevant to specific locations.
Wildfire Smoke Air Monitoring Response Technology pilot (U.S. EPA, 2021a)	Air monitoring technologies available for loan to state, local, and tribal air organizations to support supplemental air monitoring in areas affected by wildfire smoke and with observational data coverage gaps. (*Note.* The equipment is not available for general public use.)
Smoke Sense app (U.S. EPA, 2021b)	Crowdsourcing, citizen science research mobile app focused on increasing public awareness and engagement related to wildfire smoke health risks. This application is available on Apple and Android devices, and in English and Spanish.
Smoke-Ready Toolbox (U.S. EPA, 2022b)	Assortment of tools and resources for public health officials and healthcare practitioners to understand and communicate risks of smoke exposure and provide actions people can take to protect their health (Figure 1).
Wildfire Smoke and Your Patients' Health (U.S. EPA, 2021f)	Online course for physicians, nurse practitioners, nurses, asthma educators, health educators, and other medical professionals about the health effects associated with wildfire smoke and actions patients can take before and during a wildfire to reduce exposure.

ensure communities using this air sensor have a higher confidence in the data. This research supported the inclusion of this sensor's public data into U.S. EPA's AirNow Fire and Smoke Map (AirNow. 2022), vastly increasing the number of air quality observations available to inform public communications of wildfire smoke risks.

- Accelerating the development of commercially available air sensor technology suitable for wildfire smoke response. This development was achieved through a cosponsored Wildland Fire Sensors Challenge, along with five other federal agencies, with rigorous laboratory evaluation of prototypes (Landis et al., 2021) and U.S. EPA's Small Business Innovation Research Program (U.S. Environmental Protection Agency [U.S. EPA, 2022a).
- Launching the Wildfire Smoke Air Monitoring Response Technology (WSMART) pilot to increase use of new air monitoring technologies in wildfire response settings, particularly as air monitoring data might be limited in many areas affected by wildfire smoke (U.S. EPA, 2021a; The White House, 2021). The WSMART program loans quickly deployable air monitoring technologies to state, local, and tribal air organizations, as well as to air resource advisors through the Interagency Wildland Fire Air Quality Response Program. These supplemental monitoring technologies can help local governments gather timely data to assess smoke impacts and provide public health information. WSMART deployed air monitoring technologies to emergency responders at seven major wildfires in 2021.

Wildfire Smoke Risk Reduction Research

To support public health communication and health research, ORD engages the public through a crowdsourcing, citizen science research project to learn about public perception of risk and personal behavior changes during wildfire events. In 2017, ORD launched the Smoke Sense app that provides smoke data visualizations, game-based education about air quality, and allows subclinical symptom reporting for research analysis (U.S. EPA, 2021b; Table 1). Smoke Sense can be a powerful way for local environmental health practitioners to provide timely information about smoke events to communities.

Through analysis of Smoke Sense data, effective strategies for delivering health messages about smoke have been found, including:

- The need to increase health risk awareness and provide compelling evidence that protective health behaviors are beneficial, including personally relevant data that allow individuals to recognize their own personal health risk (Rappold et al., 2019).

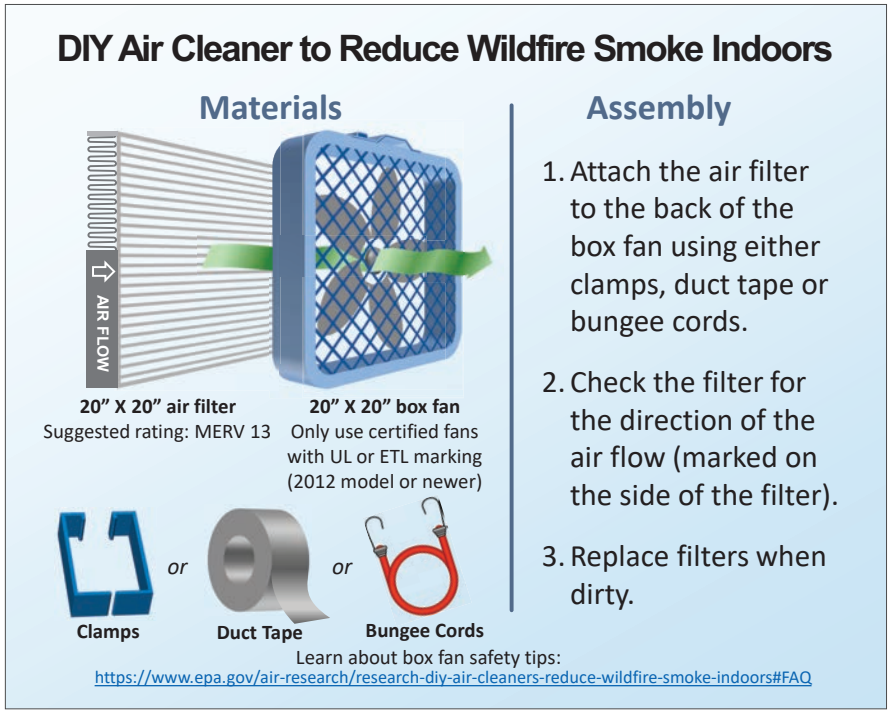
- The need to tailor health risk messaging to suit common individual traits related to perception of health risk and willingness to adopt recommended health behaviors. These traits include "protectors" (individuals who have decided to engage by adopting new health behaviors); "cautious, proactive, and susceptible" (individuals at various deciding stages); and "unengaged" (individuals who do not perceive smoke as a health issue and are unlikely to change behavior in response to messaging) (Hano et al., 2020).

Strategies that smoke-ready communities can use to reduce exposure to smoke particles during wildfire episodes have also been studied, including:

- Optimal use of face masks, including face mask type and how it is worn, to reduce exposure to airborne particles. Results from this research are relevant to airborne COVID-19 and particles of similar size in wildfire smoke (Clapp et al., 2021).
- Using HVAC filtration and portable air purifiers to reduce indoor air exposure to smoke (U.S. EPA, 2021c).
- Accelerating the availability of affordable and effective indoor air cleaning technologies through prize-based challenge competitions, such as the 2021 Cleaner Indoor Air During Wildfire Challenge (U.S. EPA, 2021d).

FIGURE **1**

DIY Air Cleaner Infographic for Reducing Wildfire Smoke Indoors



Note. Infographic is part of the Smoke-Ready Toolbox for wildfires from the U.S. Environmental Protection Agency (2021g, 2022b). DIY = do it yourself.

The Future of Wildfire Research

As the wildland–urban interface continues to expand into fire prone areas, future wildfires will likely result in the burning of more built structures, such as the recent Marshall Fire in Colorado, which increases the complexity of the wildfire smoke mixture. Looking to the future, public health practitioners will benefit from a better understanding of how smoke emissions and corresponding health risks from these types of fires vary compared to fires that are purely biomass based.

Another important unknown is the health consequences of repeated short- and long-term smoke exposure, which is becoming more common as wildfire severity and frequency increase in some areas of the U.S. As the need for prescribed fires increases, more research on prescribed fire smoke emissions (considering meteorology, biomass fuels, and burning rates) and development of risk management and communication strategies will also be needed. Toward this end, ORD recently assessed two case study fires in the Western U.S. to compare prescribed fire and wildfire emissions and public health impacts (U.S. EPA, 2021e). U.S. EPA research will continue to develop insights, methods, and tools to support environmental health practitioners as they serve their communities and adapt to a more fire prone environment.

Acknowledgements: The authors would like to acknowledge Gayle Hagler, Megan Christian, Emily Smith, and Kelly Widener for identifying supporting material and providing editorial review; Brian Gullett, Tom Long, Ana Rappold, Beth Hassett-Sipple, Jason Sacks, Amara Holder, and Matt Landis for providing scientific review; and Bruce Rodan, Bryan Hubbell, and Kacee Deener for their suggestions in framing the column.

Corresponding Authors: Alice Gilliland, Acting Director, Center for Environmental Measurement and Monitoring, Office of Research and Development, U.S. Environmental Protection Agency, 26 West Martin Luther King Drive, Mail Code 236, Cincinnati, OH 45268. Email: gilliland.alice@epa.gov.

Tim Watkins, Acting Director, Center for Public Health and Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency, 109 TW Alexander Drive, Mail Code D305-01, Research Triangle Park, NC 27711. Email: watkins.tim@epa.gov.

References

Abatzoglou, J.T., & Williams, A.P. (2016). Impact of anthropogenic climate change on wildfire across western US forests. *Proceedings of the National Academy of Sciences of the United States of America*, *113*(42), 11770–11775. https://doi.org/10.1073/pnas.1607171113

AirNow. (2022). *Fire and smoke map, v2.0*. https://fire.airnow.gov/

Aurell, J., Gullett, B., Holder, A., Kiros, F., Mitchell, W., Watts, A., & Ottmar, R. (2021). Wildland fire emission sampling at Fishlake National Forest, Utah using an unmanned aircraft system. *Atmospheric Environment*, *247*(11), Article 118193. https://doi.org/10.1016/j.atmosenv.2021.118193

Barkjohn, K.K., Gantt, B., & Clements, A.L. (2021). Development and application of a United States-wide correction for $PM_{2.5}$ data collected with the PurpleAir sensor. *Atmospheric Measurement Techniques*, *14*(6), 4617–4637. https://doi.org/10.5194/amt-14-4617-2021

Cascio, W.E. (2018). Wildland fire smoke and human health. *The Science of the Total Environment*, *624*, 586–595. https://doi.org/10.1016/j.scitotenv.2017.12.086

Clapp, P.W., Sickbert-Bennett, E.E., Samet, J.M., Berntsen, J., Zeman, K.L., Anderson, D.J., Weber, D.J., Bennett, W.D., & U.S. Centers for Disease Control and Prevention Epicenters Program. (2021). Evaluation of cloth masks and modified procedure masks as personal protective equipment for the public during the COVID-19 pandemic. *JAMA Internal Medicine*, *181*(4), 463-469. https://doi.org/10.1001/jamainternmed.2020.8168

Hano, M.C., Prince, S.E., Wei, L., Hubbell, B.J., & Rappold, A.G. (2020). Knowing your audience: A typology of Smoke Sense participants to inform wildfire smoke health risk communication. *Frontiers in Public Health*, *8*, Article 143. https://doi.org/10.3389/fpubh.2020.00143

Jaffe, D.A., O'Neill, S.M., Larkin, N.K., Holder, A.L., Peterson, D.L., Halofsky, J.E., & Rappold, A.G. (2020). Wildfire and prescribed burning impacts on air quality in the United States. *Journal of the Air & Waste Management Association*, *70*(6), 583–615. https://doi.org/10.1080/10962247.2020.1749731

Landis, M.S., Long, R.W., Krug, J., Colón, M., Vanderpool, R., Habel, A., & Urbanski, S.P. (2021). The U.S. EPA wildland fire sensor challenge: Performance and evaluation of solver submitted multi-pollutant sensor systems. *Atmospheric Environment*, *247*, Article 118165. https://doi.org/10.1016/j.atmosenv.2020.118165

National Interagency Fire Center. (2021). *Wildfires and acres*. https://www.nifc.gov/fire-information/statistics/wildfires

Radeloff, V.C., Helmers, D.P., Kramer, H.A., Mockrin, M.H., Alexandre, P.M., Bar-Massada, A., Butsic, V., Hawbaker, T.J., Martinuzzi, S., Syphard, A.D., & Stewart, S.I. (2018). Rapid growth of the US wildland-urban interface raises wildfire risk. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(13), 3314–3319. https://doi.org/10.1073/pnas.1718850115

Rappold, A.G., Hano, M.C., Prince, S., Wei, L., Huang, S.M., Baghdikian, C., Stearns, B., Gao, X., Hoshiko, S., Cascio, W.E., Diaz-Sanchez, D., & Hubbell, B. (2019). Smoke Sense initiative leverages citizen science to address the growing wildfire-related public health problem. *GeoHealth*, *3*(12), 443–457. https://doi.org/10.1029/2019GH000199

Reid, C.E., Brauer, M., Johnston, F.H., Jerrett, M., Balmes, J.R., & Elliott, C.T. (2016). Critical review of health impacts of wildfire smoke exposure. *Environmental Health Perspectives*, *124*(9), 1334–1343. https://doi.org/10.1289/ehp.1409277

U.S. Environmental Protection Agency. (2021a). *Wildfire Smoke Air Monitoring Response Technology (WSMART) pilot*. https://www.epa.gov/air-sensor-toolbox/wildfire-smoke-air-monitoring-response-technology-wsmart-pilot

U.S. Environmental Protection Agency. (2021b). *Smoke Sense study: A citizen science project using a mobile app*. https://www.epa.gov/air-research/smoke-sense-study-citizen-science-project-using-mobile-app

U.S. Environmental Protection Agency. (2021c). *Wildfire study to advance science partnerships for indoor reductions of smoke exposures*. https://www.epa.gov/air-research/wildfire-study-advance-science-partnerships-indoor-reductions-smoke-exposures

U.S. Environmental Protection Agency. (2021d, October 26). *EPA announces winners of Cleaner Indoor Air During Wildfires Challenge*. https://www.epa.gov/newsreleases/epa-announces-winners-cleaner-indoor-air-during-wildfires-challenge

U.S. Environmental Protection Agency. (2021e). *Comparative assessment of the impacts of prescribed fire versus wildfire (CAIF): A case study in the Western U.S.* (EPA/600/R-21/197). https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=352824

U.S. Environmental Protection Agency. (2021f). *Wildfire Smoke and Your Patients' Health*. https://www.epa.gov/wildfire-smoke-course

U.S. Environmental Protection Agency. (2021g). *Research on DIY air cleaners to reduce wildfire smoke indoors*. https://www.epa.gov/air-research/research-diy-air-cleaners-reduce-wildfire-smoke-indoors

U.S. Environmental Protection Agency. (2022a). *Winners of the Wildland Fire Sensors Challenge develop air monitoring system prototypes*. https://www.epa.gov/air-research/winners-wildland-fire-sensors-challenge-develop-air-monitoring-system-prototypes

U.S. Environmental Protection Agency. (2022b). *Smoke-Ready Toolbox for wildfires*. https://www.epa.gov/smoke-ready-toolbox-wildfires

The White House. (2021, June 30). *Fact sheet: The Biden-Harris Administration acts to address the growing wildfire threat*. https://www.whitehouse.gov/briefing-room/statements-releases/2021/06/30/fact-sheet-the-biden-harris-administration-acts-to-address-the-growing-wildfire-threat/

EH CALENDAR

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCE

June 28–July 1, 2022: NEHA 2022 Annual Educational Conference & Exhibition—Now a Hybrid Event, Spokane, WA, https://www.neha.org/aec

NEHA AFFILIATE AND REGIONAL LISTINGS

California
August 15–18, 2022: Annual Educational Symposium (AES), California Environmental Health Association, Clovis, CA, https://www.ceha.org

Colorado
September 13–16, 2022: 66th Annual Education Conference, Colorado Environmental Health Association, Crested Butte, CO, http://www.cehaweb.com

Iowa
May 3–4, 2022: Public Health Conference of Iowa, Iowa Environmental Health and Public Health Associations, Ames, IA, https://www.ieha.net/PHCI2022

Minnesota
May 12–13, 2022: MEHA Spring Conference, Minnesota Environmental Health Association (MEHA), Walker, MN, https://mehaonline.org

Nevada
May 3–5, 2022: NVEHA and NFSTF Joint Education Conference (Virtual), Nevada Environmental Health Association (NVEHA) and Nevada Food Safety Task Force (NFSTF), http://nveha.org

Texas
October 19–21, 2022: 66th Annual Educational Conference, Texas Environmental Health Association, Round Rock, TX, https://myteha.org/Annual-Education-Conference

Utah
May 4–6, 2022: UEHA Spring Conference, Utah Environmental Health Association (UEHA), Kanab, UT, http://www.ueha.org/events.html

Wisconsin
October 26–28, 2022: WEHA Educational Conference, Wisconsin Environmental Health Association (WEHA), Lake Geneva, WI, https://weha.net/events

Did You Know?

You can share your event with the environmental health community by posting it on the NEHA Community Calendar at www.neha.org/news-events/community-calendar. Posting is free and a great way to bring attention to your event. You can also find listings for upcoming events from NEHA and other organizations.

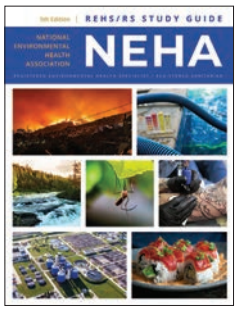
RESOURCE CORNER

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 the NEHA online Bookstore for additional information about these and many other pertinent resources!

NEHA BOOKSTORE
www.neha.org/store

REHS/RS Study Guide (5th Edition)

National Environmental Health Association (2021)

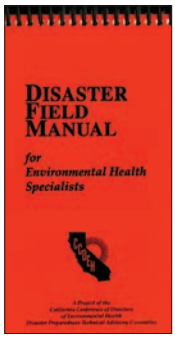


The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is the premier credential of the National Environmental Health Association (NEHA). This new edition reflects the most recent changes and advancements in environmental health technologies and theories. Incorporating the insights of 29 subject matter experts from across academia, industry, and the regulatory community, paired with references from over 30 scholarly resources, this essential reference is intended to help those seeking to obtain the NEHA REHS/RS credential. Chapters include general environmental health; statutes and regulations; food protection; potable water; wastewater; solid and hazardous waste; hazardous materials; zoonoses, vectors, pests, and poisonous plants; radiation protection; occupational safety and health; air quality and environmental noise; housing sanitation and safety; institutions and licensed establishments; swimming pools and recreational facilities; and emergency preparedness.

261 pages / Spiral-bound paperback
Member: $169 / Nonmember: $199

Disaster Field Manual for Environmental Health Specialists

California Association of Environmental Health Administrators (2012)

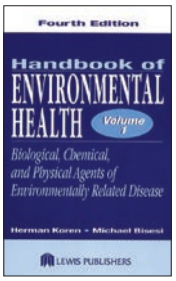


This manual serves as a useful field guide for environmental health professionals following a major disaster. It provides an excellent overview of key response and recovery options to be considered as prompt and informed decisions are made to protect the public's health and safety. Some of the topics covered as they relate to disasters include water, food, liquid waste/sewage, solid waste disposal, housing/mass care shelters, vector control, hazardous materials, medical waste, and responding to a radiological incident. The manual is made of water-resistant paper and is small enough to fit in your pocket, making it useful in the field. Study reference for NEHA's Registered Environmental Health Specialist/Registered Sanitarian credential exam.

224 pages / Spiral-bound hardback
Member: $37 / Nonmember: $45

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

Herman Koren and Michael Bisesi (2003)

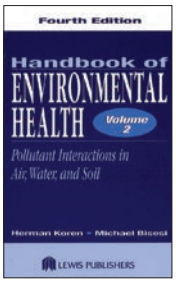


A must for the reference library of anyone in the environmental health profession, this book focuses on factors that are generally associated with the internal environment. It was written by experts in the field and copublished with the National Environmental Health Association (NEHA). A variety of environmental 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 NEHA's 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 NEHA's Registered Environmental Health Specialist/Registered Sanitarian credential exam.

876 pages / Hardback
Member: $215 / Nonmember: $245

JEH QUIZ

FEATURED ARTICLE QUIZ #6

Spatial Analysis of the Impact of "Do Not Spray" Areas on Mosquito Adulticiding in the Suburbs of Northwest Chicago, Illinois

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 three 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 6, May 2022).
8. Click the Create button.

JEH Quiz #4 Answers

January/February 2022

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

➔ Quiz effective date: May 1, 2022 | Quiz deadline: August 1, 2022

1. According to the Centers for Disease Control and Prevention, a total of __ human cases of West Nile virus (WNV) infection were reported from 1999–2020.
   a. 42,532
   b. 52,532
   c. 62,532
   d. 72,532
2. Cook County, Illinois, is the only county east of the Mississippi River to have an annual human WNV case count of __ every year from 2012–2018.
   a. >18
   b. >19
   c. >20
   d. >21
3. Adulticide application is an effective tool to reduce mosquito populations and the spread of WNV, especially when transmission could be at an outbreak level.
   a. True.
   b. False.
4. Mosquito abatement districts can conduct adult mosquito control but are committed to using it as a last resort, preferring to focus on
   a. larval control.
   b. breeding source reduction.
   c. public education.
   d. all the above.
   e. none of the above.
5. The current Northwest Mosquito Abatement District (NWMAD) do not spray (DNS) policy for residents includes anyone who makes a personal request, regardless of the reason.
   a. True.
   b. False.
6. DNS sites include
   a. residential properties.
   b. beehive locations.
   c. natural areas.
   d. a and c.
   e. all the above.
7. The article assessed the effect of residential DNS areas at the township level in
   a. the percentage of residential DNS parcels in the township.
   b. the percentage of residential DNS acreage in the township.
   c. the percentage of each township occupied by DNS parcels.
   d. all the above.
   e. none of the above.
8. The percentage of acreage lost due to natural areas (i.e., Forest Preserve Districts and Nature Preserve Areas) within NWMAD is
   a. 11.66%.
   b. 12.66%.
   c. 13.73%.
   d. 13.83%.
9. The percentage of acreage lost due to the DNS policy is almost __ of the total area within NWMAD.
   a. 12%
   b. 13%
   c. 14%
   d. 15%
10. The study found 90% of the residential DNS acreage in two townships:
    a. Barrington and Palatine.
    b. Barrington and Hanover.
    c. Hanover and Schaumburg.
    d. Palatine and Schaumburg.
11. The study found that the DNS decision of 137 residents negatively affects __ other residential homes that thereby receive reduced or no adulticide treatment.
    a. 2,147
    b. 3,147
    c. 4,147
    d. 5,147
12. Between 2015 and 2018, 65 people requested to be added to the NWMAD DNS list, which represents a __ increase since 2014.
    a. 22%
    b. 32%
    c. 42%
    d. 52%

THANK YOU for Supporting the NEHA/AAS Scholarship Fund

Samuel M. Aboagye
Tunde Akinmoladu
Mary A. Allen
American Academy of Sanitarians
Olivia Arnold
Steven K. Ault
Rance Baker
James J. Balsamo, Jr.
Gina Bare
Marcy Barnett
Clovis Begley
Carol Bennett
Jamie Betak
Mohammad Imtiaj Uddin Bhuiyan
Robert Bialas
Michael E. Bish
Logan Blank
Jesse Bliss
Eric Bradley
Corwin D. Brown
D. Gary Brown
Glenn W. Bryant
Allana Burnette
Glynis Burton
Tom Butts
Kimberley Carlton
Lynette Charlesworth
Renee Clark
Richard W. Clark
Gary E. Coleman
Jessica Collado
Brian Collins
Richard F. Collins
William D. Compton
James G. Cortelyou
Council for the Model Aquatic Health Code
Alan M. Croft
Douglas Davis
Kristen Day
Kristie Denbrock
Thomas P. Devlin
Michele DiMaggio
Jennifer Dobson
James M. Dodd
Samantha Donahue
Gery M. DuParc
David T. Dyjack
Ana Ebbert
Gretchen F. Ekstrom
Amer El-Ahraf
Alicia Enriquez Collins
Olivia Feider
Soni Fink
Shelby Foerg
Mary K. Franks
Beth Frizzell
Heather Gallant
Cynthia L. Goldstein
Carolyn J. Gray
Karen Gulley
Roberta M. Hammond
Stephanie M. Harris
Stacie Havron
Cheryl Hawkins
Jerry W. Heaps
Donna K. Heran
Thomas A. Hill
Michele Hlavsa
Evelyn Hoban
Jennifer Hoffman
Karen Hoffman Bender
Scott E. Holmes
Donna M. Houston
Douglas J. Irving
Samuel J. Jorgensen
Leila Judd
Nola Kennedy
Keelan Kenny
Eric Klein
Sharon L. Kline
Bonnie Koenig
Steve Konkel
Roy Kroeger
Ayaka Kubo Lau
Michael F. LaScuola
Philip Leger
Matthew A. Lindsey
Sandra M. Long
Ann M. Loree
Jaime N. Lundblad
James C. Mack
Robert A. Maglievaz
Patricia Mahoney
Jason W. Marion
Alan Masters
Ralph Matthews
Carol McInnes
Kaiser Milo
Leslie D. Mitchell
Peter J. Mitchell
Shawnee Moore
Wendell A. Moore
Hayashi N. Morris
Naing Myint
John A. Nakashima
Alexus Nally
Sylvester Ndimele
Johany D. Negron Bird
Eileen Neison
Lee Newman
Bert F. Nixon
Brion A. Ockenfels
Christopher B. Olson
Liz Otero
Joe Otterbein
Charles S. Otto
Michael A. Pascucilla
James E. Pierce
Kathryn Pink
Robert W. Powitz
Laura A. Rabb
Vincent J. Radke
Larry A. Ramdin
Jeremiah Ramos
Faith M. Ray
Nicole M. Real
Evangeline Reaves
Omar Rico
Geraldine Riouff
Welford C. Roberts
Catherine Rockwell
Luis O. Rodriguez
Jonathan P. Rubingh
Kristen Ruby-Cisneros
Michéle Samarya-Timm
Peter H. Sansone
Sameera Sayeed
Lea Schneider
Lynn Schneider
Mario Seminara
Jill M. Shugart
Christopher J. Smith
Sarah-Jean T. Snyder
Chintan Somaiya
James M. Speckhart
Stephen Spence
Rebecca Stephany
Beth Stern
Jordan Strahle
Denise K. Takehara
M.L. Tanner
Christl Tate
Ned Therien
Vildana Tinjic
Gail Vail
Linda Van Houten
Leon F. Vinci
Tom A. Vyles
Lora Wade
Phebe Wall
Jeffrey A. Wangsao
Sarah K. Ward
Brian S. White
Lisa Whitlock
Don B. Williams
Christian Witkovskie
Erika Woods
Margaret Zarriello
Linda L. Zaziski
Anne Marie Zimeri

To donate, visit www.neha.org/donate.

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.

Tim Hatch, MPA, REHS
Region 7
Vice-President

CDR James Speckhart, MS, REHS, USPHS
Region 8
Vice-President

National Officers

www.neha.org/national-officers

President—Roy Kroeger, REHS
President@neha.org

President-Elect—D. Gary Brown, DrPH, CIH, RS, DAAS
PresidentElect@neha.org

First Vice-President—Tom Butts, MSc, REHS
FirstVicePresident@neha.org

Second Vice-President—CDR Anna Khan, MA, REHS/RS
SecondVicePresident@neha.org

Immediate Past-President—Sandra Long, REHS, RS
ImmediatePastPresident@neha.org

Regional Vice-Presidents

www.neha.org/RVPs

Region 1—William B. Emminger, Jr., REHS, CPM
Region1RVP@neha.org
Alaska, Idaho, Oregon, and Washington. Term expires 2023.

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, CFOI
Region4RVP@neha.org
Iowa, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin. Term expires 2022.

Region 5—Traci (Slowinski) Michelson, MS, REHS, CP-FS
Region5RVP@neha.org
Arkansas, Kansas, Louisiana, Missouri, New Mexico, Oklahoma, and Texas. Term expires 2023.

Region 6—Nichole Lemin, MS, MEP, RS/REHS
Region6RVP@neha.org
Illinois, Indiana, Kentucky, Michigan, and Ohio.
Term expires 2022.

Region 7—Tim Hatch, MPA, REHS
Region7RVP@neha.org
Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee.
Term expires 2023.

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—Larry Ramdin, REHS, CP-FS, HHS
Region9RVP@neha.org
Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.
Term expires 2022.

NEHA Staff

www.neha.org/staff

Seth Arends, 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, Program and Operations Manager, PPD, nbohnenkamp@neha.org

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

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

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

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

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

Steven Dourdis, MA, Human Resources Business Partner, sdourdis@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, Instructional Designer, EZ, afloyd@neha.org

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

Nathan Galanos, Contracts Administrator, ngalanos@neha.org

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

Elizabeth Grenier, Senior Project Coordinator, NEHA-FDA RFFM, egrenier@neha.org

Madelyn Gustafson, Project Coordinator, PPD, mgustafson@neha.org

Thyra Kimbell, Project Coordinator, tkimbell@neha.org

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

Becky Labbo, MA, 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

Julianne Manchester, PhD, Senior Research and Evaluation Specialist, NEHA-FDA RFFM, jmanchester@neha.org

Bobby Medina, Credentialing Specialist, bmedina@neha.org

Jaclyn Miller, Marketing and Communications Specialist, NEHA-FDA RFFM, jmiller@neha.org

Avery Moyler, Training and Contractor Supervisor, NEHA EZ, amoyler@neha.org

Eileen Neison, Credentialing Manager, eneison@neha.org

Michael Newman, A+, ACA, MCTS, Director, Information Technology, mnewman@neha.org

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

Liz Otero, MLIS, Web Developer, lotero@neha.org

Kim Pacifico, Senior Accountant, kpacifico@neha.org

Amber Potts, REHS, CP-FS, Senior Project Coordinator, PPD, apotts@neha.org

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

Michéle Samarya-Timm, MA, HO, REHS, MCHES, DLAAS, Senior Program Analyst, Environmental Health, PPD, msamaryatimm@neha.org

Katherine Sheppard, Executive Assistant, ksheppard@neha.org

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

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

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

Christl Tate, Training Operations and Logistics Manager, NEHA EZ, ctate@neha.org

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

Gail Vail, CPA, CGMA, Associate Executive Director, gvail@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

Cole Wilson, Operations Manager, NEHA-FDA RFFM, nwilson@neha.org

Alyssa Wooden, MHS, Project Coordinator, PPD, awooden@neha.org

2021–2022 Technical Advisors

www.neha.org/technical-advisors

CLIMATE AND HEALTH

David Gilkey, PhD
dgilkey@mtech.edu

Steven Konkel, PhD
steve.konkel@gmail.com

DATA AND TECHNOLOGY

Darryl Booth, MBA
dbooth@accela.com

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

EMERGENCY PREPAREDNESS

Latasha A. Allen, MSPH, MEDM
latisha.allen@hhs.gov

Martin Kalis
mkalis@cdc.gov

Luis Rodriguez
ved8@cdc.gov

FOOD SAFETY

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

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

Zachary Ehrlich
zachary.ehrlich@doh.nj.gov

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

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

Christine Sylvis, REHS
sylvis@snhd.org

GENERAL ENVIRONMENTAL HEALTH

Michael Crea, MS
crea@zedgepiercing.com

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

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

Stan Hazan, MPH
hazan@nsf.org

Robert Powitz, MPH, PhD, RS, CP-FS
powitz@sanitarian.com

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

INFECTIOUS AND VECTORBORNE DISEASES

Tyler Zerwekh MPH, DrPH, REHS
tyler.zerwekh@dshs.texas.gov

SPECIAL POPULATIONS

Natasha DeJarnett, MPH, PhD
natasha.dejarnett@louisville.edu

Cynthia McOliver, MPH, PhD
mcoliver.cynthia@epa.gov

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

WATER QUALITY

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

Andrew Whelton, MPH
awhelton@purdue.edu

Steve Wilson
sdwilson@illinois.edu

WORKFORCE AND LEADERSHIP

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

Lauren DiPrete, MPH, REHS
diprete@snhd.org

Affiliate Presidents

www.neha.org/affiliates

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

Alaska—Joy Britt
jdbritt@anthc.org

Arizona—David Morales
david.morales@maricopa.gov

Arkansas—Richard Taffner, RS
richard.taffner@arkansas.gov

Business and Industry—Michael Crea
nehabia@outlook.com

California—Darryl Wong
president@ceha.org

Colorado—Josh Skeggs
jskeggs@tchd.org

Connecticut—Chris Buter, RS/REHS
sanitarianc@esdhd.org

Florida—Edward Bettinger
ed.bettinger@flhealth.gov

Georgia—Jessica Badour
jessica.badour@agr.georgia.gov

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

Illinois—Justin Dwyer
jadwyer84@gmail.com

Indiana—Holley M. Rose
hrose@ripleycounty.com

Iowa—Matt Even
meven@bentoncountyia.gov

Jamaica (International Partner Organization)—Karen Brown
info@japhi.org.jm

Kansas—Tanner Langer
tdlanger@cowleycounty.org

Kentucky—Brittany Wells, RS
kentuckyeha@gmail.com

Louisiana—Carolyn Bombet
carolyn.bombet@la.gov

Massachusetts—Diane Chalifoux-Judge, REHS/RS, CP-FS
diane.chalifoux@boston.gov

Michigan—Andrew Priest
apriest@meha.net

Minnesota—Lisa Schreifels, REHS
president@mehaonline.org

Missouri—Ryan Tilley
rtilley@sccmo.org

Montana—Sarah Robbin
sarahrobbin1@gmail.com

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

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

Nevada—Brenda Welch, REHS
welch@snhd.org

New Jersey—Lynette Medeiros
president@njeha.org

New Mexico—Samuel Frank
samuel.frank@ihs.gov

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

North Carolina—Tonya Zimmerman

North Dakota—Julie Wagendorf
jwagendorf@nd.gov

Northern New England Environmental Health Association—Brian Lockard
blockard@ci.salem.nh.us

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

Oklahoma—Jordan Cox
coxmj12@gmail.com

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

Past Presidents—Vince Radke, MPH, RS, CP-FS, DLAAS, CPH
vradke@bellsouth.net

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—John Shrader
shrader@ehspecialties.com

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

Utah—Karl Hartman
khartman@utah.gov

Virginia—Jessica Stewart
jessica.stewart@virginiaeha.org

Washington—Tom Kunesh
tkunesh@co.whatcom.wa.us

West Virginia—Keith Allison
wvaos@outlook.com

Wisconsin—Carrie Pohjola
carrie.pohjola@wisconsin.gov

Wyoming—Chelle Schwope
chelle.schwope@wyo.gov

Safeguarding a Road Less Traveled

85TH ANNUAL EDUCATIONAL CONFERENCE & EXHIBITION

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

AEC 2022

Spokane, WA · June 28–July 1

Feature events include...

GRAND SESSION KICKOFF PANEL

Challenges Facing the Environmental Health Workforce Regarding COVID-19 Practices

Umair A. Shah

OPENING SESSION BY

Umair A. Shah, MPH, MD
Secretary of Health
Washington State Board of Health

William "Bill" Marler

CLOSING SESSION BY

William (Bill) Marler, JD
Managing Partner
Marler Clark, The Food Safety Law Firm

Visit us online for the latest information

NEHA.ORG/AEC

Maximize Your Experience

BY JOINING US IN-PERSON

Network with your environmental health colleagues over coffee breaks and outdoor networking events

See what new technology and tools are available in the Exhibit Hall

Gain access to educational sessions within all 10 educational tracks

Enjoy the beauty of Spokane with the conference set right on the banks of the Spokane River

	In- Person	Virtual
Network with leading environmental health professionals	X	
Attend social and networking events	X	
Explore the Exhibit Hall	X	
Preconference offerings	X	
In-person Poster Hall	X	
Enjoy beautiful Spokane	X	
Number of sessions during each time slot	14+	3–4
Three featured sessions	X	X
Virtual Poster Hall	X	X
Access to recorded sessions (available for 6 months)	X	X
Ability to access content anywhere you have an internet connection	X	X

Use this QR code to learn more about what is in store and the precautions we are taking for COVID-19.

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

PRESENTING SPONSOR:

HEALTH SPACE

NEHA Credential Map Project

The National Environmental Health Association (NEHA) is known across the country as the gold standard for environmental health credentials and in particular, for our premier credential, the Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS). The REHS/RS credential was a main impetus for the founding of NEHA over 80 years ago. It is incumbent on NEHA to track and support state-level REHS/RS credentials as part of our mission to build, sustain, and empower an effective environmental health workforce.

In 2021, the NEHA Endowment Fund Committee agreed to finance a credential map project using a small percentage of donated funds to showcase how our donors have provided support to the profession and its future. This project was focused on creating a detailed map that displays REHS/RS credentialing requirements across the U.S. The work was done jointly by NEHA staff, interns, affiliates, and board members, and was released in February 2022.

Through research conducted on REHS/RS credential recognition and requirements across the U.S., NEHA Government Affairs Director Doug Farquhar and intern Georgia Lo assembled a methodical and important approach to mapping out the data. By identifying states and jurisdictions that require or use the REHS/RS credential, NEHA will be able to gauge the popularity of the credential and where the credential is valued, as well as where it is no longer used.

As with other health professions, the environmental health credential is adopted and administered by individual states, often mandated by state rule or statute. State credentialing has established procedures for achieving the credential and has minimum attributes or standards individuals must meet to apply for and maintain the credential or license. These attributes include:

- formal educational levels attained,
- work experience in the profession,
- evaluation of competency, and
- demonstrated continuing education in the profession.

The NEHA REHS/RS credential is not a required standard unless adopted by a state or organization. Furthermore, there is no national credential mandated by the federal government.

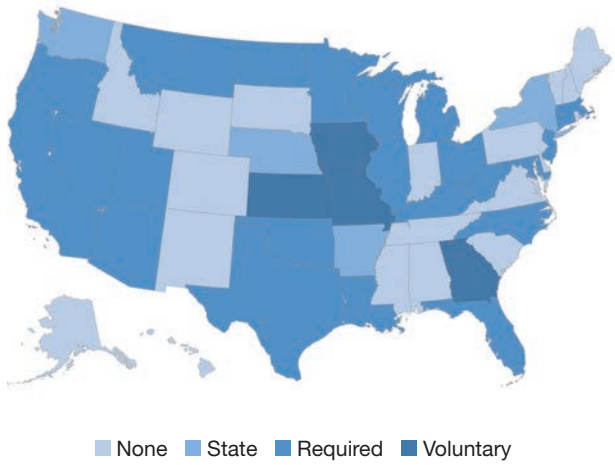
REHS/RS Credential Recognition

An environmental health credential is recognized in 31 states. The NEHA REHS/RS credential remains the foremost certification for environmental health professionals and the environmental health workforce. An environmental health credential is required at some level in 28 states and Washington, DC. Specifically, 23 states require it by statute and 8 states recognize the REHS/RS credential. Of the 8 states that recognize the credential, the credential is voluntary in 4 states and 4 states have a state-mandated credential (Figure 1).

From data on the states that require an environmental health credential:

FIGURE **1**

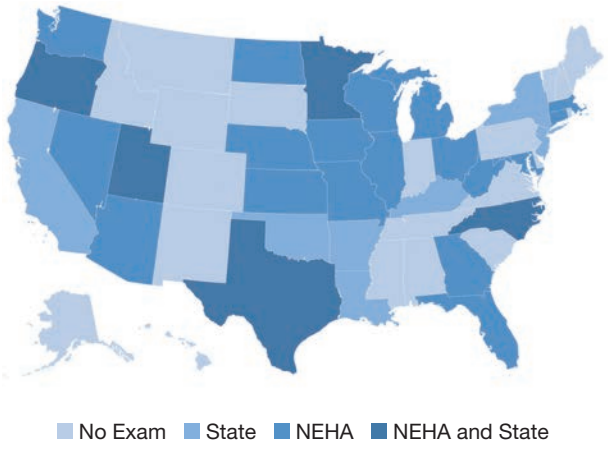
Environmental Health Credential Requirements by Statute in the United States



- 18 states require some level of continuing education to maintain registration renewal.
- 13 states have some type of formal or informal in-training or intern process specified by rule and all but one require interns to be licensed or registered.
- 17 states have a minimum work experience of 1 year in the field of environmental health with a non-environmental health bachelor's degree.
- 15 states use the NEHA REHS/RS credential exam for all or part of their proficiency testing. Moreover, 2 states have additional state exams, 5 states use a state-specific exam, and 1 state offers the option of either a state-specific or NEHA REHS/RS credential exam.
- 20 states have credential or licensing boards under a state government department. North Carolina is the only state that has an independent licensing board.
- 6 states are regulated under a state occupational licensing department and 14 states are regulated under a state health department.
- For non-environmental health bachelor's degrees, there is wide variability in the type of semester hours accepted under the education requirement. In addition, 2 states do not specify a minimum number of semester-accepted hours in science or other related disciplines.
- 2 states statutorily accept applicants for registration with an associate degree with a certain number of years of experience in environmental health.

FIGURE **2**

Type of Registered Environmental Health Specialist/Registered Sanitarian Exam Accepted in the United States



- 19 states have no training or certification requirements for the environmental health profession.

At one point, 38 states required the REHS/RS credential or its equivalent. The reasons behind why states decided to weaken their environmental health credential requirement varies, but mainly policy makers determined that the credential was an unnecessary regulatory burden. The resources necessary by both the state and individuals to comply with an environmental health credential was not perceived to have an associated public health benefit and did not warrant the regulatory costs.

REHS/RS Credential Exam

An environmental health credential is required by statute in 23 states, and 17 of those states require passing the REHS/RS credential exam to enter the profession. An additional 6 states (Georgia, Iowa, Kansas, Missouri, Nebraska, and Washington) require the exam but do not list the REHS/RS credential by statute. Montana requires the REHS/RS credential without the exam, as does Washington, DC. Additionally, 7 states offer a state-sponsored exam. Figure 2 shows the type of REHS/RS credential exam accepted by each state.

Certain known concerns about environmental health credentialing include that the bachelor's degree requirement keeps many individuals from applying for the REHS/RS credential. This requirement can be prohibitive to sitting for the REHS/RS credential exam for many individuals, including people of color.

Nevertheless, the REHS/RS credential remains the premier credential for the environmental health workforce. Efforts are being made and must continue to be made to advocate for this credential. NEHA has a goal to make the REHS/RS the required credential for the environmental health profession in every state. To achieve this goal will require a committed effort by NEHA, the NEHA affiliates, and the environmental health profession.

For more information, visit www.neha.org/node/62422. You can also direct your questions to Doug Farquhar, director of Government Affairs, at dfarquhar@neha.org. Thank you to our supporters who donated to our Endowment Fund, we could not have done this work without your support!

NEHA Releases 2021 Annual Report

In late March 2021, NEHA released its 2021 Annual Report that summarizes the achievements of the organization to build, sustain, and empower an effective environmental health workforce. The report demonstrates our continued commitment to being an essential partner and an influential voice in environmental health.

In addition to words from NEHA Executive Director Dr. David Dyjack and NEHA President Roy Kroeger, the report provides a visual picture of our achievements under the following headings:

- **We Educated**: The events NEHA hosted in 2021 are highlighted—from the 2021 Annual Educational Conference & Exhibition held virtually to more than 40 webinars hosted. Information on courses we created, updated, provided, delivered, developed, expanded, or presented are also included.
- **We Informed**: The ways in which we informed the profession are spotlighted, including 10 issues of the *Journal of Environmental Health* published and sharing valuable information and opportunities via a total of 119 emails, 22 E-News issues, and 2,366 social media posts.
- **We Supported**: Learn how NEHA designed and built a user-friendly application to award $6.3 million in funding for the NEHA-FDA Retail Flexible Funding Model Grant Program, developed more than 60 resources to enhance environmental health capabilities in response to the COVID-19 pandemic, credentialed 572 individuals, approved over 41,000 online continuing education submissions, and much more.
- **We Elevated**: Read about the different policy statement NEHA developed on topics such as body art, vector control, preparedness, and food safety, as well as the work NEHA has done to promote justice, equity, diversity, and inclusion within the organization and the profession.
- **We Advocated**: Explore the letters, resolutions, and activities NEHA undertook to advocate for the environmental health profession.
- **We Connected**: Learn about the partnerships, communities of practice, and connections NEHA has established for environmental health professionals.
- **We Stewarded**: Get a picture of the financial health of NEHA through data on our revenue streams and functional expenses.

The 2021 Annual Report can be viewed at www.neha.org/annual-reports. The webpage also includes annual reports from 2016–2020.

NEHA **NEWS**

NEHA Staff Profiles

As part of tradition, NEHA features new staff members in the *Journal* around the time of their 1-year anniversary. These profiles give you an opportunity to get to know the NEHA staff better and to learn more about the great programs and activities going on in your association. This month we are pleased to introduce you to two NEHA staff members. Contact information for all NEHA staff can be found on pages 46 and 47.

Nick Bohnenkamp

Eager to leave Iowa in my early 20s, I roamed the West Coast for a few months, eventually landing in Colorado. After a few years working in the ski industry, I found that living in Denver both quenched my thirst for access to the outdoors as well as provided professional opportunities for an idealist interested in environmentalism and city building. I was fortunate to be involved in building one of the first bike sharing networks in the nation in Denver. Our nonprofit bike share system became a model for dozens of cities across the U.S. I left bike sharing with a love for bikes and a love for running a successful nonprofit.

Through that work I developed the experience and skills I use daily at NEHA. As the program and operations manager of Program and Partnership Development (PPD), I am responsible for the operations of the department. The responsibilities can be both broad and deep, including supporting our project coordinator efforts to meet scope, schedule, and budget across their portfolios; developing contracts and subaward agreements; redirecting project funds as plans change; assigning project cost codes; and supporting our cooperative agreement reporting efforts throughout the year. Behind the scenes I love thinking through standard operating procedures, process improvements, and striving to achieve a state of operational excellence across PPD.

When not at my keyboard I am fully engaged in the lives of my two young daughters—reliving my own childhood through them as I see them learn to ski, swim, build, bike, play, and most of all, negotiate every little thing.

Michéle Samarya-Timm

When I began my career as a registered environmental health specialist in a local health department, I found there was a great depth and breadth to the profession and realized I needed additional confidence, more training, and a pathway to upskill my competencies. I came across the *Journal of Environmental Health* and decided to become a member of NEHA. And so, my connection with NEHA was born.

After becoming a member, I noticed a promotion in the *Journal* that was looking for NEHA members who were interested in participating on a committee to review food safety curricula. Through this call for members, I identified something I could do on my own time to apply my skills and add to my professional experiences and résumé. As such, I responded to the call. The NEHA staff welcomed me to the cadre of project volunteers and actually thanked me for my efforts—something that did not happen often in my experience in local environmental health. I was hooked and asked if I could volunteer more. The answer from NEHA was a resounding yes!

Over time, I had the pleasure of volunteering with NEHA on both core and groundbreaking projects: Epi-Ready, the Food-Safe Schools Action Guide, food defense, position statements, handwashing initiatives, surface sanitization infographics, and promoting women's leadership in environmental health. I also had numerous opportunities to help coordinate and present a wide range of topics at the NEHA Annual Educational Conference & Exhibition as a section chair and technical advisor in food safety and protection, women's issues, and workforce and leadership.

My active membership with NEHA defined and amplified my career. As I continue my professional journey, it was a perfect match for me to join the NEHA staff to "practice forward" and continue to concentrate on essential and innovative environmental health topics to assist the environmental health workforce in the same manner that NEHA has always done for me.

I am excited to have joined the NEHA Washington, DC, staff as part of the PPD team, specializing in preparedness. For me, this work is personal. Environmental health is regularly facing new and reoccurring challenges, and my focus is concentrating on projects to help our profession be more nimble, more prepared, more capable, and more visible. At its core, this work is about you—the NEHA members and boots-on-the-ground environmental health workforce—and the communities we have the pleasure and privilege to serve and protect.

Keep an eye out in the *Journal* and on the NEHA social media accounts and communications for resources and opportunities in the area of preparedness, as well as in other topics of value to the profession. I am so energized to be working with NEHA in this space! I look forward to engaging and reengaging with all.

Did You Know?

You can now view the history of the NEHA Annual Educational Conference (AEC) & Exhibition on the NEHA History Project webpage at www.neha.org/neha-history-project. The posted AEC reports provide a rich history of the events with pressing topics, award winners, and images from our past.

DirecTalk
continued from page 54

when they desire to speak with staff, should know who to touch base with and how to reach them. Sixth, our website needs to be optimized for search and social media hits. That is, we ideally should appear in search engines when individuals inquiring about the profession are probing the digital universe. Please note there is texture and detail I have omitted, some of it profound, that is beyond the scope of this column. Our vision is to provide you with what you need to know and when you need to know it—all in a manner you find helpful.

Internal to NEHA, these days I inquire less about the "what" and am more focused on the "so what." In that spirit and threading data to the website discussion, what information are professionals accessing when they visit our website and how long do they remain there? What does that mean? Are there temporal associations or patterns? Do they download our policy and position statements and if so, what are they doing with them? Extending that discussion, are our webinars well attended? Why or why not? Do individuals find value in

An old, familiar door. Photo courtesy of David Dyjack.

our courses and if we inquired with them one year after attendance, could course attendees describe what changed in their practice? Data will inform these discussions.

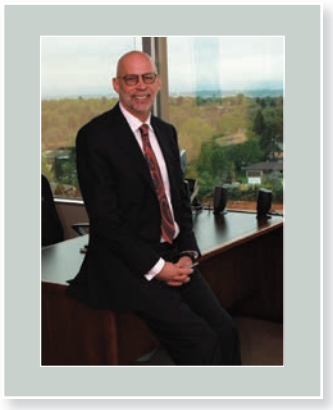
Our organization is deceiving in its complexity. Longtime members Gina Bare and Michéle Samarya-Timm recently joined our staff and have subsequently expressed astonishment at the breadth and depth of the organization's activities. They were unaware. In the haze of meeting the expectations of busy portfolios, I ask myself what performance data are most reasonable and useful to collect to better understand organizational efficiency and effectiveness. I have developed a personal list of my favorite attributes of association data. Are the data easy to collect? Are the data easy to understand? Are the data directional? Are the processes underlying the data amenable to intervention? Do these data represent an organizational priority?

Many of you have heard me speak or read my perspectives on data. I believe most people do not make decisions based on data. They make decisions based on their values, beliefs, and absorbed identities. Our professional data, to be useful, must be woven into stories that deeply resonate with decision makers on a personal level. That is a whole different column.

I feel we are at a threshold, an old and familiar one centered on data. If we elect to open that door, let us start with the pipes that are available to demonstrate the full potential of our profession.

ddyjack@neha.org
Twitter: @DTDyjack

DirecTalk



David Dyjack, DrPH, CIH

Triangulate the Data

"Use the pipes that are available." The speaker's voice rattled in my cochlea. The thread-worn reference to electronic health and medical records harkened back to the Obama era conversations centered on data. I throttled a primordial urge to enter a comment in the chat feature: "Environmental health pipes are the ones that are available."

In a recent call with a senior federal official, I shared that environmental health data collection and reporting systems are well established, stable, and frequently the ones with the most experience at the local level. The kinks have been worked out, reflecting local and regional policies, systems, and sensibilities. Given that established presence, we should collectively lead the public health enterprise in the use of data for informed decision making. At a minimum, we can and should contribute to national discussions on data, some of which are underway.

The creation of the Centers for Forecasting and Outbreak Analytics was announced last August. This new center is meant to help predict how disease spreads and to assist in real-time interventions. It will be charged with improving the Atlanta-based agency's data tools. The Centers for Disease Control and Prevention is also engaged in a Data Modernization Initiative, an effort to create an integrated, real-time public health data and surveillance system that can protect us from health threats. This iteration of the federal government is data-oriented, and we too are leaning into that conversation.

Earlier this week we submitted a new 3-year grant application for $18 million to the Food and Drug Administration to create a visionary technology infrastructure centered on human and animal food safety. We proposed development of a transformational data management system and have assembled a team and partners capable of bringing that vision to life within 3 years. Our project narrative threaded each sector (i.e., state and local environmental public health, agriculture, academia, and laboratories) in the food supply chain, inclusive of One Health. We proposed designing a system that will allow data mining and artificial intelligence to create predictive analytics aimed at identifying and extinguishing the next foodborne outbreak before one needlessly harms or ends a life.

> *We can and should contribute to national discussions on data.*

Closer to home, our organization—in collaboration with the talented people at Nordensight, one of our IT partners—is creating an organization data lake for the National Environmental Health Association (NEHA). This data ecosystem will provide us the IT architecture to import data from virtually any source and make it accessible for analysis. The potential is virtually limitless. Imagine the power of crosswalking credentialing data with environmental health performance data. I can foresee analyzing exposure data with electronic health record data. Our ability to detect trends and enhance predictive analytics will grow and possibly leapfrog our association into a new era of potential in the process.

The journey into that preferred future is expensive and riddled with figurative and organizational land mines. If we elect to embark on this journey in earnest, we must stay abreast of the world around us. For example, concurrent national public health data conversations are staying on message: relevant and visionary data systems must address health equity, be cloud-based, and puncture the recalcitrant boils of data silos.

As you read this column, we will have created the architecture of our new website. Data and performance analytics will feature prominently, coupled with other useful features. There are several attributes we are interested in providing our membership. First, we desire to create a convenient user interface that centers on our common call to action and our priorities as a profession. Second, the website must be intuitive and easy to use. Third, the website should be optimized for mobile technology as an increasingly large segment of the population and our profession digest their news and perform their work from mobile devices. Fourth, our content should be fresh and valuable. I believe we are ready. We now employ six people in our association communications team, an increase from two only a few years ago.

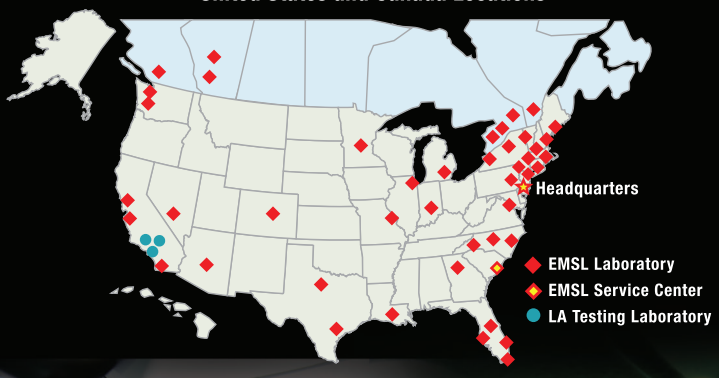
Fifth, readily accessible staff information should be provided on the website. Members,

continued on page 53

LABORATORY TESTING SERVICES

- ☑ **WATER QUALITY TESTING:** *E. Coli, Fecal Coliforms, Total Coliforms & More*
- ☑ **FOOD SAFETY TESTING:** *Salmonella, Listeria, Pathogens*
- ☑ **LEGIONELLA TESTING:** *CDC Elite Certified Labs*
- ☑ **LEAD & METALS TESTING:** *Air, Water, Soil, Dust, Paint Chips*
- ☑ **ENVIRONMENTAL TESTING:** *VOC's, PCB's, PFAS, TCLP*
- ☑ **INDOOR AIR QUALITY TESTING:** *Formaldehyde, Particulates & More*
- ☑ **MOLD TESTING:** *Spore Traps, Tape Lifts, Swabs, ERMI, Culture Plates*
- ☑ **ASBESTOS TESTING:** *TEM, PLM, PCM, SEM, XRD*
- ☑ **SILICA TESTING:** *Crystalline Silica & Amorphous Silica ID*
- ☑ **FIRE & SMOKE TESTING:** *Soot, Char, Ash, Cigarette & Marijuana Smoke*

United States and Canada Locations



EMSL℠

EMSL ANALYTICAL, INC.

TESTING LABS • PRODUCTS • TRAINING

www.EMSL.com

Sampling supplies available!

West Coast
866.798.1089

East Coast
800.220.3675

HealthSpace is proud to be the presenting sponsor of **NEHA 2022 AEC** in **Spokane**

After two challenging years for the nation's dedicated environmental health professionals, it will be wonderful to gather again.

Be sure to visit our booth to win some amazing prizes - including a TV - and be sure to see our presentation where we will be unveiling the next generation of functionality and features for Environmental Health data management.

gethealthspace.com

info@hscloudsuite.com
980.375.6060

We know budgets are challenging - especially coming out of the pandemic!

Simply scan the QR code above to enter to be our guest in Spokane. Including 2 fully paid AEC registrations and two nights hotel stay.

All submissions must be received by 12:00AM May 15, 2022.
The winners will be notified by May 20, 2022 via email and must confirm receipt and acceptance of award within 24 hours of notification or award will go to next drawing recipient.

One submission is allowed per email address. You do not have be a client of HealthSpace USA to be eligible to win. HealthSpace is not liable for any damages or matters arising from injury or illness, or death to any persons, or damage to or destruction of any property incurred by the recipient through the airline, hotel or conference venue during the dates of the travel. Rules and Restrictions apply.