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ABOUT THE COVER

Multiple organizations and agencies have called for a more diverse environmental health workforce. In environmental health practice—taking into consideration the importance of community engagement—diversity in the workforce is crucial to ensuring a wealth of cultural knowledge that facilitates community relations and builds trust. In this month's cover article, "Increasing Diversity in Environmental Health Graduate Programs," the study aimed to determine what motivates and deters students from historically marginalized populations from pursuing degrees in environmental health and to develop recommendations that programs can implement to diversify their student body and, subsequently, the workforce.

See page 26.

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PRESIDENT'S MESSAGE

D. Gary Brown,
DrPH, CIH, RS, DAAS

We Are Your Strongest Advocate

Dr. Martin Luther King, Jr. said, "Courage is an inner resolution to go forward despite obstacles." My fellow environmental health professionals, every day you show tremendous courage, fortitude, and empathy toward protecting the public. You constantly amaze me by coming up with novel solutions to problems people never realized they had. In our profession, people never speak about being bored. Speaking with environmental health professionals throughout the land, everyone loves our field. Please share your passion for environmental health with everyone you meet just like the individuals on Sesame Street.

As Dr. David Dyjack, executive director of the National Environmental Health Association (NEHA), states, "Environmental health is a contact sport." As such, contact is necessary to get our message out. We share the message of environmental health with our elected officials and policy makers to improve the profession and provide our members with the tools they need. The NEHA Board of Directors, along with several of our members, spoke with elected officials and policy makers during our sixth annual Hill Day on February 23, 2023, to educate, enlighten, and hopefully, even entertain.

Darwin D. Martin stated, "A teacher's job is to take a bunch of live wires and see that they are well-grounded." Doug Farquhar, our director of Government Affairs, does an unbelievable job in preparing us for Hill Day and ensuring we are well-grounded.

> *Our message is to speak about the importance of a robust and well-resourced environmental health workforce.*

He even provides a Hawaiian shirt and sneaker wearing fashionista such as myself with professional dress tips such as wearing socks and a tie.

We are the profession's strongest advocate for excellence in the practice of environmental health as we deliver on our mission to build, sustain, and empower an effective environmental health workforce. Our message is to speak about the importance of a robust and well-resourced environmental health workforce. Many people might not know that we represent almost 7,000 government and private sector environmental health professionals in the U.S.

The messages we shared during Hill Day included:

- Environmental health professionals assure healthy, safe, and prosperous communities.
- Environmental health professionals often work outside traditional health departments and might be omitted from the benefits of legislation if not specifically called out.
- Environmental health professionals are allies in environmental justice efforts.
- Environmental health professionals are on the front lines in climate and health issues.

Environmental health services are not a luxury. They are essential to providing the public basic needs, such as safe drinking water, clean air, safe food, healthy housing, climate change adaptation, emergency preparedness, and more. Environmental health has long been recognized as being a crucial service of government at state, local, tribal, territorial, and federal levels.

Environmental health professionals are scientifically trained and certified to identify and mitigate environmental dangers as well as promote alternatives. We are handling threats on the front lines of public health. Environmental health professionals form a critical component of the public health delivery system, providing services to curb environmental health threats and prevent adverse health outcomes. We assist communities to prepare for, respond to, and recover from disease outbreaks and natural and anthropogenic disasters. We are on the front lines of public health handling threats such as environmental inequities (e.g., lead exposure), climate change (e.g., drought), food safety (e.g., baby food), safe drinking water (e.g., perfluorooctanesulfonic acid [PFOS]), and clean air (e.g., ozone).

Environmental health professionals are strategically positioned to identify and intervene to prevent public health and environmental health threats from affecting local populations.

As a nation, the U.S. spends over $3 trillion annually on healthcare but lags behind other developed countries in practically every health metric. The lack of investment into the environmental health system is costly for this nation.

The top four messages we wanted the congressional staff we met with during Hill Day to remember were to:

1. Fund the National Center for Environmental Health within the Centers for Disease Control and Prevention at $300 million and to fund the Agency for Toxic Substances and Disease Registry at $95 million.
2. Fund the Federal and State Initiative of the Food and Drug Administration—which supports food safety inspections—at $140 million and provide $35 million for states to purchase equipment to serve healthier meals and improve food safety.
3. Encourage the Health Resources and Services Administration to include environmental health within the Public Health Workforce Loan Repayment Program.
4. Share with the congressional offices the importance of environmental health to state and local public health agencies.

The author J.K. Rowling said, "No story lives unless someone wants to listen. The stories we love best do live in us forever." Please share your environmental health stories with your elected officials and policy makers to improve the profession. Even if you are not comfortable speaking with these individuals, remember what Elmo said, "If you keep practicing, you can do anything." The more we share our stories with elected officials, policy makers, fellow scientists, and the public, the greater the impact.

When people think of how public health improves their lives, what comes to mind is what environmental health ensures—clean air, food, and water along with a safe and healthy place to live, work, and play. Environmental health provides the biggest bang for the buck of all of the health fields. As Warren Buffett stated, "Someone's sitting in the shade today because someone planted a tree a long time ago." Environmental health professionals have planted forests to protect the public.

I look forward to seeing you at our 2023 Annual Educational Conference & Exhibition in New Orleans, Louisiana, on July 31–August 3. Thank you for all of your hard work to protect the public every day. Please continue helping me spread the word that environmental health is public health. As Yoda sagely stated, "Try not. Do or do not. There is no try."

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Lead Source Attribution by Stable Isotope Analysis in Child Risk Assessment Investigations

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Abstract **Lead isotope analysis (LIA) is a promising technique for identifying potential sources of lead exposure among children with lead poisoning that are not revealed via traditional lead risk assessment methods. A total of six Wisconsin children with blood lead levels (BLLs) ≥10 µg/dl were included in this case series. Lead isotope ratios from blood and environmental samples were analyzed using a multicollector inductively coupled plasma mass spectrometer (MC-ICP-MS) to determine exposure source. LIA identified likely sources of lead poisoning: lead-based paint, dust, imported spices, ceremonial objects, or mixtures of these sources. LIA both corroborated findings from standard lead risk assessment and identified novel sources. LIA using high-precision MC-ICP-MS can identify and exclude sources of exposure when interpreted alongside traditional lead risk assessment approaches. Furthermore, LIA can serve as a useful tool in identifying and eliminating lead exposures in poisoning cases, particularly when traditional methods fail to identify the likely cause.**

Introduction

Lead exposure early in life can lead to irreversible harm; even low levels of lead exposure can affect the developing central nervous system and result in impaired cognitive function (Hou et al., 2013; Reuben et al., 2017). The primary intervention for a child with a case of lead poisoning is to remove the sources of lead from the child's environment. Finding the sources, however, can be a significant challenge because lead is pervasive and is present in many materials. Environmental health specialists use screening questionnaires to identify likely exposure routes and X-ray fluorescence instruments to determine lead concentrations of materials in the home.

Confirming the cause of lead exposure requires removing the source and observing a reduction in the child's blood lead level (BLL), the latter of which might take months to years depending on peak BLLs and chronicity of exposure. Standard risk assessment methods can fail to identify the primary cause and result in continued lead exposure. Lead isotope analysis (LIA) holds promise for improving the accuracy of childhood lead investigations.

LIA is based on the four stable, naturally occurring isotopes of lead (^{204}Pb, ^{206}Pb, ^{207}Pb, and ^{208}Pb), which all have relative abundances in the Earth's crust. Isotopes ^{208}Pb, ^{207}Pb, and ^{206}Pb are products of radioactive decay over geologic time. The abundances of isotopes vary given the age of the lead ore due to this radioactive decay. Isotope abundances are analyzed as Pb isotope ratios (PbIR), which are distinct and commonly called isotopic fingerprints. Advancements in technology used to measure isotopic fingerprints have increased discrimination due to higher sensitivity and precision compared with earlier applications (Gulson et al., 1995; Gwiazda et al., 2005; Millen et al., 1995; Oulhote et al., 2011; Yaffe et al., 1983).

Given the potential of LIA for lead risk assessment, the Wisconsin Department of Health Services piloted a case series to demonstrate the use of high-precision LIA in identifying the primary source and secondary contributors of lead exposure among Wisconsin children with lead poisoning.

Methods

Investigation Protocol

To be eligible for this case series, a child with a case of lead poisoning must have met the following criteria: 1) peak venous BLL ≥10 µg/dl, 2) age ≤6 years, and 3) resided in southern Wisconsin. Public health officials identified and conducted data collection among six cases during May 2019–November 2021. Local health departments obtained consent from the child's legal guardian.

TABLE **1**

Case 1: Lead Isotope Ratios With Standard Error and Concentration for Whole Blood and Environmental Sources Sampled for Lead Isotope Analysis

Sample #	Sample	Sample Type	$^{206}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	$^{208}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	Lead (Pb) Concentration
1	5-min flush	Tap water	19.1288	0.0007	15.6850	0.0006	0.81997	0.00001	2.02814	0.00003	0.501 µg/L
2	Kitchen first draw	Tap water	19.2560	0.0006	15.7004	0.0005	0.81535	0.00001	2.01897	0.00003	0.514 µg/L
3	Living room carpet floor	Wipe	18.6609	0.0007	15.6362	0.0007	0.83792	0.00001	2.05779	0.00004	1.43 µg/ft^2
4	Child's bedroom trough	Wipe	20.8818	0.0006	15.8365	0.0005	0.75839	0.00001	1.92719	0.00003	193 µg/ft^2
5	Living room front trough	Wipe	20.4126	0.0007	15.7959	0.0006	0.77383	0.00001	1.95307	0.00003	10.9 µg/ft^2
6	Kitchen floor	Wipe	19.0898	0.0006	15.6850	0.0005	0.82165	0.00001	2.03461	0.00003	0.458 µg/ft^2
7	Child's carpet floor	Wipe	18.9164	0.0007	15.6667	0.0007	0.82821	0.00001	2.04463	0.00003	0.421 µg/ft^2
8	Solder	Solder (metal)	18.8035	0.0006	15.6916	0.0006	0.83452	0.00001	2.08079	0.00004	36.206 µg/g
9	Soil (side D)	Soil	19.1292	0.0007	15.6883	0.0007	0.82014	0.00001	2.03425	0.00003	136 µg/g
10	Child's window jamb	Paint	20.6180	0.0008	15.8147	0.0006	0.76703	0.00001	1.94195	0.00003	8,696 µg/g
11	Living room window jamb	Paint	21.5600	0.0008	15.8954	0.0006	0.73727	0.00001	1.89251	0.00003	7,766 µg/g
12	Subject initial blood draw	Whole blood	20.4675	0.0012	15.8006	0.0009	0.77199	0.00001	1.95093	0.00004	11.1 µg/dl
13	Subject second blood draw	Whole blood	20.7182	0.0006	15.8223	0.0005	0.76369	0.00001	1.93683	0.00003	15.4 µg/dl

Note. The report unit for the lead isotope ratio is the atom ratio.

Certified risk assessors conducted a lead-based paint risk assessment and administered the Resident Questionnaire for Investigation of Children With Elevated Blood Lead Levels from the U.S. Department of Housing and Urban Development (HUD, Form 16.1). An environmental health specialist from the Wisconsin Department of Health Services obtained environmental samples for LIA.

This case series was deemed by the Wisconsin Department of Health Services to constitute public health surveillance and practice, thus review by an institutional review board was not required.

Lead-Based Paint Risk Assessment

Lead in surface coatings was identified using an X-ray fluorescence instrument to determine lead loading in mg/cm^2. Lead-based paint was defined as ≥0.7 mg/cm^2 and a lead dust hazard as ≥40 µg/ft^2 on a floor, 200 µg/ft^2 on a windowsill, and 1,200 ppm in soil (Supplemental Text, www.neha.org/jeh-supplementals).

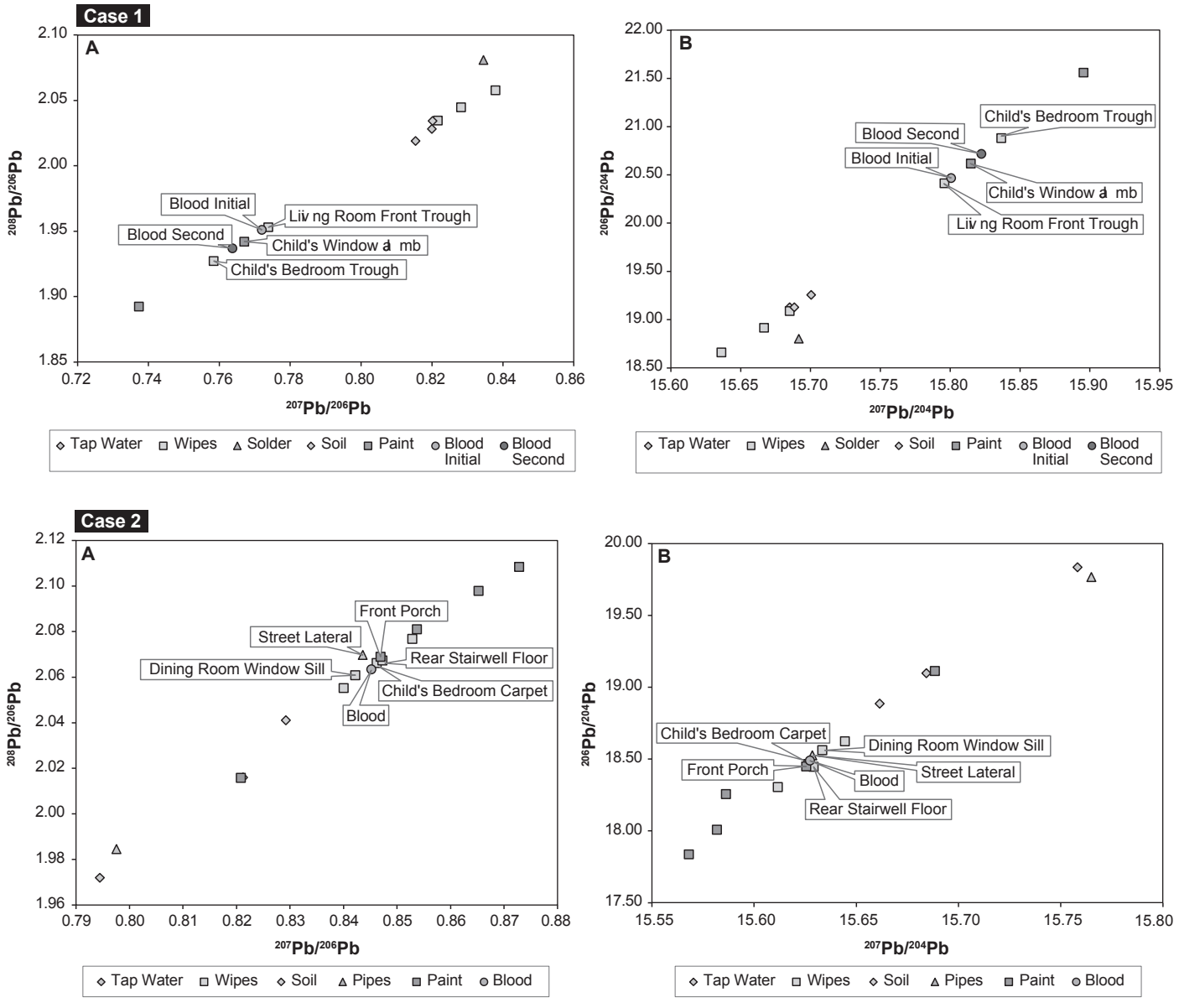
Isotope Sample Preparation and Analysis

All acid reagents used for laboratory procedures were Optima grade purchased from Fisher Scientific. Different sample types required slight modifications to digestion and preparation procedures prior to purification. Tap water samples (first draw and 5-min flush) were collected in clean 2-L fluorinated ethylene propylene bottles and dried in 1-L polytetrafluoroethylene (PFA) jars. Dust wipes, paint samples, pipes and solder, spices, cosmetics, and whole blood were digested in PFA jars on a hotplate using combinations of concentrated nitric and hydrochloric acids. Soil samples were digested using a combination of nitric and hydrofluoric acids.

Lead was purified from samples using the standard anion exchange technique (Strelow & Toerien, 1966). Lead isotopic analysis was performed using Tl-doping on a NeptunePlus multicollector inductively coupled plasma mass spectrometer (MC-ICP-MS). Total lead concentrations of the analyzed materials were estimated using the dilution factors and standard concentrations used for the isotopic analysis. Full sample preparation and analytical details are provided in the Supplemental Text. Results from LIA were used to calculate major (ratios not including Pb^{204}) and minor (ratios including Pb^{204}) isotopic ratios. These ratios were qualitatively compared with isotopic ratios from blood samples to identify the likely source of exposure.

FIGURE **1**

Two-Dimensional Isotope Ratio Plots for Whole Blood and Environmental Lead Sources Sampled for Lead Isotope Analysis for Cases 1–6



continued ▸

Results

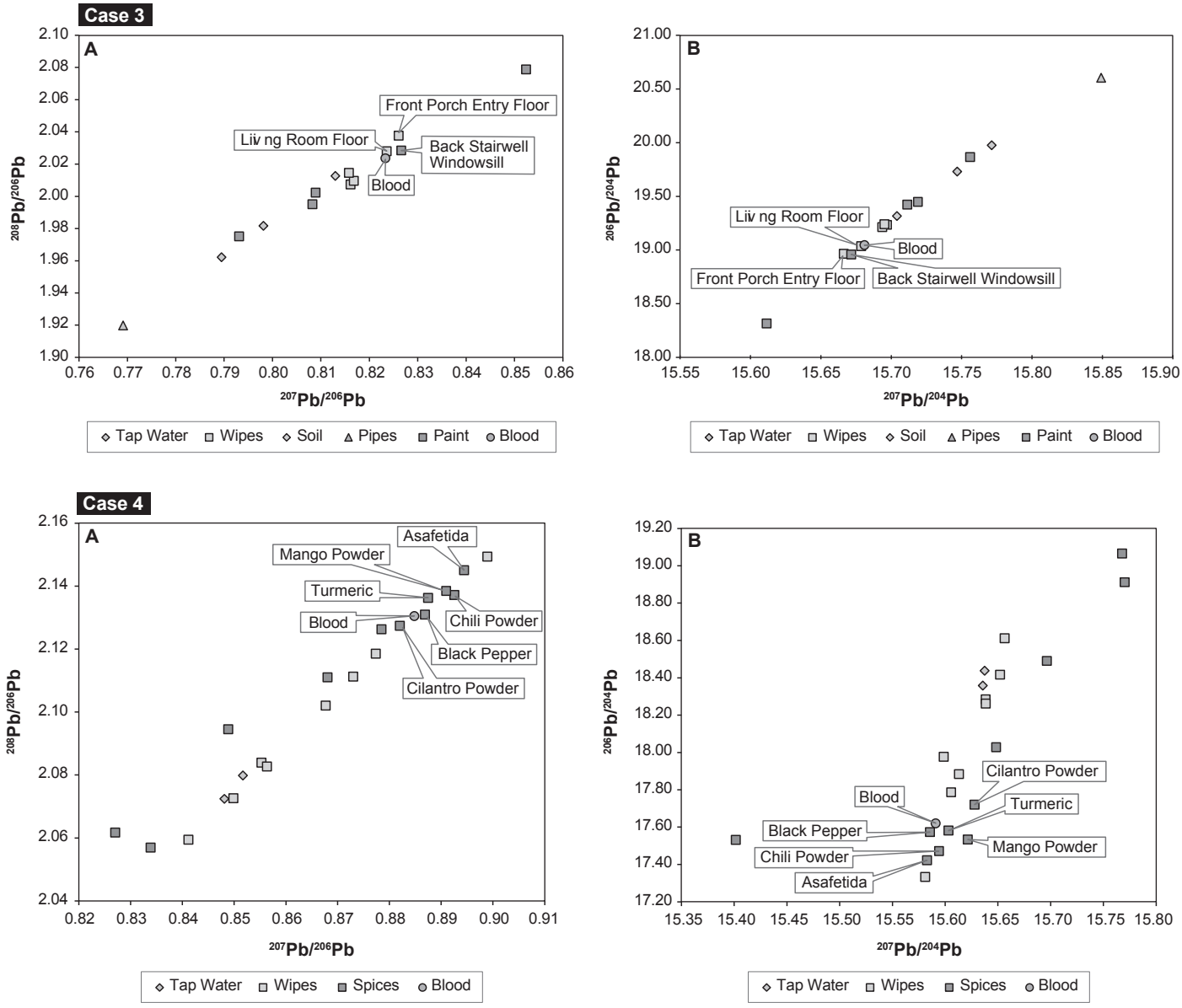
Case 1

Case 1 involved a female at 24 months with a BLL of 12 µg/dl. The risk assessment found lead-based paint on the windows, doors, walls, and trim of the home. The highest lead concentrations were from the doorstop in the living room (20 mg/cm^2) and the kitchen window (220 µg/ft^2). The HUD questionnaire determined that the child played at her bedroom window and on the living room floor and ate in the living room.

LIA indicated that the PbIR of the water (samples 1 and 2), soil (sample 9), solder (sample 8), and floors (samples 3, 6, and 7) did not match those of blood specimens (Table 1). The sample closest to the initial blood isotope (sample 12) was the wipe from the living room front window trough (sample 5; Figure 1, Case 1). The sample closest to the second blood isotope (sample 13) was the wipe from the child's window jamb paint (sample 10), with the wipe from the child's bedroom window trough (sample 4) as a close second match. Samples 5 and 10 remained the best matches to the

FIGURE **1** *continued*

Two-Dimensional Isotope Ratio Plots for Whole Blood and Environmental Lead Sources Sampled for Lead Isotope Analysis for Cases 1–6



continued on page 12

blood isotopes when all ratios were considered. These items (samples 5, 10, and 4) were also identified as the play areas from the questionnaire. LIA suggested the child ingested deteriorating lead-based paint via hand-to-mouth behavior while playing at the windows.

After 6 months, the child's BLL was 15 µg/dl, and 9 months after the initial BLL, the family's home was remediated and passed clearance. Furthermore, 1.5 years after the initial BLL, the child's venous BLL decreased to 4 µg/dl.

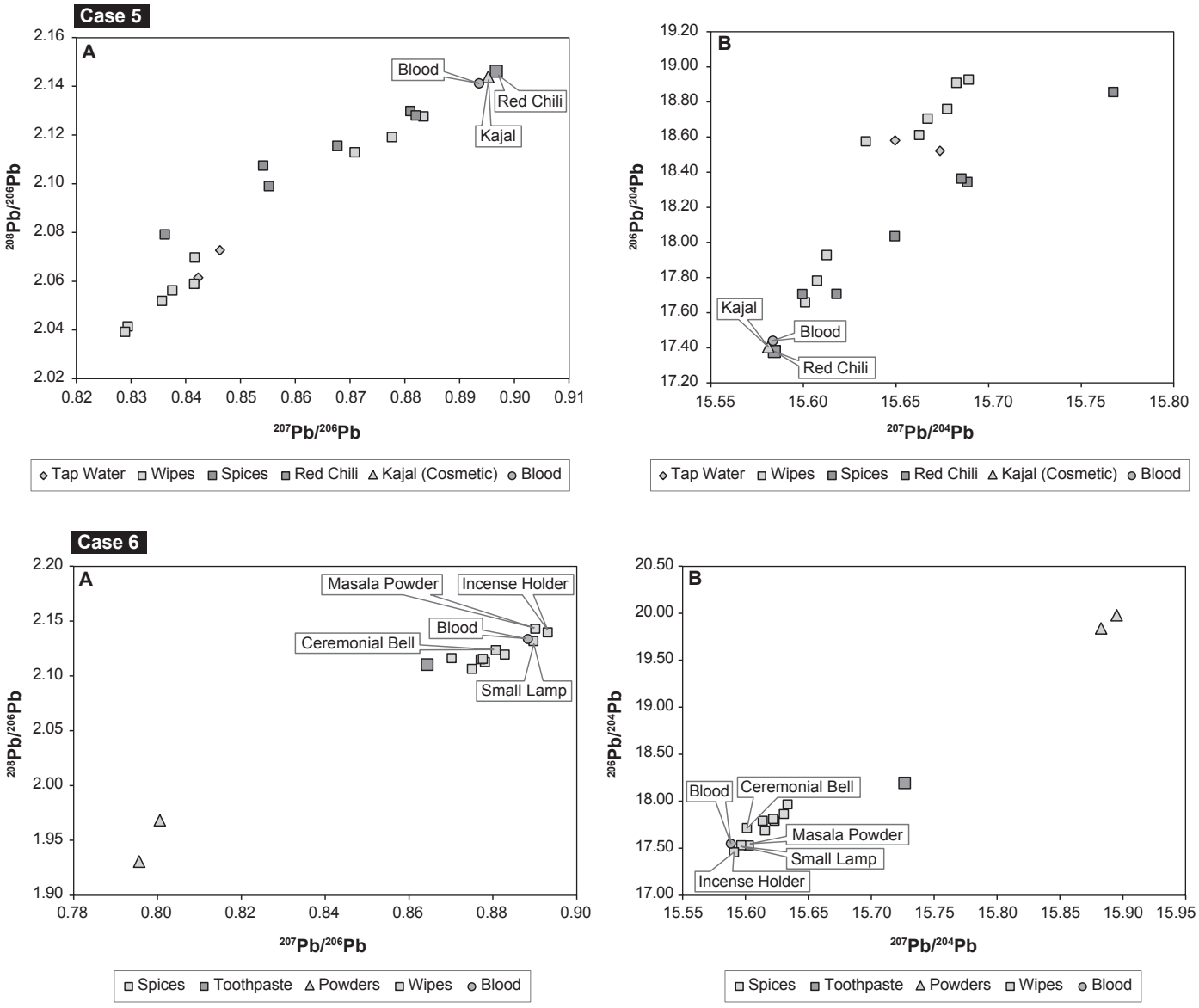
Case 2

Case 2 involved a male at 24 months with a venous BLL of 14 µg/dl. The risk assessment found lead-based paint above acceptable limits on the windows, doors, walls, and trim of the home. The dust wipes with the highest concentrations were from the living room windowsill (10,000 µg/ft^2) and back entry floor (10,000 µg/ft^2). Questionnaire responses indicated that the child ate in the dining room and played in the living room.

Blood PbIR were similar to the street lateral water pipe (sample 9) but dissimilar to tap water (samples 1 and 2) and the floor lateral

FIGURE **1** *continued from page 11*

Two-Dimensional Isotope Ratio Plots for Whole Blood and Environmental Lead Sources Sampled for Lead Isotope Analysis for Cases 1–6



Note. A = $^{208}Pb/^{206}Pb$ versus $^{207}Pb/^{206}Pb$; B = $^{206}Pb/^{204}Pb$ versus $^{207}Pb/^{204}Pb$.

pipe (sample 10; Table 2). Other samples closest to the blood PbIR were dust from the child's bedroom carpet (sample 4), dust from the rear stairwell floor (sample 7), dust from the dining room windowsill (sample 6), and front porch paint (sample 11) by all ratios (Figure 1, Case 2). The dust wipe sample ratios fell within the upper and lower ratio limits of suspected paint contributors. This pattern was consistent with the deterioration of chipping paint from the walls and windowsills, which accumulated as lead-contaminated dust inhaled or ingested by the child (Figure 1, Case 2).

LIA supported the exposure pathway of hand-to-mouth behavior in play areas identified by the questionnaire and lead concentration measurements from the risk assessment. Although there was no remediation completed, increased cleaning was recommended. After 5 months, the child's second BLL decreased by one half to 7 µg/dl.

Case 3

Case 3 involved a female at 19 months with a venous BLL of 18 µg/dl. The risk assessment found lead-based paint on the windows,

TABLE **2**

Case 2: Lead Isotope Ratios With Standard Error and Concentration for Whole Blood and Environmental Sources Sampled for Lead Isotope Analysis

Sample #	Sample	Sample Type	$^{206}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	$^{208}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	Lead (Pb) Concentration
1	5-min flush	Tap water	19.8351	0.0006	15.7582	0.0006	0.79446	0.00001	1.97195	0.00003	0.361 µg/L
2	Kitchen first draw	Tap water	19.0985	0.0004	15.6843	0.0004	0.82123	0.00001	2.01598	0.00003	0.798 µg/L
3	Child's bedroom windowsill	Wipe	18.3052	0.0005	15.6115	0.0004	0.85284	0.00001	2.07685	0.00002	57.6 µg/ft^2
4	Child's bedroom carpet	Wipe	18.4668	0.0004	15.6265	0.0005	0.84619	0.00001	2.06621	0.00004	11.5 µg/ft^2
5	Master bedroom floor	Wipe	18.6236	0.0005	15.6444	0.0005	0.84004	0.00001	2.05522	0.00003	9.0 µg/ft^2
6	Dining room windowsill	Wipe	18.5622	0.0004	15.6333	0.0004	0.84221	0.00001	2.06086	0.00003	1,272 µg/ft^2
7	Rear stairwell floor	Wipe	18.4468	0.0006	15.6291	0.0005	0.84726	0.00001	2.06730	0.00003	181 µg/ft^2
8	Backyard	Soil	18.8866	0.0006	15.6614	0.0005	0.82924	0.00001	2.04108	0.00003	248 µg/g
9	Street lateral	Pipe	18.5256	0.0003	15.6284	0.0004	0.84361	0.00001	2.06981	0.00003	128,683 µg/g
10	Floor lateral	Pipe	19.7667	0.0005	15.7650	0.0004	0.79756	0.00001	1.98448	0.00002	32,438 µg/g
11	Front porch	Paint	18.4497	0.0005	15.6255	0.0005	0.84692	0.00001	2.06890	0.00004	2,659 µg/g
12	Living room wall (side A)	Paint	18.2564	0.0004	15.5862	0.0004	0.85374	0.00001	2.08100	0.00003	38,033 µg/g
13	Living room window jamb	Paint	18.0086	0.0004	15.5817	0.0004	0.86524	0.00001	2.09786	0.00003	37,011 µg/g
14	Child's bedroom window jamb	Paint	17.8365	0.0004	15.5680	0.0005	0.87282	0.00001	2.10845	0.00003	53,193 µg/g
15	Rear stairwell	Paint	19.1132	0.0004	15.6884	0.0004	0.82081	0.00001	2.01580	0.00003	25,993 µg/g
16	Subject initial blood draw	Whole blood	18.4896	0.0005	15.6273	0.0005	0.84520	0.00001	2.06345	0.00003	13.2 µg/dl

Note. The report unit for the lead isotope ratio is the atom ratio.

doors, walls, and trim of the home. The highest lead concentrations were the interior windowsills (mean of 1,158 µg/ft^2), the porch entry floor (54 µg/ft^2), and the backyard play area (4,874 ppm). The HUD questionnaire indicated that the child ate and played in the living room and at the windowsills. The main suspected sources of exposure were interior windowsills and floors with soil tracked from the backyard.

LIA excluded tap water (samples 1 and 2) and the lateral service line (sample 9) as the primary source of exposure given the poor match with blood PbIR (sample 15; Table 3). Samples closest to the blood PbIR were the paint in the back stairwell windowsill (sample 10), wipe from the living room floor (sample 7), and wipe from the front porch entry floor (sample 6) by both major and minor ratios. Dust sample (samples 3–7) isotope compositions were similar to each other and plotted within the upper and lower limits of the isotope ratios of the samples from paint (samples 10–14) and soil (sample 8), which suggested that the dust samples were likely a result of paint deterioration and soil tracked inside the home (Figure 1, Case 3).

LIA excluded potential sources so that priority could be given to the floors and points of entry to the home. Even though remediation work was not performed, cleaning was increased. Overall, 2 months after the initial BLL, the second BLL decreased to 9 µg/dl. The child's family moved 15 months after first blood draw and 2 months after the move, the child's BLL decreased further to 4 µg/dl.

Case 4

Case 4 involved a male at 15 months with a venous BLL of 10 µg/dl. The risk assessment did not find any lead hazards in the walls, floors, or points of entry of the home. Based on the questionnaire, the main suspected sources of exposure were spices and pressure cookers purchased in India. Lead concentrations in turmeric, asafetida, teething powder, and kajal with aela (a cultural eye cometic) were 99, 180, 97, and 98 ppm, respectively. The spices turmeric and asafetida were then

TABLE **3**

Case 3: Lead Isotope Ratios With Standard Error and Concentration for Whole Blood and Environmental Sources Sampled for Lead Isotope Analysis

Sample #	Sample	Sample Type	$^{206}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	$^{208}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	Lead (Pb) Concentration
1	5-min flush	Tap water	19.9770	0.0003	15.7713	0.0003	0.78947	0.00001	1.96219	0.00002	1.090 µg/L
2	Kitchen first draw	Tap water	19.7307	0.0004	15.7469	0.0004	0.79810	0.00001	1.98160	0.00003	9.008 µg/L
3	Child's bedroom floor carpet	Wipe	19.2338	0.0005	15.6970	0.0004	0.81612	0.00001	2.00743	0.00003	60 µg/ft^2
4	Living room windowsill	Wipe	19.2135	0.0007	15.6936	0.0006	0.81680	0.00001	2.00960	0.00003	443 µg/ft^2
5	Kitchen floor	Wipe	19.2393	0.0005	15.6952	0.0005	0.81578	0.00001	2.01453	0.00002	37 µg/ft^2
6	Front porch entry floor	Wipe	18.9651	0.0006	15.6662	0.0006	0.82606	0.00001	2.03770	0.00003	313 µg/ft^2
7	Living room floor	Wipe	19.0367	0.0007	15.6786	0.0006	0.82361	0.00001	2.02807	0.00003	250 µg/ft^2
8	Backyard	Soil	19.3163	0.0004	15.7040	0.0004	0.81300	0.00001	2.01272	0.00003	3,261 µg/g
9	Service lateral	Pipe	20.6057	0.0005	15.8491	0.0004	0.76915	0.00001	1.91982	0.00003	19,483 µg/g
10	Back stairwell windowsill	Paint	18.9586	0.0005	15.6716	0.0005	0.82662	0.00001	2.02849	0.00003	3,116 µg/g
11	Kitchen window trough	Paint	19.4228	0.0004	15.7114	0.0004	0.80892	0.00001	2.00226	0.00003	63,318 µg/g
12	Living room window jamb	Paint	19.8662	0.0004	15.7560	0.0005	0.79311	0.00001	1.97517	0.00003	36,975 µg/g
13	Front porch door	Paint	19.4478	0.0004	15.7190	0.0004	0.80827	0.00001	1.99512	0.00002	34,821 µg/g
14	Window sash by bed	Paint	18.3150	0.0007	15.6114	0.0006	0.85239	0.00001	2.07881	0.00003	14,675 µg/g
15	Subject initial blood draw	Whole blood	19.0458	0.0008	15.6809	0.0007	0.82333	0.00001	2.02366	0.00003	16.8 µg/dl

Note. The report unit for the lead isotope ratio is the atom ratio.

sent for isotopic analysis along with other environmental samples.

LIA did not indicate lead-contaminated dust (samples 3–10) or tap water (samples 1 and 2) as potential sources of lead exposure by both the major and minor ratios (Table 4). Samples closest to the blood isotope composition (sample 22) were black pepper (sample 11), cilantro powder (sample 16), and turmeric (sample 13; Figure 1, Case 4). Although black pepper was the closest in isotopic composition to the child's blood, turmeric and asafetida had the highest levels of lead concentration out of the spice samples (Supplemental Table).

The family stopped using the spices and pressure cookers and were advised to buy locally sourced food items and cookware. After 7 months, the child's BLL decreased to 4 µg/dl.

Case 5

Case 5 involved a female at 16 months with a BLL of 23 µg/dl. The risk assessment did not identify potential lead hazards in the walls, floors, or points of entry of the home. Based on the HUD questionnaire, suspected hazards included items manufactured in India, such as pressure cookers, spices, and kajal.

The sample closest to the blood (sample 20) isotope composition was kajal (sample 19) and red chili (sample 15; Table 5). Even though the kajal material was insoluble, a significant amount of lead (approximately 500 ng) was present in the leachate, suggesting this material was rich in lead (Supplemental Table). The kajal isotope ratios were consistent with the blood isotopic composition by both major and minor ratios. The wipes (samples 3–11), tap water (samples 1 and 2), and spices (samples 12–18) except red chili (sample 15) had isotope ratios that were not consistent with the blood composition (Figure 1, Case 5).

Intervention included use of alternative and locally sourced eyeliners, spices, and pressure cookers. Over the next 6 months, five additional blood lead measurements demonstrated a slow decrease in BLLs: 16, 15, 15, 14 (isotope-analyzed result for sample 20), and 13 µg/dl, respectively.

Case 6

Case 6 involved a male at 10 months with a BLL of 14 µg/dl. The child was 16 months at the first isotope-analyzed blood draw (8 µg/dl). The risk assessment found one lead hazard: a bell with a lead concentration of 93 µg/ft^2. The

TABLE **4**

Case 4: Lead Isotope Ratios With Standard Error and Concentration for Whole Blood and Environmental Sources Sampled for Lead Isotope Analysis

Sample #	Sample	Sample Type	$^{206}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	$^{208}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	Lead (Pb) Concentration
1	Kitchen first draw	Tap water	18.3581	0.0006	15.6356	0.0005	0.85170	0.00001	2.07985	0.00003	3.388 µg/L
2	5-min flush (kitchen)	Tap water	18.4378	0.0009	15.6373	0.0008	0.84810	0.00001	2.07245	0.00003	0.105 µg/L
3	Living room rug	Wipe	17.8841	0.0006	15.6131	0.0006	0.87301	0.00001	2.11131	0.00003	0.1 µg/ft^2
4	Bedroom carpet	Wipe	17.7869	0.0004	15.6057	0.0005	0.87737	0.00001	2.11856	0.00003	0.2 µg/ft^2
5	Large pressure cooker	Wipe	17.3334	0.0005	15.5811	0.0005	0.89890	0.00001	2.14941	0.00003	43.7 µg/ft^2
6	Small pressure cooker	Wipe	18.2844	0.0025	15.6383	0.0022	0.85528	0.00003	2.08393	0.00008	0 µg/ft^2
7	Bathtub	Wipe	17.9773	0.0003	15.5985	0.0003	0.86768	0.00001	2.10208	0.00003	1.6 µg/ft^2
8	Bedroom windowsill	Wipe	18.6121	0.0005	15.6562	0.0005	0.84119	0.00001	2.05947	0.00003	1.3 µg/ft^2
9	Halloween pumpkin	Wipe	18.2618	0.0008	15.6385	0.0006	0.85634	0.00001	2.08272	0.00003	0.1 µg/ft^2
10	Entry carpet	Wipe	18.4166	0.0006	15.6520	0.0005	0.84988	0.00001	2.07266	0.00003	0.2 µg/ft^2
11	Black pepper	Kitchen spice	17.5736	0.0029	15.5855	0.0029	0.88686	0.00004	2.13096	0.00018	0.2 µg/g
12	Pink salt	Kitchen spice	19.0658	0.0006	15.7676	0.0005	0.82702	0.00001	2.06173	0.00004	0.4 µg/g
13	Turmeric	Kitchen spice	17.5815	0.0005	15.6032	0.0005	0.88748	0.00001	2.13628	0.00003	2.3 µg/g
14	Chili powder	Kitchen spice	17.4722	0.0006	15.5942	0.0007	0.89252	0.00001	2.13718	0.00003	0.7 µg/g
15	White salt	Kitchen spice	18.9118	0.0033	15.7701	0.0031	0.83387	0.00003	2.05695	0.00015	0.1 µg/g
16	Cilantro powder	Kitchen spice	17.7199	0.0028	15.6279	0.0028	0.88199	0.00003	2.12744	0.00015	0.1 µg/g
17	Cumin seeds	Kitchen spice	18.0285	0.0039	15.6482	0.0036	0.86804	0.00004	2.11106	0.00015	0.1 µg/g
18	Asafetida	Kitchen spice	17.4226	0.0005	15.5828	0.0005	0.89440	0.00001	2.14508	0.00003	1.7 µg/g
19	Rai	Kitchen spice	18.4908	0.0075	15.6962	0.0068	0.84886	0.00007	2.09457	0.00028	0.1 µg/g
20	Mango powder	Kitchen spice	17.5334	0.0018	15.6214	0.0018	0.89095	0.00003	2.13850	0.00011	0.3 µg/g
21	Wheat flour	Kitchen spice	17.5323	0.0424	15.4015	0.0374	0.87845	0.00020	2.12633	0.00053	0 µg/g
22	Subject initial blood draw	Whole blood	17.6207	0.0008	15.5910	0.0008	0.88482	0.00001	2.13053	0.00004	10.3 µg/dl

Note. The report unit for the lead isotope ratio is the atom ratio.

HUD questionnaire identified imported powders and spices as main suspected hazards.

LIA demonstrated that not only the bell (sample 3) but also other objects (samples 12 and 13) located on a religious altar where the family burned incense were similar to the blood in isotope concentration, suggesting lead exposure near the altar contributed to the child's BLL. LIA indicated that the powders (samples 1 and 2) were not the primary suspected hazards because their isotopic compositions were dissimilar to the blood PbIR. The samples closest to the blood isotope composition were dust wipes from the small lamp (sample 12), incense holder (sample 13), and masala powder (sample 9; Table 6). These samples were also most similar to the blood isotope composition by minor isotope ratios (Figure 1, Case 6).

After getting the LIA results, the family was advised to buy locally sourced spices and restrict access to the entire altar area. The child's BLLs at 7, 8, 9, and 22 months decreased after the initial BLL and were 8, 7, 6, and 5 µg/dl, respectively.

Discussion

Our study demonstrates the application of LIA for source attribution among lead-poisoned children. In the six homes investigated, LIA identified lead-based paint, lead-contaminated dust, kajal, foreign ceremonial objects, and imported spices such as turmeric and black pepper as likely sources of lead poisoning. This technique was useful in ruling out exposures when interpreted alongside measurements of lead concentration and questionnaires about behavioral risk factors.

TABLE **5**

Case 5: Lead Isotope Ratios With Standard Error and Concentration for Whole Blood and Environmental Sources Sampled for Lead Isotope Analysis

Sample #	Sample	Sample Type	$^{206}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	$^{208}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	Lead (Pb) Concentration
1	First draw	Tap water	18.5807	0.0034	15.6494	0.0011	0.84225	0.00013	2.06144	0.00021	0.022 µg/L
2	5-min flush	Tap water	18.5219	0.0174	15.6737	0.0150	0.84625	0.00008	2.07268	0.00014	0.002 µg/L
3	Elephant wipe	Wipe	18.7607	0.0007	15.6776	0.0006	0.83566	0.00001	2.05194	0.00003	0.1 µg/ft^2
4	Bracelet wipe	Wipe	17.6595	0.0004	15.6009	0.0004	0.88342	0.00001	2.12768	0.00003	0.9 µg/ft^2
5	Gold charm wipe	Wipe	18.7060	0.0006	15.6671	0.0006	0.83754	0.00001	2.05626	0.00003	0 µg/ft^2
6	Living room sill wipe	Wipe	18.9088	0.0005	15.6826	0.0004	0.82939	0.00001	2.04150	0.00003	0.4 µg/ft^2
7	Floor dust wipe	Wipe	18.9274	0.0005	15.6892	0.0004	0.82892	0.00001	2.03924	0.00002	0.9 µg/ft^2
8	Metal cart wipe	Wipe	18.6116	0.0004	15.6625	0.0004	0.84154	0.00001	2.05890	0.00002	0.2 µg/ft^2
9	Bathtub wipe	Wipe	18.5758	0.0005	15.6337	0.0005	0.84162	0.00001	2.06975	0.00003	1.8 µg/ft^2
10	Old cooker wipe	Wipe	17.9282	0.0005	15.6125	0.0004	0.87083	0.00001	2.11286	0.00002	4.1 µg/ft^2
11	New cooker wipe	Wipe	17.7830	0.0004	15.6074	0.0005	0.87765	0.00001	2.11914	0.00003	2.6 µg/ft^2
12	Chunky chat masala	Kitchen spice	18.8568	0.0005	15.7673	0.0005	0.83617	0.00001	2.07926	0.00003	0.08 µg/g
13	Dal makhani masala	Kitchen spice	18.0354	0.0006	15.6493	0.0006	0.86769	0.00001	2.11559	0.00003	0.09 µg/g
14	Sabzi masala	Kitchen spice	18.3446	0.0004	15.6885	0.0004	0.85521	0.00001	2.09903	0.00003	0.15 µg/g
15	Red chili	Kitchen spice	17.3785	0.0004	15.5843	0.0005	0.89675	0.00001	2.14614	0.00003	22.8 µg/g
16	Black pepper	Kitchen spice	18.3640	0.0025	15.6853	0.0024	0.85412	0.00003	2.10746	0.00012	0.01 µg/g
17	Turmeric	Kitchen spice	17.7062	0.0007	15.5994	0.0006	0.88102	0.00001	2.12986	0.00004	0.01 µg/g
18	Coriander	Kitchen spice	17.7070	0.0005	15.6178	0.0006	0.88201	0.00001	2.12803	0.00003	0.05 µg/g
19	Kajal	Cosmetic	17.4047	0.0010	15.5811	0.0005	0.89522	0.00004	2.14390	0.00006	–
20	Subject initial blood draw	Whole blood	17.4400	0.0006	15.5834	0.0006	0.89355	0.00001	2.14124	0.00003	10.1 µg/dl

Note. The report unit for the lead isotope ratio is the atom ratio.

Similar to previous studies, cases 1–3 demonstrated that LIA was able to identify the most common household exposure: legacy lead-based paint exposure via hand-to-mouth behavior (Becker et al., 2022; Gulson et al., 1995; Manton et al., 2000). BLLs decreased among these cases after intervention on sources identified by LIA.

Cases 4–6 involved nonpaint-related sources more commonly identified in recent years (Forsyth et al., 2019; Gorospe & Gerstenberger, 2008; Mohta, 2010; Smith et al., 2017) and demonstrate at-risk groups for lead poisoning among immigrant populations (Angelon-Gaetz et al., 2018; Centers for Disease Control and Prevention, 2012; Shakya & Bhatta, 2019). A questionnaire can identify a foreign spice as a potential hazard, but LIA can provide additional evidence that the spice contributed to blood lead through matched PbIRs.

Unlike other recent isotopic analyses, water was also investigated in our case series due to the historical use of lead pipes in the U.S. (Triantafyllidou et al., 2009). Contaminated water might be a significant contributor to overall lead exposure among young children even at low concentrations (Zartarian et al., 2017). Environmental health specialists extensively sampled water sources by testing tap water, pipes, and solder for five out of six cases. Water was not observed as the dominant or likely source in our cases. The PbIRs of the tap water samples for cases 1–5 were dissimilar to the children's blood samples (Figure 1). For case 2, the PbIRs between street lateral pipe (sample 9) and child's blood (sample 16) appeared similar but could be due to the lead street lateral pipe

TABLE **6**

Case 6: Lead Isotope Ratios With Standard Error and Concentration for Whole Blood and Environmental Sources Sampled for Lead Isotope Analysis

Sample #	Sample	Sample Type	$^{206}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{204}Pb$	$2\sigma/\sqrt{n}$	$^{207}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	$^{208}Pb/^{206}Pb$	$2\sigma/\sqrt{n}$	Lead (Pb) Concentration
1	Lavender powder	Cosmetic	19.8394	0.0004	15.8828	0.0004	0.80056	0.00001	1.96837	0.00002	0.18 µg/g
2	Baby powder	Cosmetic	–	–	–	–	–	–	–	–	–
3	Hindu powder	Cosmetic	19.9784	0.0005	15.8952	0.0004	0.79561	0.00001	1.93069	0.00003	3.41 µg/g
4	Spicy masala powder	Kitchen spice	17.7920	0.0005	15.6231	0.0005	0.87809	0.00001	2.11261	0.00004	0.07 µg/g
5	Turmeric	Kitchen spice	17.8115	0.0004	15.6218	0.0004	0.87706	0.00001	2.11514	0.00002	0.63 µg/g
6	Masala powder	Kitchen spice	17.5293	0.0007	15.6026	0.0007	0.89008	0.00001	2.14296	0.00004	0.04 µg/g
7	Chili powder	Kitchen spice	17.8629	0.0007	15.6304	0.0006	0.87502	0.00001	2.10647	0.00003	0.05 µg/g
8	Coriander powder	Kitchen spice	17.6877	0.0006	15.6154	0.0005	0.88284	0.00001	2.11941	0.00004	0.06 µg/g
9	Health mix powder	Kitchen spice	17.9669	0.0019	15.6335	0.0017	0.87016	0.00002	2.11616	0.00005	0.01 µg/g
10	Toothpaste	Cosmetic	18.1945	0.0005	15.7265	0.0005	0.86436	0.00001	2.11029	0.00004	0.03 µg/g
11	Subject initial blood draw	Whole blood	17.5476	0.0007	15.5884	0.0006	0.88834	0.00001	2.13368	0.00004	5.3 µg/dl
12	Ceremonial bell	Wipe	17.7146	0.0006	15.6011	0.0005	0.88068	0.00001	2.12352	0.00002	14.6 µg/ft^2
13	Small lamp	Wipe	17.5312	0.0006	15.5966	0.0005	0.88965	0.00001	2.13170	0.00003	0.8 µg/ft^2
14	Incense holder	Wipe	17.4571	0.0004	15.5907	0.0004	0.89309	0.00001	2.13964	0.00003	4.0 µg/ft^2
15	Ceremonial vase	Wipe	17.7920	0.0009	15.6135	0.0007	0.87758	0.00001	2.11546	0.00003	0.1 µg/ft^2

Note. The report unit for the lead isotope ratio is the atom ratio.

being from the same geological deposit as the dominant lead exposure source(s) or the same ratio as the sum of multiple lead exposure sources (Supplemental Table).

The differences in environmental and blood PbIR between cases 4–6 and cases 1–3 demonstrate how abundances of isotopes vary given the age of the source lead ore. Cases 1–3 possessed a $^{208}Pb/^{206}Pb$ isotopic composition range of 1.93–2.06, which is consistent with Midwestern ore deposits (Doe & Delevaux, 1972; Field et al., 2018; Millen et al., 1995; Potra et al., 2018) or Great Lakes precipitation that reflects industrial pollution and coal burning (Sherman et al., 2015). In contrast, cases 4–6 possessed a $^{208}Pb/^{206}Pb$ isotopic composition range of 2.13–2.14, which is consistent with anthropogenic lead sources in India (Sen et al., 2016).

The high precision afforded by MC-ICP-MS methods is a major strength of our study. Previous LIA case series used sector field/magnetic sector ICP (Gwiazda et al., 2005; Oulhote et al., 2011) or solid source MS (Gulson et al., 1995; Millen et al., 1995; Yaffe et al., 1983) for lead isotopes. The uncertainties around PbIR in those studies typically are between 0.1–1% (Gulson et al., 1995; Gwiazda et al., 2005; Millen et al., 1995; Oulhote et al., 2011; Yaffe et al., 1983). In contrast, our case-series method using MC-ICP-MS obtained precisions of approximately 0.02–0.03% in whole blood (Supplemental Table) based on repeat analyses of whole blood standards, although there are still no isotopic reference materials for this purpose.

Another strength of our study is our inclusion of a wide array of samples, even those with low lead concentrations. Moreover, our study was unique in that case follow-up of BLLs has not been reported routinely in past LIA studies and thus contributes data to the impact of LIA in remediation efforts.

There are at least three limitations to our case series. Blood lead isotopic analysis represents all sources of lead—both endogenous or exogenous—which was supplemented by our diverse array of samples but could not account for lead from the mother during gestation or bone storage of lead. Also, mixtures of lead sources are challenging to interpret and not fully explored. Given that this study is a pilot project and case-series analysis, our sample size limits the generalizability of our results. A further limitation to conducting LIA is the cost and availability of mass spectrometers.

Conclusion

Overall, our findings suggest that high-precision isotopic analysis with MC-ICP-MS methods could be used as a supplemental tool during lead risk assessment. Our cases demonstrate that LIA can identify recontamination from legacy lead and imported items such as spices and cosmetics. All sources of lead exposure are important to consider because lead poisoning affects individuals with infinitely variable behaviors and environments. Future work should assess the use of LIA on a larger scale and the cost-effectiveness of this technique.

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Did You Know?

The Council to Improve Foodborne Outbreak Response (CIFOR) has recently released the third edition of the CIFOR Toolkit. The toolkit was developed to help implement the third edition of the *Guidelines for Foodborne Disease Outbreak Response* released in 2020. Find more information at https://cifor.us/products/toolkit.

GUEST COMMENTARY

A Call for Action to Increase the Scrutiny of Surface Cleaning and Cleaning Agents in Retail Food Establishments

Juan Goncalves, PhD

According to the most recent Food and Drug Administration (FDA, 2022) Retail Food Risk Factor Study, proper cleaning and sanitization of food contact surfaces in retail establishments remain an unmet need, with up to 60% of delis, fast food, and full-service restaurants failing to comply with the cleaning objectives for food contact surfaces set forth by the FDA model *Food Code*. While these results could reflect shortcomings with proper chemical sanitizer use, its critical preceding cleaning step (i.e., the effective removal of soils and particles that allow for viruses and bacteria such as norovirus or *Salmonella* to survive and infect individuals) is likely a significant performance culprit (Todd et al., 2007). Indeed, if tools were available to accurately evaluate proper cleaning of encrusted grease and food soils beyond a qualitative "clean to sight and touch" guideline, the actual incidence of environmental sanitation violations would most certainly increase (Kim et al., 2021).

This practice gap is critical, for without a proper cleaning step, visible and invisible food soils that linger on glasses, utensils, dishes, and general food contact surfaces can inhibit or quench quaternary, chlorine, iodine, or lactic acid sanitizing chemistries, thus rendering food contact sanitizers ineffective (Araújo et al., 2013; Lambert & Johnston, 2001). Further, because foodstuff is much less heat conductive than glass, ceramic, or metal surfaces, food soils on contaminated surfaces can also insulate these surfaces from achieving the proper temperature thresholds required to inactivate bacteria and viruses in applications that leverage hot sanitization strategies. Accordingly, overlooking the cleaning step can result in a false reassurance of sanitation and heightened risk for foodborne infection transmission.

Unfortunately, the regulatory framework described in Chapter 4 of the *Food Code* appears to lack enough granularity to help end users and health inspectors evaluate the cleaning process outcomes. "Clean to sight and touch" might meet the need from an intent perspective, but its real-life execution is much more complicated. Invisible soils such as starches and specific proteins can easily be missed on dirty surfaces. Indeed, many soiled surfaces appear to be clean, which has been widely documented in the healthcare industry as a major risk factor for infection control professionals in the struggle to mitigate transmission of infectious pathogens (Sherlock et al., 2009). Further, touching a surface can reintroduce contaminants onto areas that had previously been cleaned. More importantly, this cleaning success criteria relies on the sensorial perception from food establishment employees and health inspectors on if surfaces meet the criteria.

Unlike registered sanitizers and disinfectants whose public health claims have been judiciously scrutinized by the U.S. Environmental Protection Agency (U.S. EPA) to ensure they perform as advertised, cleaning agents and products typically used in retail food establishments (i.e., products that are not registered by U.S. EPA or lack public health claims) are not required to undergo performance validation by regulatory agencies. This lack of cleaning performance oversight by reguatory entities affects the vast majority, if not all, of the cleaning agents and products used in the first compartment of commercial kitchen sinks or in mechanical warewashing machines, among others. As a result, the performance of cleaning and detergent products against food soils is not assessed by independent entities.

So, what options are we left with? Instruments that can measure cleanliness on a surface do exist, but they are costly; complex to use, calibrate, and maintain; and are primarily left for applications in healthcare or food manufacturing. Their main practical focus has in many cases been reduced to training cleaning staff rather than quantifying soils (i.e., was a target surface left untouched by the cleaning staff?). Further, their relevance and accuracy have sometimes been the subject of scrutiny among the scientific community (Omidbakhsh et al., 2014).

What is more beneficial in this cleaning and detergent product performance vacuum is a combination of the following framework we call the four Ps: product, procedure, place, and practice.

Product

Not everything that foams is a cleaning agent, and not every cleaning agent is good at cleaning. Commodity cleaning agents and products are formulated with limited amounts and types of ingredients that fail to tackle the incredibly large number of soils encountered in a retail food establishment. These commodity products do not always keep up-to-date with changes in food marketplaces or regulatory trends. For example, moving from animal-based fats and oils to plant-based ones (e.g., canola, soy, corn, coconut, sunflower) to combat the adverse health effects of the former created an unintended cleaning issue.

Plant-based oils interact with oxygen and moisture in the air and the heat of the cooking process functions to "cure" these oils, hardening them onto the ware surfaces. These hardened oils might not be removed easily with commodity cleaning agents and products and could create the need for additional labor or rewash to improve results. Whenever possible, using cleaning agents and products with a demonstrated strong history of superior cleaning performance and innovation is best. Otherwise, user directions for many food contact sanitizers—such as "preclean visible soils"—places the burden on the end user to guess when soils have been visibly cleaned.

An important case is the use of single-detergent sanitizer or cleaner sanitizer products

for soil cleaning. The type and concentration of ingredients used in their formulation is restricted by the norms set forth in CFR 40 §180.940. These special products are formulated to be safe enough to be left on food contact surfaces without the need for a potable water rinse. The performance trade-off, though, is their cleaning power against hardened food soils might be limited, because very powerful cleaning agents are excluded from CFR 40 §180.940. As such, using a proper, alternative cleaning and detergent product followed by rinsing with potable water could provide a better cleaning outcome.

Procedure

Cleaning agents and products will not do the job if they are not used according to label instructions and the processes they were designed for. Reading labels, though, can be a burden for employees in a retail food establishment. Instead, clear, succinct, and primarily visual instructions and procedures for how to use a cleaning agent or product are crucial to achieve the cleaning goals of the *Food Code*. Items that need to be covered in the instructions and procedures include how much cleaning agent to dilute or apply directly on a surface, soaking time if recommended, water temperature requirements, and cleaning tools; these steps are the most common, necessary ones for manual cleaning of food contact surfaces. Meticulously following all steps in a procedure while using inferior commodity cleaning agents and products might not achieve the proper food soil removal.

Place

According to the Conference for Food Protection (2016), "cleaners should be used according to a Sanitation Standard Operating Procedure (SSOP) specific to a location or piece of equipment being cleaned." Cleaning a deep fryer requires a different performance strength from the detergent of choice compared to products intended for a salad bar. Likewise, cleaning agents and products that meet the cleaning needs in a steakhouse or sit-down restaurant will differ from cleaning agents and products that can do the job in a limited-capacity coffee shop.

Practice

Personal hygiene shortcomings (e.g., lack of handwashing etiquette, touching foods with contaminated hands, working while ill or failure to report an illness, among others) is a major driver of food-related outbreaks. Personal hygiene is correlated with knowledge, attitudes, and behaviors of food service managers and employees alike (Pragle et al., 2007), and those same factors affect the perception by food service managers and employees of the cleanliness of surfaces in the retail establishment. The person in charge and—equally importantly—the health inspector must educate food service workers (and validate the learnings acquired) about the importance of effective surface cleaning through proper training and continuous monitoring and improvement.

Conclusion

Cleaning should not be regarded as a chore. Proper cleaning of surfaces in food service establishments remains an opportunity—and with it, an improvement—in mitigating a major risk factor for transmission of foodborne pathogens. Implementing the appropriate cleaning tools, superior cleaning agents and products, easy-to-execute procedures, and the right mindset will help achieve these goals.

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SPECIAL REPORT

Federal Meat and Poultry Inspection Duties and Requirements—Part 1: History and Current Responsibilities

Roger W. Amery, CP-FS

Abstract **This 4-part series aims to inform environmental health specialists of the duties and requirements for federal meat and poultry inspectors and the companies they regulate. The other parts of the series will be presented in subsequent issues of the *Journal of Environmental Health*. This special report presents part 1 and starts with the history, responsibilities, and general requirements of federal meat and poultry inspectors. The Food Safety and Inspection Service (FSIS) comes under the authority of the U.S. Department of Agriculture. FSIS began with the Meat Inspection Act of June 1906 and has developed through the years into the current public health agency that regulates sanitation, labeling, and food safety requirements at federally inspected meat and poultry producing companies (Animals and Animal Products, 2023a).**

The primary purpose of FSIS is to ensure that regulated companies are producing safe food for consumers. If noncompliance is discovered, FSIS inspectors mandate appropriate action. Enforcement investigation and analysis officers conduct assessments of written and conducted procedures to determine if the company procedures are scientifically sound and supportable. These officers respond to consumer complaints and conduct recall effectiveness checks at the recalling companies and their consignees.

History

The original Meat Inspection Act, passed in 1891, was only for meat products exported overseas. It was not until June 30, 1906, that the U.S. Congress took action to protect consumers by passing the original Food and Drugs Act and the Federal Meat Inspection Act of 1906.

The impetus for this congressional action was the 1906 publication of Upton Sinclair's novel *The Jungle*, which exposed the unsanitary conditions and brutal hardships endured by immigrants who, by economic necessity, worked in notoriously dangerous factories. The story took place partially in fictional "Packingtown," which was modeled after the slaughter and meat processing facilities in Chicago, Illinois, that were called the Union Stock Yards. Shocking scenes in the book depicted industrial accidents as severe as workers stumbling into tanks where animal parts were being ground up to be sold as lard (Sinclair, 1906). Shortly after the novel was published, meat sales went down drastically because of outraged and disgusted consumers who were fearful about the depicted unsanitary conditions at meat processing companies.

Upton sent his book to President Theodore Roosevelt, personally advocating for action. After reading the novel, Roosevelt ordered an investigation that yielded what he called "a sickening report" (Gable, 2004). It was never published. Instead, Congress passed the Federal Meat Inspection Act of 1906 that mandated inspection, throughout its processing, of meat sold overseas or across state lines, which ultimately is the responsibility charged to the current Food Safety and Inspection Service (FSIS) within the U.S. Department of Agriculture (USDA).

Since 1906, the following actions have been taken:

- 1938: Congress passed the Federal Food, Drug, and Cosmetic Act.
- 1957: Congress passed the Poultry Products Inspection Act.
- 1967: Congress passed the Wholesome Meat Act, amending the Federal Meat Inspection Act of 1906, so that companies producing meat inspected and sold within their own states were subject to the same inspection standards as for overseas sales.
- 1968: The Wholesome Poultry Act was passed to similarly amend the Poultry Products Inspection Act of 1957 (Roberts, 2001).
- 1972: Both meat and poultry inspection were placed under the Animal and Plant Health Inspection Service.
- 1977: The Food Safety and Quality Service was formed to assume the responsibility

TABLE **1**

Companies Regulated by the Food Safety and Inspection Service (FSIS)

General Obligations of Slaughter and Fabrication Companies	
• Determine the 8 hours that are their official operating hours. Overtime worked by FSIS inspectors is paid by the companies to FSIS and these inspectors are paid time and a half. • Provide FSIS inspectors, by law, adequate offices and office furniture, access to telephones and online computer facilities, and functioning restrooms. • Provide proper facilities, equipment, products, and requested records for inspection activities. • Not hinder FSIS inspection activities in any way and follow directions from FSIS.	
Slaughter Companies • Slaughter livestock, including domesticated mammals and domesticated birds.	Fabrication Companies • Process products after slaughter and before shipping to retail stores. It is important to note that retail stores are not inspected by FSIS.
The tasks entailed in slaughter include: • Unload livestock from livestock trucks to pens. • Corral livestock onto the slaughter floor. • Kill, exsanguinate, skin, and disembowel the livestock. • Trim carcasses and place into coolers. • Harvest and segregate offal products (e.g., viscera, head meat). For the purposes of this special report, meat means the edible flesh of domesticated mammals. Poultry means the edible flesh of domesticated birds.	The tasks entailed in fabrication (called processing by FSIS inspectors) include: • Debone products and then cut into wholesale cuts (e.g., primals, subprimals) or grind. • Cut products into smaller cuts (e.g., steaks, chops, filets, ribs, drumsticks). • Grind, cook, or marinate products (e.g., for sausages). • Mix products with other foods (e.g., pizza). • Make into anything from a raw retail cut to cooked soup, oils, or shortenings. To be inspected and labeled by FSIS inspectors, fabricated products must consist of at least 2% meat or poultry.

of meat and poultry inspections. After 4 years, the name of the service was changed to FSIS.

- 1995: FSIS started inspection of facilities known as "breaker plants" that break shelled eggs for the manufacture of egg products.
- July 25, 1996: FSIS published the Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems federal rule to alert companies and inspectors of the upcoming HACCP requirements.
- 1998: FSIS was formally charged with enforcing HACCP requirements to identify and prevent, eliminate, or reduce potential hazards.
- January 27, 1997: Each inspected meat and poultry company was required to have written and implemented standard sanitation operating procedures (SSOPs). SSOPs documented the plans of companies to prevent contamination of food and food contact surfaces before and during operations.
- March 1, 2016: FSIS began inspection of siluriformes fish and fish products, which include fish commonly known as catfish. Siluriformes fish inspection follows the same regulations as meat inspection.

Current Responsibilities

Regulated Companies

FSIS regulates companies that produce, at the wholesale and/or retail levels, meat and poultry products sold to other companies. The regulated companies are slaughter companies, fabrication companies, and companies that conduct both slaughter and fabrication activities. See Table 1 for general obligations of slaughter and fabrication companies. Categories of FSIS personnel and their job descriptions are listed in Table 2.

Enforcement Investigation and Analysis Officers

The primary responsibility of enforcement investigation and analysis officers (EIAOs) is to conduct assessments of food safety systems. They analyze HACCP components, SSOP components, and compare what is written in the HACCP and SSOP components with government regulations. They observe general sanitation such as warehousing, pest control, and cleanup of the facilities. They review the supporting documentation to determine compliance to the government regulations and if the decisions the company made are supportable. If decisions are not supportable, then it is considered noncompliance.

EIAOs write reports on what is observed regarding the design of the systems and what has been found to be noncompliant. A recommendation is made to the management with the FSIS district office as to if an enforcement action is required. The report is written in a manner such that any decision made about an enforcement action is supportable by the regulations. EIAOs document letters, interview notes, decision memos regarding enforcement, and documents generated by consumer safety inspectors to build a case file that might result in suspending the operations, withdrawal of inspection, or eventually closing the company.

EIAOs respond to consumer complaints that are associated with federally inspected companies. On receipt of a complaint, it is entered into a consumer complaint monitoring system for other agency personnel to review. If there are similar complaints with the same root cause, this pattern will be detected by those personnel, and—with the information of the product packaging—the root cause can be traced to the origin of the problem. EIAOs can be instructed to take pictures and collect samples and other evidence pertaining to the affected product.

EIAOs respond to recalls of product generated by the companies. EIAOs will visit these companies to be a liaison between the companies and FSIS personnel in Washington, DC, to ensure that the companies are contacting and informing the consignees of the recall. Companies are to provide a list of those consignees with sufficient information for EIAOs to check the consignees for recall effectiveness and to ensure that the affected product does not continue into commerce. Randomly selected consignees, visited or contacted via telephone, could reveal more consignees, so recall effective-

TABLE **2**

Personnel of the Food Safety and Inspection Service (FSIS)

Job Title	Job Qualifications	Job Description
Food inspector (FI)	High school diploma and 2 years of experience in sanitation, farm animal raising, and/or meat processing	Work on the line in slaughter companies. It is required that an FI be on the line whenever slaughter lines are operating.
Consumer safety inspector (CSI)	≥1 years of FI experience within FSIS	Work off-line at slaughter lines at slaughter and/or fabrication companies. Patrol assignment might include two or more companies daily; one of the companies serves as headquarters for the patrol assignment.
Enforcement investigation and analysis officer (EIAO)	Training in EIAO methodology; a bachelor's of science degree (usually), but medical doctors and doctors of veterinary medicine are often hired as EIAOs, both within and outside FSIS	Assess and analyze food safety systems written and implemented by companies. Investigate consumer complaints. Determine action to be taken when companies have demonstrated numerous noncompliances. EIAOs are stationed in government district offices.
Public health veterinarian (PHV)	Doctor of veterinary medicine degree or equivalent	Supervise FIs and CSIs. Conduct dispositions of carcasses and cadavers that have been segregated by FIs to determine whether certain parts or the whole should be condemned and destroyed.
Inspector-in-charge (IIC)	CSI or PHV	The primary FSIS inspector in any regulated company.

Note. Once hired, FSIS employees receive specific training from FSIS. CSI is a promotion from an FI position.

ness checks are conducted on these additional consignees.

At recall effectiveness checks, EIAOs ascertain:

- If consignees received the recall notices from the recalling firm.
- When, how, and how much of the affected product was received.
- How much of the product was left on the shelf at the time the recall notice was received.
- What was done to the product (e.g., placed on hold for further instructions by the manufacturer or company headquarters, destroyed and discarded, shipped further into commerce, shipped back to the supplier).

If stores have not received recall notifications, a traceback is conducted to determine if a prohibitive action in the chain of consignees was the cause of the recall failure. If stores, having received the recall notification, are still offering the affected product for sale, the EIAO will contact the district office for instructions. This action usually results in product detention and eventual seizure by federal sheriffs if the owner does not properly make a disposition of the affected product.

For both consumer complaints and recall effectiveness checks, EIAOs confer with the case specialist at the district office to prepare case files in the possible event that these matters are taken to court.

Companies are to have written procedures for recalling adulterated products, including how they will make the decision to recall and how the recall will be implemented. Furthermore, companies are to notify the FSIS district office within 24 hr of learning they have received or shipped adulterated products (Animals and Animal Products, 2023b).

General Control

FSIS inspectors control the companies by stopping production until the company resolves any sanitation or labeling issue. FSIS inspectors can "tag" products, areas, or equipment that do not meet regulatory requirements. These tagged items are not to be used or processed until the regulatory requirements are met and the tags have been removed by FSIS. Whenever tagging does occur, FSIS inspectors (not EIAOs) write a noncompliance record documenting the noncompliance, the regulation(s) violated, and other noncompliance record numbers for which noncompliances of the same root cause might have been documented. The FSIS inspectors give a copy of the noncompliance record to the company, and then after the company takes immediate corrective action, writes how the correction was completed and details the proposed preventive measure. The noncompliance report is the major tool FSIS uses for documenting noncompliances at federally inspected meat and poultry companies.

Conclusion and Summary

Part 1 of this special report highlights the history, personnel, responsibilities, and general requirements of federal inspectors and companies. The key dates for the history of FSIS are 1906 when FSIS was first initiated by the Meat Inspection Act due to Upton Sinclair's novel, *The Jungle*; 1957 when the Poultry Products Inspection Act was written; and January 2000 when the deadline was set for all existing companies to have HACCP plans in place.

FSIS inspectors include public health veterinarians, food inspectors, consumer safety inspectors, and EIAOs. Public health veterinarians are in supervisory positions at the district and circuit levels. Food inspectors work on the line at slaughter companies. Consumer safety inspectors are off-line inspectors at slaughter and fabrication companies. EIAOs conduct duties outside of the circuit levels and are stationed in government district offices.

Readers may find it interesting that food inspectors and consumer safety inspectors do not require a science or agriculture degree for entry and promotion. Other food inspection agencies generally require at least a bachelor's

degree in environmental health, microbiology, food technology, or food science. Credentials such as the Registered Environmental Health Specialist/Registered Sanitarian or Certified Professional–Food Safety are neither encouraged nor rewarded by FSIS.

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

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SPECIAL REPORT

Increasing Diversity in Environmental Health Graduate Programs

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Abstract **The aim of our study was to determine what motivates and deters students from historically marginalized populations from pursuing degrees in environmental health and to develop recommendations that programs can implement to diversify their student body and, subsequently, the workforce. We recruited four self-identified underrepresented (as defined by the National Institutes of Health, https://diversity.nih.gov/about-us/population-underrepresented) environmental health graduate students via an email sent to members of the Environment Section of the American Public Health Association. Students were asked to participate in a listening session to gauge what motivated and hindered their interests in environmental health. The sessions were held in December 2021 and February 2022 via Zoom. Students highlighted the significance of personal and departmental financial support, mentorship, peer representation, and broader support for faculty initiatives as potential areas of improvement, among others. Student perspectives from historically marginalized populations offer invaluable insights into how to foster diversity in the field. Future studies should continue exploring student experiences to assess and further develop these recommendations for university policies.**

Introduction

Multiple sources, including briefs by the National Environmental Health Association and the Centers for Disease Control and Prevention, have called for a more diverse environmental health workforce (Harper, 2007; National Environmental Health Association, 2020; Oliver, 2020; Walker & Spann, 2008). Currently, 86% of environmental health professionals are White (Gerding et al., 2019). Underserved minority populations are at an increased risk of exposure to environmental contaminants and hazards and yet are less likely to have adequate access to healthcare (American Public Health Association, 2019; Collins et al., 2002; Tessum et al., 2019). In other health fields, increased workforce diversity is associated with increased levels of healthcare access in underserved populations (Mitchell & Lassiter, 2006). In environmental health practice—taking into consideration the importance of community engagement—diversity in the workforce is crucial to ensuring a wealth of cultural knowledge that facilitates community relations and builds trust.

Although academic institutions have guidelines on fostering diversity and inclusion, currently there are no standardized recommendations specifically for environmental health programs. This topic came up in 2019, when the American Public Health Association (APHA) convened a strategic planning session with the Environmental Health Workforce and Education Committee of the Environmental Health & Equity Collaborative.

The Collaborative is a group of environmental health professionals acting as a unified voice for environmental health that strives to create healthier communities for all via partnerships, resource sharing, and coordinated efforts. During the aforementioned session, the members of the Collaborative recognized the need to identify barriers and best practices as a priority to increase diversity in the environmental health workforce.

Consequently, the Collaborative designed this project to enhance understanding of what attracts students from diverse backgrounds to the environmental health field and what barriers might prevent them from entering it. Based on two listening sessions, a work group developed recommendations for graduate programs in environmental health to increase student diversity that ideally would translate into greater workforce diversity.

Methods

The institutional review board of the Johns Hopkins Bloomberg School of Public Health

TABLE **1**

Focus Group Questions

#	Question
1	How long have you been studying/working in environmental health and what sparked your interest in the field?
2	Was there ever an instance where something deterred you from working in this field or made you dislike it?
3	On the flip side, was there anything that kept or motivated you to remain in the field?
4	What are some of your thoughts on the current environmental health program being offered at your institution?
5	How well do you feel the program equips students to enter the environmental health workforce?
6	Do you feel that the program is doing anything particularly well or taking any initiatives to be more accessible or accommodating to students who are underrepresented minorities? In what ways?
7	What are ways in which the program can improve?
8	Are there any issues in the program that you think makes it unappealing to prospective students who are underrepresented minorities?
9	What are some ways they could address these issues to improve the program?
10	Some people have suggested mentorship programs to further support students who are underrepresented minorities. What are your thoughts on this?
11	Are there other recommendations regarding improving program diversity and inclusion that you have or suggestions you would like to make?
12	Are there any other thoughts you would like to share before we wrap up?

Note: The term underrepresented minorities is used here to align with the National Institutes of Health definition that the authors reference in the text.

approved this project. We conducted two listening sessions with self-identified underrepresented students (as defined by the National Institutes of Health [NIH]) in environmental health graduate programs to understand how the students became interested in the field and why they continue to stay engaged. Students were recruited via a mass email sent to members of the APHA Environment Section in fall 2021. A total of nine students expressed interest in participating.

Two calls were scheduled: one in December 2021 and one in February 2022. On each call, participants were asked to self-identify as underrepresented minorities using the NIH (2019) definition. This definition includes Blacks or African Americans; Hispanics or Latinos; American Indians or Alaska Natives; Native Hawaiians; other Pacific Islanders; individuals with disabilities; and individuals from disadvantaged backgrounds (e.g., those who experienced homelessness; were in the foster care system; are first-generation college students; grew up in a rural or health professional shortage area; or were eligible for Federal Pell Grants, federal free and reduced lunches, or the Special Supplemental Nutrition Program for Women, Infants, and Children).

After the students self-identified and gave verbal consent, the moderator asked the 12 questions (Table 1). During the listening sessions, a notetaker tracked themes and the responses were audio recorded. Later, the responses were deidentified and summarized. The listening sessions occurred via Zoom to allow students from multiple institutions to come together despite COVID-19 restrictions. To help reduce bias in participant responses, the moderator was unknown to the students and not affiliated with their institutions. Students also were allowed to turn off their cameras during the Zoom session to help maintain privacy.

Results

Ultimately, the effort involved four participants whose responses were deidentified. Of the nine students who were initially interested, four did not attend the session after the time was set and one left the session during the consent process after hearing the NIH definition for an underrepresented minority; this student did not identify as fitting the criteria.

The conversations with the remaining students, however, did provide fruitful insights. One student became interested in environmental health due to personal and family health experiences. Three students independently discovered their interest in graduate school. They all were studying in health-related fields such as public health or medicine when they were exposed to environmental health jobs or courses that sparked their interest. Each cited an understanding of the importance of environmental health and its ability to positively affect lives as a motivating factor in pursuing and remaining in the field. The students did cite, however, a lack of widespread societal understanding of and respect for the field compared with other health professions (e.g., medical doctors) as potential deterrents.

Additionally, finances played a significant role on multiple levels of students' engagement with the field. Participants noted that doctoral candidates not receiving stipends over the summer deterred them from accepting an offer from some programs. Having to secure their own research funding or not being guaranteed funding for doctoral research also made some environmental health programs unappealing to students. This situation was described as a barrier especially for students from low-income backgrounds, as it is difficult to justify leaving a full-time job to be a student without stable income. Thus, students recommended better financial support throughout their degree program. Additionally, students noted that funding undergraduate research would further increase exposure to and interest in the field.

In addition to finances, students highlighted the importance of support in acclimation to the school environment. Guidance on navigating predominantly White institutes as a person of color and acclimating to U.S. culture as an international student were specifically cited as areas where students wanted better support. Students suggested that these improvements could be achieved through mentorship programs or networking events hosted by the program. These mentorship programs and networking events could occur both between students of varying levels and between students and faculty.

With respect to representation, students expressed that interacting with peers and professors of similar backgrounds was beneficial and could assist with student recruitment and retention. One student specifically applauded her program for including underrepresented students in the admissions process, which could help attract a more diverse student population. Students conveyed that having a student body and faculty made up of people from different backgrounds—along with support systems to help students navigate settings—is crucial.

At a faculty level, students suggested incentivizing inclusion efforts and rewarding faculty members who champion diversity. Giving recognition on the tenure ladder or increasing salaries for such efforts could create a culture of inclusion that naturally fosters diversity at all levels of the institution.

Even after initiatives have been developed, students emphasized the importance of communication among departments across a given university. They noted that there must be buy-in and coordinated efforts from every level of the university and program to ensure that a diverse population of students not only exists but also feels included. One student stated that actively connecting incoming students to relevant cultural affinity groups, such as a Black Student Union, can be helpful.

For more general recruitment efforts, students suggested academic reform and outreach. They felt that exposure to environmental health coursework in related disciplines, such as public health and medicine, could bring more people to the field. One student explained how the mandatory environmental health coursework for all public health graduate students in her program was removed, decreasing overall knowledge and exposure to environmental health among the students. Another noted that environmental health coursework is offered at her university by other public health departments but is not branded as such, so many students are unaware that it can be its own field. Students also recommended implementing or increasing outreach to high school students specifically in environmental justice communities to increase their representation in the field.

Discussion and Conclusion

From this project, we have identified several areas of improvement that inform recommendations to increase diversity in the environmental health workforce. These recommendations include providing better financial support to students in the form of guaranteed research funding and year-round stipends for graduate students, as well as peer mentoring to help students navigate cultural differences and identity-specific challenges in their program. Additionally, faculty members should be rewarded for championing diversity, and students from diverse backgrounds should be included in the recruitment and admissions processes.

More generally, introducing environmental health topics into broader disciplines such as public health programs or high school science programs could increase overall awareness and interest in the field. As one of the first initiatives to better understand the motivators and deterrents of diversity in environmental health, our case study introduces the importance and value of obtaining student input to gain a greater understanding of issues that students from historically marginalized populations experience.

It should be noted, however, that due to the limited sample size of our study, this list of recommendations is by no means exhaustive. Future studies should include a larger sample size, as well as college or high school students, to better gauge potential influencers of interest in environmental health. Offering remuneration for their time might help with both recruitment and retention of listening-session participants. Future studies should also explore the relationship between increased diversity of environmental health students and increased diversity of the environmental health workforce. Moreover, initiatives should be created to disseminate the recommendations of our study and the findings of future related studies to environmental health schools and programs.

Given the disproportionate prevalence of environmental justice issues in underrepresented populations and the emphasis that the environmental health field places on community involvement, it is crucial to take more steps to increase student diversity. Implementing policies to attract and support students from historically marginalized populations might help diversify the environmental health workforce and subsequently reduce barriers to healthcare for more people. These steps could result in improving overall public health across the U.S.

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DIRECT FROM AAS

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

Strategic Professional Development

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

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

Environmental health is a compelling career field. Environmental health practitioners are scientists who protect our communities through the practice of identifying and evaluating possible environmental dangers and hazardous agents, and limiting exposures to hazardous physical, chemical, and biological agents in air, water, soil, and food to reduce or eliminate risk (National Environmental Health Association [NEHA], 2023a). We are valuable assets to keeping communities safe and healthy. We also see and find fulfillment in meeting the depth and breadth of the challenges in front of us. Sometimes, however, the job and life provide circumstances that cause a professional to pause and wonder about the place they are in their career, the direction they have come from, and where they are heading.

New and evolving situations are challenging environmental health professionals as they work to address routine and emergent community needs. The role of those professionals working in environmental health is continually reemphasized by emergencies requiring rapid and effective responses to address environmental issues and ensure protection of the public's health (Gerding et al., 2019). Adaptability is often key to surviving emergencies and workplace challenges, and to finding fulfillment in environmental health endeavors.

To be motivated, satisfied, and successful in your career, it is crucial to chart a course based on your desired workforce goals. To assure adequate competencies for job effectiveness and for current and future leadership roles, environmental health professionals can benefit from developing a personal career plan, also known as career pathing. Career pathing is a process used to chart where you are in your work life, where you want to be, and steps to take to get there. It is a type of SWOT (strengths, weaknesses, opportunities, threats) analysis that helps one identify areas for personal professional improvement.

In this column we share some strategies an environmental health professional can take to develop their environmental health career goals, skills, needed knowledge, and experience. Thoughtfully considering a series of questions—and laying out an action plan based on them—can help lay a foundation for you to better progress through your career laterally or vertically through promotions and career benchmarks.

This series of questions include:

1. **Self-evaluation: Who am I?**
   - Identify what you like and do not like about working in environmental health.
   - What are your priorities?
   - Name five things you want in a job.
2. **Skills analysis: Where am I going?**
   - Evaluate your KSAs (knowledge, skills, and abilities).

- What are your qualifications and experience?
- What are your key strengths and skills?
- What are your biggest accomplishments to date?
- What are your areas for development?

3. **Set your direction: How am I going to get there?**
   - Think about what industries or roles you belong in.
     - » The broad industries that really appeal to you.
     - » The types of roles that suit you best.
     - » The skills your need to develop.
   - Assess impediments and potential remedies.
   - Stay current with technology.
   - Update your résumé.
4. **Achievement: How will I define success?**
   - Prioritize what you want to accomplish.
   - Set goals.
   - Get a mentor.
   - Make milestones for the next 6, 12, and 60 months.
   - Identify how to achieve your training and education plan.
   - Identify how to expand your network.
   - Celebrate successes.
5. **Keep learning and exploring: How can I stay curious?**
   - Leverage internet platforms.
   - Find and access resources.
   - Identify productivity tools.
   - Explore communication methods (e.g., abstracts and articles, report writing, public speaking).

Once you have a few years of experience in the field, acquire a credential. A credential shows that you are a subject matter expert and have acquired the knowledge and experience to perform your work (NEHA, 2023b). The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is the standard in environmental health (NEHA, 2023c), but there are other credentials that you can obtain. NEHA has several credentials related to food safety but there are many other credentials available from different organizations.

Volunteer your time with NEHA and/or your state affiliate. This endeavor will help you network with new and seasoned environmental health professionals. Attend conferences to learn from others. Take it a step further and present at conferences to share your knowledge and experience. Learning new skills, such as grant writing, new technology, and computer systems, can increase your value to employers. Expand your network beyond environmental health to include related fields (e.g., epidemiology, laboratory science, medicine, etc.). Understand the legal constructs at the federal, state, and local levels that you work under. Work with leaders in your community to understand its culture.

Know that NEHA—in its mission to build, sustain, and empower an effective environmental health workforce—and the American Academy of Sanitarians—in its complementary focus of improving the practice and advancing the professional proficiency of environmental health professionals—work to provide thought leadership and opportunities to forward your career. Together, we provide opportunities for strategic professional development; networking with peers, mentors, and leaders; and sharing ideas and experiences to further environmental health and you.

Acknowledgement: Thank you to Michéle Samarya-Timm and Eric Bradley for their contributions to this column.

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DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES

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

Here Come the Surf Venues and Artificial Swimming Lagoons

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

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

Michele Hlavsa leads healthy swimming activities at the National Center for Emerging and Zoonotic Infectious Diseases within CDC. CDR Joseph Laco serves as an environmental health officer at the National Center for Environmental Health within CDC.

In September 2018, the Centers for Disease Control and Prevention (CDC) and state and local public health partners in Texas investigated a fatal case of *Naegleria fowleri* infection likely associated with a surf venue (Miko et al., 2023). Investigators found that the surf venue water was not recirculated or filtered, and water quality testing and treatment were not documented. *N. fowleri* can infect people when water containing the amoeba enters the nose and then travels up the olfactory nerve and into the brain. Once in the brain, trophozoites (the infective life stage) destroy brain tissue, causing primary amoebic meningoencephalitis (PAM). While PAM rarely occurs, it is over 97% fatal.

N. fowleri can be found in untreated recreational water venues (e.g., lakes, rivers, hot springs), particularly in the sediment at the bottom. During 1962–2021, of the 154 known cases of PAM in the U.S., 85 (55%) were associated with such venues and 7 (5%) with aquatic venues (e.g., pools, splash pads, surf venues). Linking an aquatic venue, or a venue with treated (e.g., filtered and chlorinated) water, to a PAM case is a red flag for inadequate water treatment in that aquatic venue.

Surf venues are novel, large format aquatic venues dedicated to surfing on a surfboard—or other similar surfing and wave riding devices—and have equipment and a floor shaped to generate traveling and surfable waves that mimic those in oceans. The CDC Model Aquatic Health Code (MAHC) provides guidance to help prevent public aquatic venue-associated illness and injury through venue design, construction, operation, and management. Because the risk of illness and injury associated with surf venues is inherently different from that associated with other aquatic venues, a change request proposing inclusion of text specific to surf venues was submitted for the fourth edition of the 2023 MAHC. It was not, however, approved.

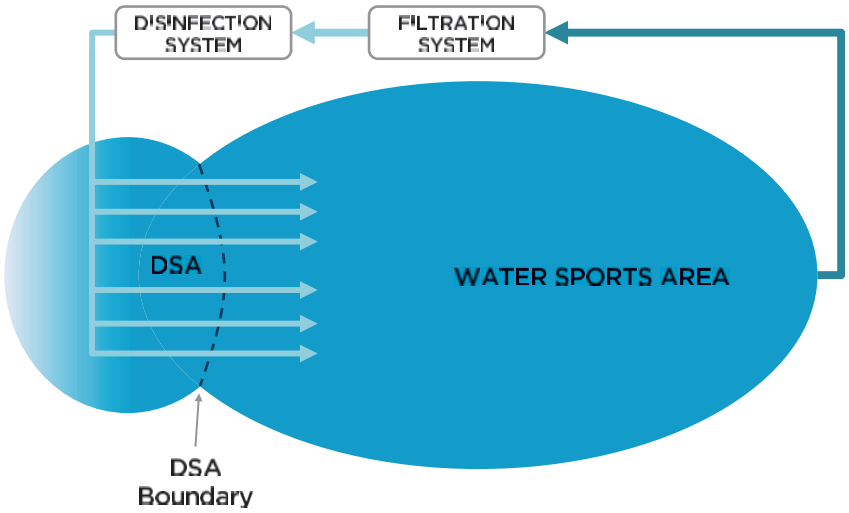
With multiple surf venues being planned before the release of the fifth edition of the MAHC, the Council for the Model Aquatic Health Code (CMAHC), a key CDC MAHC partner, reconvened its surf venue ad hoc committee in August 2022. The ad hoc committee is made up of public health officials and representatives from across the surf venue sector. Committee members have been categorizing each recommendation in the MAHC as "properly addresses surf venues," "is not applicable," or "needs revision to properly address surf venues." The committee is focusing on the recommendations in the "needs revision" category.

Based on these discussions, CDC has been drafting interim guidance and the committee will then develop and submit a change request that proposes inclusion of text specific to surf venues for the fifth edition of the MAHC. To prevent injuries, discussion topics have included revising: 1) MAHC recommendations for slip-resistant finish where waves break in less than 3 ft of water, 2) depth marker recommendations for where water depths change substantially, and 3) lighting recommendations given that light basin color and shallow water combined can cause glare.

Artificial swimming lagoons (ASLs) are being similarly addressed with support from the CMAHC artificial swimming lagoon ad hoc committee. ASLs are novel, large-format (up to hundreds of millions of gallons of

FIGURE **1**

Diagram of an Artificial Swimming Lagoon



Note. Artificial swimming lagoons combine swimming and nonswimming activities into one venue, which pose challenges for keeping water clean and healthy for swimmers. DSA = designated swimming area.

water) aquatic venues designed to mimic a natural lagoon. ASLs include one or more designated swimming areas (DSAs) for traditional aquatic venue activities (e.g., swimming, wading). The rest of the lagoon—the water sports area—is designated for nonswimming aquatic activities such as kayaking and sail boating (Figure 1). The completely artificial environments, including artificial bottoms, simultaneously have clear water giving the appearance of a pool and can be several acres like a pond or lake.

The challenges with developing guidance for ASLs stem from the fact that two types of recreational water venues (i.e., an aquatic venue and an untreated recreational water venue), each designated for different purposes, share water. Areas designated for swimming will need to be monitored and regulated as aquatic venues, in which water is filtered and disinfected. But most of the venue will be open water for nonswimming aquatic activities and not subject to the same water quality requirements. Open water will need microbiological water quality monitoring as conducted at untreated recreational water venues with freshwater. The ad hoc committee also focused on treated water renewal, or displacement (rather than turnover time in DSAs); restricted access to DSAs to prevent unauthorized entry; water clarity maintenance throughout the entire ASL; and lifeguarding.

CDC posted the fourth edition of the 2023 MAHC in February on its MAHC website at www.cdc.gov/mahc (Figure 2). CDC will also post interim guidance for surf venues and ASLs later this year on its Healthy Swimming website at www.cdc.gov/healthyswimming. CMAHC will accept change requests for the fifth edition of the MAHC from spring through fall 2023 and will hold the Vote on the Code Conference and the vote on change requests in early 2024.

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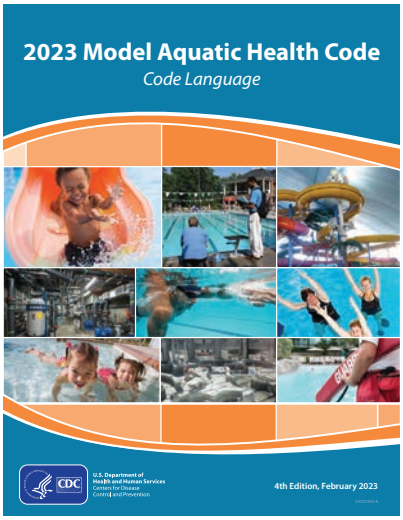
FIGURE **2**

Fourth Edition of the 2023 Model Aquatic Health Code



The latest edition of the Model Aquatic Health Code is now available. It includes updated guidance on preventing illness and injury associated with public aquatic venues, including preventing pathogen transmission, pool chemical injuries, spinal cord injuries, and drowning. You can explore the new edition at www.cdc.gov/mahc/editions/current.html.

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Did You Know?

According to the U.S. Census Bureau, there are more than 30 million swimmer visits each year in the U.S. We have a webpage of resources that can help you keep your communities safe, especially with the summer months approaching. Explore our recreational water resources at www.neha.org/recreational-waters.

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


Heather Drumm


Wyn Zenni

Stimulating Innovation Through the Challenges and Prizes Program From the U.S. Environmental Protection Agency

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.

Heather Drumm is the Innovation Team lead within ORD at U.S. EPA. Wyn Zenni is a National Student Services contractor on the Innovation Team within ORD at U.S. EPA.

Introduction

The power of open competition inspires innovative, transformative ideas that can help solve environmental issues and address community concerns. Challenge and prize competitions have rapidly gained support across federal agencies as a way to promote innovation and accelerate problem-solving, while delivering cost-effective, efficient solutions. By harnessing the ingenuity and creativity of the public, these incentive competitions can address pressing problems, stimulate innovative thinking, and encouraging community engagement in government activities. Challenge and prize competitions that are open to diverse audiences have a long history of use in both the public and private sectors. The information, solutions, or practices resulting from challenge and prize competitions have the potential to be leveraged by other organizations or communities facing similar environmental or public health issues.

Since 2012, the Challenges and Prizes Program of the U.S. Environmental Protection Agency (U.S. EPA, 2023a) has hosted over 40 competitions that have used cash prizes and other incentives to reward problem-solvers. Over that time, U.S. EPA has awarded over $1 million to prize winners and has collaborated with communities, federal agencies, and nonprofits to advance our core mission of protecting human health and the environment.

The following U.S. EPA challenges are just three examples of how challenge and prize competitions can provide a unique opportunity to tackle long-standing environmental and public health issues using the power of the crowd.

Wildland Fire Sensors Challenge

Wildland fires are a major source of air pollution that can irritate the eyes, nose, and throat; cause difficulty breathing; and worsen lung and heart disease. As the intensity and frequency of wildland fires continues to increase across the U.S., the need for improved air and smoke monitoring capabilities is critical, especially since most regulatory-grade smoke sensors are stationary and complicated to operate. In 2017, U.S. EPA partnered with five federal agencies to launch the Wildland Fire Sensors Challenge, which encouraged solvers to develop innovative, low-cost air sensors that were easy to deploy, usable for high concentration events, durable in difficult field conditions, and able to report data continuously and wirelessly to communities impacted by wildfire smoke (U.S. EPA, 2023b).

The winners of the challenge demonstrated incredible ingenuity using emerging technologies such as miniaturized direct-reading sensors, compact microprocessors, and wireless data communications to develop continuous, real-time smoke sensors that are accurate and portable. Overall, the Wildland Fire Sensors Challenge increased awareness of the importance of monitoring air quality during wildfires and served as a catalyst for advancing the next generation of sensor technology systems for wildland fire applications to protect public health. Even better, the winning sensors—Sensit and Thingy AQ (Figure 1)—are now commercially available and in use for wildland fire responses (Sensit Technologies, 2021; Thingy LLC, 2023).

Let's Talk About Heat Challenge

Extreme heat is an increasing problem for all parts of the U.S.. Increasing temperatures

FIGURE **1**

Second Place Winner of the Wildland Fire Sensors Challenge

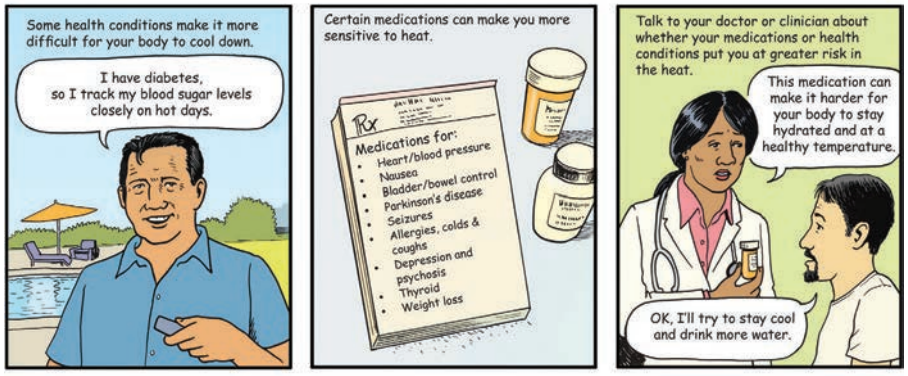
The Thingy AQ from Thingy LLC in Bellevue, Washington, measures $PM_{2.5}$, carbon monoxide, carbon dioxide, and total volatile organic compounds. It is part of the Wildfire Smoke Air Monitoring Response Technology (WSMART) equipment loan program for state, tribal, and local governments from the U.S. Environmental Protection Agency.

FIGURE **2**

Map of Submission and Winner Locations for the Let's Talk About Heat Challenge

FIGURE **3**

Example of the Comic Strip From One of the Winners of the Let's Talk About Heat Challenge



The comic strip was designed and published by Public Health–Seattle & King County in partnership with the Department of Environmental & Occupational Health Sciences at the University of Washington. The campaign was designed to reach people at high risk for heat illnesses and was offered in 13 different languages.

due to climate change are intensifying already higher temperatures in heat island areas where buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than natural landscapes. Communities need help developing clear messages about the risks of extreme heat, how to stay safe, and how to build cooler communities for the long-term.

To address this need, U.S. EPA and its cosponsors launched the Let's Talk About Heat Challenge to identify innovative and effective communication strategies that inform people of the risks of extreme heat and offer ways to keep people safe (U.S. EPA, 2022a). Target audiences for these messages included farm workers, children, construction workers, unsheltered neighbors, people living in neighborhoods with higher incidences of heat-related illnesses, and people with existing health disparities.

The challenge received 97 submissions from 31 different states, demonstrating a nationwide interest in the topic (Figure 2). Overall, 10 winners were publicly announced at a national webinar in August 2022 in the middle of heat season. The winners of the challenge all had memorable and effective strategies in place or in development that can now be shared with other communities across the country. For example, Public Health–Seattle & King County partnered with the Department of Environmental & Occupational Health Sciences at the University of Washington to design and publish "Stay Safe in the Heat" comic strips to reach people at high risk for heat illnesses in 13 different languages (Figure 3).

Now that the challenge is complete, U.S. EPA plans to work with some of the winners to collaboratively evaluate the effectiveness of different heat risk messages and outreach methods. This study could be used to develop a framework for evaluating heat risk messaging for other communities that are trying to manage the impacts of extreme heat.

Environmental Justice Video Challenge for Students

Many communities face greater environmental exposures and public health risks due to a history of inequitable environmental policies and lack of access to the decision-making process.

U.S. EPA defines environmental justice (EJ) as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (U.S. EPA, 2022b). U.S. EPA and cosponsors launched the two-phase EJ Video Challenge for Students to enhance the capacity of communities to address local environmental and public health inequities (U.S. EPA, 2023c).

In the first challenge phase, students created videos to identify and characterize an EJ issue(s) in a select community using data and publicly available tools. The winners of Phase 1 (Figure 4; U.S. EPA, 2022c) helped U.S. EPA and our partners have a better understanding of some of the EJ challenges facing vulnerable communities and how data and publicly available tools—including tools developed by U.S. EPA such as EnviroAtlas (www.epa.gov/enviroatlas), CompTox Chemicals Dashboard (www.epa.gov/chemical-research/comptox-chemicals-dashboard), EJScreen (www.epa.gov/ejscreen), and the National Stormwater Calculator (www.epa.gov/water-research/national-stormwater-calculator)—can be used to identify and characterize EJ issues. Students enhanced their knowledge and experience working with local organizations and helped communities identify EJ issues of importance.

Phase 2 of the challenge focuses on enhancing the capacity of communities to address the EJ issues identified in Phase 1. To achieve this goal, students are working collaboratively with community-based organizations to develop a proposed strategy for community capacity building that demonstrates effective community engagement to address the previously identified EJ issues. The winners of Phase 2 are expected to be announced in spring 2023, with the prize money going to the students and partnering community organizations.

Onward and Upward

As the federal prize competition landscape grows, U.S. EPA will continue to use competitions and open-source innovations to fill priority gaps and increase the scale in which environmental issues are addressed. Local environmental health practitioners may find opportunities through these competitions to partner with their communities and other organizations to address their most important environmental health challenges.

FIGURE **4**

Map of Phase 1 Applicant and Winner Locations of the Environmental Justice (EJ) Video Challenge for Students

We encourage potential solvers who want to help address nationwide problems to learn more and get involved. Inviting the public to participate in scientific and technical explorations allows agencies and organizations to reach a multitude of problem-solvers with diverse backgrounds, skills, and perspectives who can bring new solutions to the table and inspire people into action.

Acknowledgement: The authors acknowledge Bruce Rodan, Mary Ross, Kacee Deener, Denice Shaw, Maggie LaVay, James Gentry, Valerie Blank, Megan Christian, Sania Tong-Argao, Abby Hall, and Gail Robarge for their editorial review of this column.

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Walter S. Mangold Award

Walter S. Mangold dedicated his life to the practice of environmental health in an extraordinary and exemplary way. In doing so, he became a beacon of excellence and inspiration for all environmental health professionals who followed after him.

Do you have a colleague who fits the definition of doing extraordinary environmental health work? Consider taking the time to nominate them for the Walter S. Mangold Award, our most prestigious award.

Nomination Deadline: May 15, 2023

neha.org/mangold-award

neha National Environmental Health Association

extraordinary *adjective*

ex·traor·di·nary | ikˈstrôrd(ə)nˌerē

1. Going beyond what is usual, regular, or customary
2. Exceptional to a marked extent

Walter F. Snyder Award

Honoring a history of advancing environmental health.

Walter F. Snyder was a pioneer in our field and was the cofounder and first executive director of NSF. He embodied outstanding accomplishments, notable contributions, demonstrated capacity, and leadership within environmental health. Do you know someone like that?

Nominate them for the Walter F. Snyder Award for outstanding contributions to the advancement of environmental health. This award is cosponsored by NSF and NEHA.

Nomination Deadline: May 1, 2023

neha.org/awards
nsf.org/about-nsf/annual-awards

neha National Environmental Health Association

NSF

ENVIRONMENTAL HEALTH ACROSS THE GLOBE

Artificial Intelligence and Environmental Health Teaching: Impacts for the Wider Profession

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Editor's Note: **We are familiar with the phrase, "Environmental health is extremely local." While environmental health affects most of us on the local level, we also understand that environmental health is universal and does not know borders. The location, geography, people, and conditions can differ but the science and principles of environmental health do not. In this new column, the National Environmental Health Association (NEHA) will present environmental health issues and topics from a global perspective. Understanding environmental health on a global scale can help us recognize how that influences our local spheres and provides learning opportunities to broaden our perspectives.**

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

The Environmental Health Community of Practice is a group of professionals from around the world with expertise in the teaching and practice of environmental health. The community was established in the early days of the COVID-19 pandemic and its goal was to share ideas to respond to the challenges posed by the pandemic and to offer each other support. The community continues to meet and focuses on writing manuscripts for publication and sharing teaching ideas and practice insights.

ChatGPT, a new, easily accessible, and user-friendly artificial intelligence (AI) platform (https://chat.openai.com/chat), as well as other emerging AI platforms, allow for the creation of well-crafted essays complete with citations, and quickly and mostly correct answers to multiple-choice questions. These types of platforms pose significant concerns for academic programs, including environmental health, as much of our students' learning is guided by written assignments. Academic integrity is an educational and professional attribute and breaches of ethical conduct risk the reputations of organizations and by association, those who work in them.

To address this threat, the Environmental Health Community of Practice (CoP)—a group of academic professionals in environmental health from across the globe—has developed potential approaches to address AI within the academic and professional realms of environmental health. These approaches include positive engagement such as appealing to student morality, their desire to learn, and their developing sense of professionalism. Threats of punishments and incorporating AI-resistant assessment approaches are also considered.

We believe most environmental health students (and indeed most university students) are overwhelmingly honest, and the assignments they submit are a result of their own work and endeavor. The world of academia has become, however, increasingly concerned with the development and sophistication of AI systems that are able to produce work on demand. The new AI systems facilitate easy access to information and its ease of use is likely to result in widespread adoption. It is this ubiquity of use that has prompted our CoP to consider AI from a professional and academic perspective.

Ever since universities came into being, there have been students who have cheated or presented others' work as their own (known as plagiarism). Such activities have adapted to changes in technology. Text matching software was developed to identify students' work that was copied directly from the internet or other sources; however, we reached a stage this year where AI is readily able to write coherent and appropriate answers to assignments. AI detection software is only partly successful in its detection capacity. We have entered an arms race with plagiarism and detection software seeking to catch up with the latest developments and being unable to currently overtake them.

It might seem odd to bring a discussion around plagiarism to the field of environmen-

tal health practice, but there is the potential for significant impacts on the profession as a result of AI. The roles of environmental health practitioners are many and varied, with giving advice, technical support, and education all key aspects of these roles. Yet at its heart, environmental health remains an enforcement profession and environmental health practitioners must act with integrity and be seen as honest brokers and trustworthy by businesses, the public, and their colleagues. Anything that would seek to undermine this integrity and trust is worthy of the profession's attention.

Universities are at the forefront of creating the next generation of environmental health practitioners. Having students who engage in cheating will have repercussions for the profession. There is a danger that through plagiarizing, students will fail to understand the taught material, which will have implications for their ability to practice in the future. In addition, universities provide more than the accumulation of knowledge, they are the first step on the road to developing professionalism in students. Plagiarism could foster a set of behaviors and beliefs that are not in line with professional expectations, such as established codes of ethics.

Therefore, there is a challenge for both universities and the profession to deal with this issue. For universities, the answer lies in not simply investing in more effective detection software or returning to face-to-face exams. Below we outline a few approaches.

First is an appeal to the students themselves not to engage with AI systems, both in their own learning and their own developing professional identity. In terms of learning, it should be made clear to students that environmental health programs are cohesive in nature. While there are individual components of environmental health that students study, these components build together and support the creation of environmental health professionals. To weaken any of these blocks by engaging in plagiarism is to weaken the whole structure.

In terms of their professional development, as previously noted, universities are where students take their first steps on the pathway to becoming professionals. An appeal to a student's sense of fairness, honesty, and integrity should be made. This approach could be more formalized, with perhaps the profession adopting a "fitness to practice" element that students sign up to. Such an approach has been taken, for example, with nursing in the UK. This fitness to practice element would set out the standards and expectations that a student would need to ensure they met and maintained, with consequences if they do not. For our readers who hold a credential such as the Registered Environmental Health Specialist/Registered Sanitarian, you are familiar with the code of ethics that articulates that credential holders do nothing to undermine, detract from, or otherwise cause to develop any damaging associations with respect to their professional status.

Second, we might consider the manner in which students are assessed. The issue of plagiarism relates almost exclusively to coursework assignments. One approach might be to limit the amount of coursework and substitute written assessment with in-person or oral examinations. There is significant opposition, however, to increasing the exam load. Universities have favored moving away from the traditional exam. This process was accelerated by the COVID-19 pandemic, when social distancing meant such exams were not possible and the return of exams has been patchy or nonexistent.

The practical components of environmental health do mean that more practical and individual assignments can be used to assess student learning. Indeed, students seem to favor practical assignments as they can see a clear link between the assignment requirements and professional practice. Such assignments will, however, result in an increase in demand on staff time and resources to undertake them effectively and fairly. For example, having a student undertake a viva—where they talk through their assignment with their lecturer to show they have understood what they have written—is an option currently used in several universities but requires significant staffing resources. With this in mind, there might be a role for the wider profession and employers to help support and develop practice-based assignments. A wholly practical approach to assignments will not, however, solve all issues, as this type of assignment cannot examine the more theoretical elements of environmental health teaching.

The current AI systems work well with assignments that are low on Bloom's taxonomy where students have been asked to remember facts and content. AI systems currently do less well on the higher order functions such as analysis and critical evaluation. Undoubtedly, AI will become more sophisticated and will perform better in these higher-level functions.

A third approach is the manner in which cases of plagiarism or cheating are adjudicated. Across all universities, mechanisms exist to discipline students who have been found guilty of breaches of academic integrity. The penalties students can incur operate on a sliding scale that takes into account the severity and frequency of the offense, and ranges from students being required to resubmit the suspect work to the possiblility of expulsion. As AI systems become more sophisticated and therefore their use becomes harder to detect, we need to ensure the penalties associated with cheating remain relevant as a deterrent.

The authors recognize students tend to plagiarize when they are desperate, especially when they are short on time. Since these AI systems are efficient in producing assignments, they will be appealing to students if they have left the assignment to the last minute. This situation means that universities should carefully consider the structure, nature, and timing of assignments to remove some of this pressure and the subsequent temptation to cheat.

On a positive note, there are many ways that AI can be embraced to support and enhance our teaching and to prepare students to enter the world of work. AI will increasingly become a feature of workplace activities. In addition, the advantages of utilizing AI in universities are numerous, ranging from being an assistive technology in teaching to supporting individuals with disabilities. In fact, AI might be an appropriate teaching vehicle to raise the issues of ethics, morals, and professionalism. For example, the Council on Education for Public Health in the U.S. identifies leadership as one the eight foundational competencies for master of public health-level education. Professional ethics, including the appropriate use of AI, could be addressed in the curriculum. AI can help professionals with environmental health literacy—with communication to the public, business owners, elected officials, and others. The tools within AI could better convey what needs done and why and how to encourage change. Additionally, its use in grant writing might be significant. AI could be advantageous in many areas of environmental health, especially for those working in public health and health promotion, in creating

accessible, simple messages and well-written communication tools.

In conclusion, the environmental health practice is based on the ability of its practitioners to solve problems. In view of this basis, skills related to seeking out information and drawing appropriate conclusions from the information available are of paramount importance. Therefore, assignments at universities should be used to help develop these cross-cutting, problem-solving core skills. In this new world, we need to rethink the methods to achieve this endeavor, acknowledging both the advantages and perils of AI. Certainly, AI can be an effective tool to help practitioners systematize existing knowledge, thus saving time, but it cannot replace many of the skills required for the practice of environmental health. Nor can it instill a sense of professionalism within students, which is an essential characteristic of environmental health and how we are judged by the outside world.

It remains to be seen how AI affects university teaching. By taking the lead and determining which components of AI we embrace—and those components that counter in our teaching—we can ensure our environmental health students continue to acquire the skills and knowledge they required to be valuable and professional environmental health graduates.

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PROGRAMS ACCREDITED BY THE NATIONAL ENVIRONMENTAL HEALTH SCIENCE AND PROTECTION ACCREDITATION COUNCIL

The following colleges and universities offer accredited environmental health programs for undergraduate and graduate degrees (where indicated). For more information, please contact the schools directly or visit the National Environmental Health Science and Protection Accreditation Council website at www.nehspac.org.

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†*University also has an accredited graduate program.*
††*Accredited graduate program only.*
Note. G = graduate; UG = undergraduate.

ENVIRONMENTAL HEALTH **CALENDAR**

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCE

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

NEHA AFFILIATE AND REGIONAL LISTINGS

California
June 19–22, 2023: Annual Educational Symposium (AES), hosted by the Superior Chapter of the California Environmental Health Association, Sacramento, CA, https://www.ceha.org

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

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

Georgia
September 20–22, 2023: Annual Educational Conference, Georgia Environmental Health Association, Jekyll Island, GA, https://geha-online.wildapricot.org

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

Indiana
September 25–27, 2023: Fall Educational Conference, Indiana Environmental Health Association, Muncie, IN, https://www.iehaind.org

Minnesota
May 11–12, 2023: Spring Conference, Minnesota Environmental Health Association, Grand Rapids, MN, https://mehaonline.org

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

North Dakota
October 17–19, 2023: Fall Education Conference, North Dakota Environmental Health Association, West Fargo, ND, https://ndeha.org

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

Utah
May 10–12, 2023: Spring Conference, Utah Environmental Health Association, Richfield, UT, https://sites.google.com/ueha.org/ueha/home

Washington
May 8–10, 2023: Annual Educational Conference, Washington State Environmental Health Association, Tacoma, WA, https://www.wseha.org

West Virginia
May 16–18, 2023: Sanitarian Mid-Year Conference, West Virginia Association of Sanitarians, Wheeling, WV, https://wvaos.org/trainings

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

TOPICAL LISTINGS

Food Safety

May 8–11, 2023: Food Safety Summit, produced by *Food Safety Magazine*, Rosemont, IL, https://www.food-safety.com/food-safety-summit

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

Preparedness
May 21–27, 2023: Environmental Health Training in Emergency Response Operations, Center for Domestic Preparedness, Federal Emergency Management Agency, Anniston, AL, https://cdp.dhs.gov/training/course/PER-309

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

Did You Know?

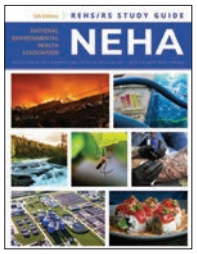
Join us on May 11 at 1 p.m. ET for a webinar to learn about the leading practices for integrating climate justice into state, tribal, local, and territorial environmental public health programs. Speakers will provide federal and local perspectives. Register now at https://neha.zoom.us/webinar/register/WN_nNswEdGYSqiLQfysI8B3cA.

RESOURCE CORNER

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

REHS/RS Study Guide (5th Edition)

National Environmental Health Association (2021)

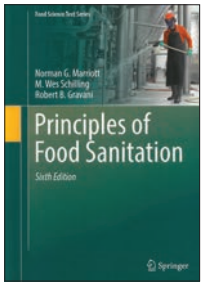


The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is the premier credential of the National Environmental Health Association (NEHA). This edition reflects the most recent changes and advancements in environmental health technologies and theories. Incorporating 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: $165/Nonmember: $199

Principles of Food Sanitation (6th Edition)

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

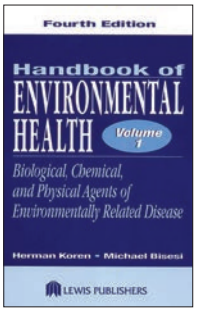


Now in its 6th edition, this highly acclaimed book provides sanitation information needed to ensure hygienic practices and safe food for food industry professionals and students. It addresses the principles related to contamination, cleaning compounds, sanitizers, and cleaning equipment. It also presents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

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

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

Herman Koren and Michael Bisesi (2003)

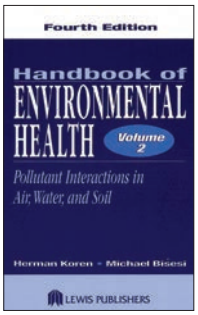


A must for the reference library of anyone in the environmental health profession, this book focuses on factors that are generally associated with the internal environment. It was written by experts in the field and copublished with NEHA. A variety of environmental issues are covered such as food safety,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

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

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

Herman Koren and Michael Bisesi (2003)



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

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

JEH QUIZ

FEATURED ARTICLE QUIZ #6

Lead Source Attribution by Stable Isotope Analysis in Child Risk Assessment Investigations

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

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

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

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

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

➔ Quiz effective date: May 1, 2023 | Quiz deadline: August 1, 2023

1. The primary intervention for a child with a case of lead poisoning is to remove the sources of lead from the child's environment.
   a. True.
   b. False.

2. Lead isotope analysis (LIA) is based on the __ stable, naturally occurring isotopes of lead that all have relative abundances in the Earth's crust.
   a. two
   b. three
   c. four
   d. five

3. To be eligible for the case series in this study, a child with a case of lead poisoning must have met the following criteria:
   a. peak venous blood lead level (BLL) ≥10 µg/dl.
   b. age ≤6 years.
   c. resided in southern Wisconsin.
   d. all of the above.
   e. none of the above.

4. Lead in surface coatings was identified in this study using an X-ray fluorescence instrument and a lead dust hazard for floors was defined as
   a. ≥0.7 mg/cm^2.
   b. ≥40 µg/ft^2.
   c. 200 µg/ft^2.
   d. 1,200 ppm.

5. Case 1 involved a female at 24 months with a BLL of
   a. 10 µg/dl.
   b. 12 µg/dl.
   c. 14 µg/dl.
   d. 16 µg/dl.

6. For case 1, 1.5 years after the initial BLL and after the family's home was remediated, the child's venous BLL decreased to
   a. 4 µg/dl.
   b. 5 µg/dl.
   c. 6 µg/dl.
   d. 7 µg/dl.

7. In case 2, lead isotope ratios in blood were similar to the street lateral water pipe but dissimilar to
   a. tap water.
   b. the floor lateral pipe.
   c. all of the above.
   d. none of the above.

8. In case 3, the highest lead concentrations were
   a. the interior windowsills.
   b. the porch entry floor.
   c. the backyard play area.
   d. all of the above.
   e. none of the above.

9. In case 4, the risk assessment found lead hazards in the walls, floors, and points of entry of the home.
   a. True.
   b. False.

10. In case 6, the child's BLL at 22 months after the initial BLL decreased to
    a. 5 µg/dl.
    b. 6 µg/dl.
    c. 7 µg/dl.
    d. 8 µg/dl.

11. In this study, cases 4–6 demonstrated that LIA was able to identify the most common household exposure: legacy lead-based paint exposure via hand-to-mouth behavior.
    a. True.
    b. False.

12. Water was __ as the dominant or likely source of lead in the cases investigated in this study.
    a. not observed
    b. weakly observed
    c. strongly observed

JEH Quiz #4 Answers

January/February 2023

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

Did You Know?

The Davis Calvin Wagner Sanitarian Award represents the highest honor the American Academy of Sanitarians bestows on its diplomates. The award is conferred for exceptional leadership ability, professional commitment, outstanding resourcefulness, dedication, and accomplishments in advancing environmental public health. The deadline to submit award nominations has been extended to May 15, 2023. Learn more at https://sanitarians.org/Awards.

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.

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86th Annual Educational Conference & Exhibition

AEC 2023

neha National Environmental Health Association presents

July 31 – August 3 | New Orleans, LA

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Raising the Voice of the Environmental Health Workforce

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Jonas Salk Chair in Population Health
Communities and Climate Through the Lens of Environmental Health Practice

Lt. General Russel L. Honoré, U.S. Army (Ret.)
Commander of Joint Task Force Katrina
Leadership, Safety, and Global Preparedness Authority
Leader of U.S. Capitol Complex Security Review
Leadership: Getting the Difficult Job Done

Frank Yiannas
Food Safety Executive
Former Deputy Commissioner, Food Policy & Response,
Food and Drug Administration

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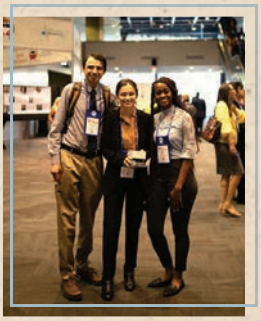
No matter where you work or what you are interested in, we have something for everyone!



2023 Educational Tracks

- Climate & Health
- Data & Technology
- Emergency Preparedness & Response
- Focused Populations
- Food Safety
- General Environmental Health
- Healthy Communities
- Infectious & Vectorborne Diseases
- Water Quality
- Workforce & Leadership

Immerse yourself in the culture of historical **New Orleans!**

Don't miss our networking event on August 2 that will feature local cuisine, local music, and local entertainment. Reconnect with old friends and meet new contacts at this attendee-favorite event!

Learn more at
neha.org/aec

NEHA **NEWS**

NEHA Government Affairs Updates

Doug Farquhar, JD (dfarquhar@neha.org)

Hill Day

The National Environmental Health Association (NEHA) held our sixth annual Hill Day on Thursday, February 23. The NEHA Board of Directors and several of our members met with 53 members of the U.S. Congress from the House of Representative and Senate, as well as both parties who serve on appropriations committees. These individuals are the decision makers who determine how much funding each federal agency receives.

Overall, 14 members of our board participated along with a new member from New Jersey, members from Texas and California, and two members from Colorado. Other board members from Alabama, Kentucky, Maryland, Massachusetts, Minnesota, Ohio, and Oregon also participated. Further, our members from the state affiliates in Connecticut and Florida participated to discuss environmental health with congressional offices from their states.

We met with 53 congressional offices, mainly congressional appropriators from the House and Senate (31 Democratic offices and 18 Republican offices). Of the visits, five were from offices in Colorado, five were from Maryland, four were from Alabama, four were from California, and three each were from Connecticut, Florida, Georgia, Massachusetts, Minnesota, Oregon, Texas and Wyoming. We had two visits to offices from Kentucky, New Jersey, and Utah. One visit was to the office of Senator Patty Murray (D-WA).

Our meetings focused on appropriations to the Food and Drug Administration (FDA) and National Center for Environmental Health within the Centers for Disease Control and Prevention (CDC), highlighting the importance of federal funding for food safety and other environmental health objectives to the state and local environmental health profession. Our work is vital as we are the only association that advocates solely for environmental health and the environmental health profession before Congress.

During our meetings, we asked Congress to consider the following:

- Fund the CDC National Center for Environmental Health at $300 million and the Agency for Toxic Substances and Disease Registry at $95 million.
- Fund the FDA Federal and State Initiative that supports food safety inspections at $140 million and $35 million for states to purchase equipment to serve healthier meals and improve food safety.
- Encourage the Health Resources and Services Administration (HRSA) to include environmental health within the Public Health Workforce Loan Repayment Program.
- Share with congressional offices the importance of environmental health to state and local public health agencies.

Senator John Barrasso (R-WY) wanted to meet with NEHA Immediate Past-President Roy Kroeger, and was scheduled to join the call. Kroeger noted that Senator Barrasso was an advocate for food safety when he served in the Wyoming state legislature. Other members were highly interested in our activities, especially on red tide in Florida, onsite wastewater in Alabama, and the recent train derailment in Ohio.

In the context of national politics, these visits are essential to any association promoting their profession. Congress pays attention to those groups that actively promote their profession and supports funding for federal agencies and activities that provide for their profession. Congress needs to hear and know that these efforts have an impact on their constituents and communities. While Hill Day is just one day, we are committed to continuing our efforts to advocate for the environmental health profession. You can view all our government activities at www.neha.org/advocacy.

Support Letters

We submitted a support letter to the U.S. Department of Health and Human Services and HRSA in February 2022. The letter requested HRSA to ensure that the environmental health workforce is included in the Public Health Workforce Loan Repayment Program. This program was authorized by the Consolidated Appropriations Act of 2023 as part of the PREVENT Pandemics Act and is essential in ensuring the public health workforce needed for the future. We also requested that the President's Budget for Fiscal Year 2024 should include at least $100 million for the Public Health Workforce Loan Repayment Program.

We also submitted a letter to FDA in January 2023. The letter presented how we can assist FDA with recommendations outlined in the Reagan-Udall Foundation report to improve our nation's food safety system. We focused on three key recommendations outlined in the report: 1) the U.S. food safety system structure, 2) personnel and workforce, and 3) advocacy for financial support.

You can view all our letters and sign-ons at www.neha.org/letters.

NEHA Releases 2022 Annual Report

In March 2022, we released our 2022 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 Dr. D. Gary Brown, the report provides a visual picture of our achievements under the following headings:

- **Inspiring & Providing Professional Development:** One of the key ways we work to build and sustain the workforce is through education. Learn about our up-to-date training and educational offerings that help environmental health professionals protect their communities and improve health outcomes.

- **Uncovering Research & Creating Resources:** While environmental health has been practiced for centuries, changes to our society and physical environment require our profession to stay up-to-the-minute on the evolving practice. We highlight our publications, discussions, and announcements that aid our members in meeting this challenge.
- **Supporting the Profession Across the Globe & Life Span:** Two keys vital to the success of our profession are adequate support for our work and trust in our abilities and knowledge. In this section we explore our investments and programs that support professionals who work on the front lines of environmental public health.
- **Elevating the Organization, Profession, & Workforce:** Environmental health is often invisible—to the public, lawmakers, and even funders. Learn in this section how we work to raise the visibility of NEHA and elevate the workforce through communication, marketing, and government affairs.
- **Connecting & Partnering for Better Outcomes:** Our work can be tough and our resources light. We highlight the brain trust of environmental health professionals we brought together to address systemic, ongoing, and emerging issues to provide a place for support and the sharing of best practices.
- **Minding the Dollars & Data:** None of our work is possible without funding to staff the organization, invest in communities, or generate data to demonstrate our effectiveness. We explore our focus on meaningful financial tracking and data and IT integration to enhance our ability to make informed decisions and provide relevant data to the workforce.

The 2022 Annual Report can be viewed at www.neha.org/annual-reports. The webpage also includes annual reports from 2016–2021.

Anniversary Celebration for the Private Water Network

We celebrated the 3-year anniversary of the Private Water Network (PWN) in March. PWN is a virtual community of practice for individuals working to protect the public's health from contaminants in private drinking water sources. PWN aims to be a one-stop-shop resource for peer learning and information exchange for professionals who serve communities with private drinking water systems.

The mission of PWN is to build a sustainable community for professionals who work to support private water programs and to build capacity to protect public health more effectively and efficiently. PWN also provides a way to connect with peers; to share experiences, insights, and resources; and to gain access to timely and relevant guidance for existing and emerging issues.

To celebrate the anniversary and National Groundwater Awareness Week (held on March 5–11, 2023), we hosted a series of events focused on the challenges and opportunities related to standardizing private well data:

- **Twitter Chat:** Managing private wells for public health protection requires data not only from well water sampling but also on well characteristics such as type of well, depth of well, and the people using the wells. Continued efforts to increase the number and frequency of well testing are needed, but new data collection activities for wells and their users are also necessary. We initiated a conversation on Twitter on March 6 about the challenges, opportunities, and priorities regarding private well data and what we can do to respond to emerging and existing issues. You can view the chat on @privatewaternet or via #PWNChat.
- **Flash Webinar—New Hampshire's Well Water Dashboard and Ongoing User Testing and Community Outreach:** This webinar held on March 7 featured Samuel Harris from the New Hampshire Department of Health and Human Services who shared insights on New Hampshire's Well Water Dashboard and ongoing user testing and community outreach.
- **Panel Session—Developing Approaches to Estimate the Number of Private Wells Within a Jurisdiction:** In this panel session held on March 8, Judy Manners and Rose Galbraith provided an overview of a pilot study focused on estimating the number of private wells and private well users within a jurisdiction, determining private well testing distribution in the region, and assessing the risk of contaminant exposures and water quality issues affecting private well users.

Thank you for joining us to celebrate the anniversary of PWN. You can learn more about PWN, including other resources and how to join, at www.neha.org/private-water-network.

New! Self-Assessment and Verification Audit Course Series

We invite you to participate in the new self-guided, online Self-Assessment and Verification Audit (SA/VA) Course Series. This series is now available to help your jurisdiction navigate the Voluntary National Retail Food Regulatory Program Standards (Retail Program Standards) from FDA. In addition, the series is available to you at any time.

The series consists of 10 self-guided courses that provide relevant information and instruction for retail program enrollment or advancement in conformance with the Retail Program Standards. The self-paced series:

- Walks you through the SA/VA process.
- Allows you to choose which Retail Program Standard(s) to focus on.
- Allows you to return to the content any time.
- Can be completed on your timeline and at your own pace.
- Includes content identical to the face-to-face SA/VA course.
- Includes examples from sample jurisdictions.

Learn more at www.neha.org/retail-grants-sava.

NEHA Staff Profile

As part of tradition, we feature new staff members in the *Journal* around the time of their 1-year anniversary. These profiles give you an opportunity to get to know our staff better and to learn more

NEHA **NEWS**

about the great programs and activities going on in your association. This month we are pleased to introduce you to one NEHA staff member. Contact information for all NEHA staff can be found on pages 46 and 47.

Alfonso Valadez

I joined NEHA in April 2022 as a membership services representative. I have an extensive background in customer service and hold an associate degree in computer programming. I am also an ordained deacon for the Catholic Church in the Archdiocese of Denver. Prior to NEHA, I was employed by the Colorado Bar Association and worked with state and local attorneys regarding their membership needs.

My duties at NEHA are to assist our membership and credentialing team with the following tasks:

- Ensuring members are getting the right benefits (e.g., access to E-Learning, the *Journal of Environmental Health*, membership discounts, etc.).
- Troubleshooting and independently resolving member issues.
- Overseeing our membership renewal process.
- Assisting with membership engagement and marketing efforts such as blog posts and marketing campaigns.
- Assisting with fundraising efforts.
- Creating and sending invoices and receipts and processing payments for our members and customers.
- Running membership reports.

Journey to Cuba

Image © Adobe Stock: SeanPavonePhoto.

We have an exciting opportunity for environmental health professionals to join our private delegation to Havana, Cuba, on November 2–6, 2023. We will explore Cuba's rich and varied cultural heritage and go beyond tourist corridors by engaging with local environmental health professionals, officials, engineers, entrepreneurs, musicians, and artists who will offer in-depth commentary on health policies, economics, environmental justice, art, history, architecture, and culture. The trip is being organized by CLE Abroad, a provider of customized educational travel programs around the world. The trip is open to all individuals over 18 years.

Registration costs range between $2,900 and $4,225 depending on selected accommodations. For each registration, $150 will be contributed to our scholarship fund. Registration fees include:

- Accommodations, as selected
- Ground transportation, including airport transfers
- Full-time program escort and local tour guides
- Daily breakfast and select meals with beverages
- Admission to all activities
- Educational programming with up to 7 continuing education contact hours available

Register before the early-bird deadline on June 1 to save $350. Please note that airfare, a Cuban Tourist Card, additional meals or beverages, gratuities, COVID-19 testing, and trip insurance are not included in registration fees.

Learn more at www.neha.org/cuba.

Highlights of the NEHA 2023 AEC

The NEHA 2023 Annual Educational Conference (AEC) & Exhibition—to be held on July 31–August 3 in New Orleans, Louisiana—aims to "Raise the Voice of the Environmental Health Workforce." Over the 4 days of the conference, along with 3 days of preconference offerings, the 2023 AEC is packed full of knowledgeable speakers, informative sessions and trainings, networking opportunities, and fun events. Learn more at www.neha.org/aec.

Featured Sessions

With over 350 speakers and 250 concurrent educational sessions planned for 10 different environmental health tracks, the 2023 AEC is packed with educational opportunities for anyone working in the field of environmental health. We also have planned five different featured sessions that will explore a variety of timely and pressing environmental health topics. Learn more at www.neha.org/aec-featured-sessions.

- **Keynote Address (July 31):** We are pleased to have Dr. Maureen Lichtveld, professor and dean of the School of Public Health at the University of Pittsburgh, open our conference with an address on "Communities and Climate Through the Lens of Environmental Health Practice." Communities, especially those facing intransigent inequities, rely on environmental health practitioners to counter these insults and strengthen community resilience. Dr. Lichtveld will examine the triple threats many communities face—pollution, disasters, and climate change—and will discuss local and global examples; discuss gaps in environmental health practice, policy, and science; and propose a road map for action.
- **Grand Educational Session Kickoff (August 1):** We have brought together a panel of regional experts to present a symposiumn on rodent control. The symposium will explore how to use effective communication, control practices, and resources to elevate your rodent control program. Panelists include Dr. Claudia Riegel, director of the City of New Orleans Mosquito, Termite, and Rodent Control Board; Dr. Imelda K.

Moise, associate professor and director of Global Health Studies at the University of Miami; and Janet A. Hurley, senior extension program specialist in integrated pest management (IPM) at Texas A&M.

- **Keynote Address (August 1):** In this Keynote Address, Lt. General Russel L. Honoré, U.S. Army (retired) and an authority on leadership, safety, and global preparedness, will speak to our attendees on "Leadership: Getting the Difficult Job Done." In a time when leadership is more important than ever, Lt. General Honoré will present the topic with a no-nonsence, devisive approach to leadership, vision, and resiliency.
- **Grand Educational Session Kickoff (August 2):** Presented by the NEHA Business & Industy affiliate, this session will explore "The Conundrum of Food Safety Culture: Breaking Through Barriers to Drive Improvement." Given the competing priorities in business, how do our food industry leaders maintain a balance and account for food safety when making decisions? In this panel discussion, executive leadership from top retail and food service industries will share how their organizations achieve and maintain a culture of food safety despite rising inflation, workforce shortages, extreme weather, pandemic recovery, and food defense.
- **Closing Session (August 3):** We are pleased to announce that Frank Yiannis will be speaking at our Closing Session. Yiannis is a food safety executive and former deputy commissioner for Food Policy and Response at FDA.

Events

No AEC would be complete without some events to bring us together for networking and learning opportunities. You can learn more at www.neha.org/aec-events.

- **Exhibition Grand Opening (July 31):** Connect with your peers and industry leaders to learn about the latest products and services for environmental health professionals.
- **Student Reception (August 1):** The future of our profession depends on the next generation. Come share your insights (and business cards) with environmental health students at this casual event. Students, come with your questions!
- **Photo Exhibition and Contest (August 1):** Enjoy an evening with Gina Bare, photographer and NEHA staff member, who will share her photography and showcase the photos of contest winners. We will also discuss the impact photography can have when communicating about environmental health.
- **Town Hall Assembly (August 2):** Join NEHA President Dr. D. Gary Brown for breakfast and a recap of the year's accomplishments on behalf of the environmental health profession.
- **Raising Your Voice Networking Event (August 2):** Join your fellow environmental health professionals for food, beverages, music, and conversation.

Preconference Offerings

Add to your 2023 AEC experience by attending one of our many preconference workshops and trainings. A full listing of these offerings can be found at www.neha.org/aec-preconference. Here are just a few of the exciting workshops and trainings we are offering this year.

- **Certified Professional–Food Safety (CP-FS) Credential Review Course (July 29–30):** This 2-day refresher course is designed to enhance your preparation for the NEHA CP-FS credential exam and will cover exam content areas. Participants are expected to have prior food safety knowledge and training equal to the eligibility requirements to sit for the exam. *Fee: $449 for NEHA members and $549 for nonmembers. Registration includes the CP-FS Study Package (*CP-FS Study Guide *(4th edition) and CP-FS flash cards).*
- **Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) Credential Review Course (July 29–31):** This 2.5-day refresher course is designed to enhance your preparation for the NEHA REHS/RS credential exam and will cover exam content areas. Participants are expected to have a solid foundation of environmental health knowledge and training equal to the eligibility requirements to sit for the exam. *Fee: $549 for NEHA members and $649 for nonmembers. Registration includes the* REHS/RS Study Guide *(5th edition).*
- **Body Art Facility Inspector Training (July 30 and July 31):** This introductory-level course focuses on the fundamentals of body art facility inspection. It includes a body art facility inspection simulation, in-person equipment demonstrations, job aids, resources, and more. The training will also cover public health risks, communication, infection control, inspection procedures and requirements, and equipment review. *Fee: $150 for NEHA members and $200 for nonmembers.*
- **Council for the Model Aquatic Health Code: Certified Pool Operator (CPO) Fusion Course (July 30):** This 1-day CPO Fusion Course prepares attendees to be certified or recertified as a CPO. Attendees will complete one half of the course online at their own pace and then will attend the 1-day course at the AEC for certification. *Fee: $350.*
- **Council for the Model Aquatic Health Code: Certified Public Health Pool Inspector Course (July 31):** This new, 1-day certification course is designed just for public health officials. Based on the Model Aquatic Health Code from the Centers for Disease Control and Prevention, the course provides the information needed to confidently inspect commercial pools. This course is a pilot offering and attendees will be able to provide input to guide finalization of the course. *Fee: $200.*
- **Environmental Health and Land Reuse (EHLR) Immersion Training (July 29–31):** This interactive 2.5-day training aims to increase the skills of the environmental health workforce to engage in land reuse and redevelopment. The training takes a deeper dive into the first three modules of our original EHLR Basic Training, which focuses on community engagement, evaluation, and risk communication. Participants will earn 20 CE contact hours after completion of the training. *Fee: $25 for NEHA members and $50 for nonmembers.*

NEHA MEMBER SPOTLIGHT

Chantal McBride, CPHI(C)
Saskatchewan Health Authority, Canada

The National Environmental Health Association (NEHA) is shining a spotlight on the people within our membership through this new feature in the *Journal*. This month we are pleased to introduce you to Chantal McBride, a public health inspector with the Saskatchewan Health Authority for 4 years. She works in a rural area and is a generalist who works on various environmental and public health issues including food safety, water quality, personal services, wastewater disposal, plumbing, tobacco, communicable disease, adult care facilities and childcare, outbreak management, and subdivision reviews. McBride attended the Concordia University of Edmonton and has been in the environmental health profession for 6 years.

Why did you join NEHA and what aspects of membership have you found most valuable to your career?
I am interested in forming connections with other environmental health officers and public health inspectors in the field. I would love to obtain a job somewhere in the US. I like to stay up-to-date on which states or health authorities are hiring and who would recognize my Canadian credentials and experience. Also, I find sharing knowledge and experiences with NEHA members and other environmental health officers very valuable.

Why did you choose the environmental health field?
I love how diverse my job is. I am never doing the same thing each day and never know what the next day will bring. I love being able to help people in the capacity that I do. My job is flexible, challenging, and rewarding all at the same time.

If you weren't an environmental health professional, what other profession would you like to work in?
Prior to receiving my bachelor of science in public health, I was taking courses to earn a bachelor of nursing degree at the Lethbridge College in Lethbridge, Alberta. I completed 2 years in nursing studies and it was not until I completed a practicum at the hospital that I realized I was in the wrong profession. Thankfully, I was able to transfer my 2 years of course work over to the University of Lethbridge where I completed my degree in public health in 2014.

I did not know at first that I wanted to be a health inspector. I actually stumbled on environmental public health while doing an infection control practicum with the Office of the Medical Officer of Health in Lethbridge. I got to observe and go out with the field health inspectors, which sparked my interest in the field. I am so glad that I made the switch. Often times, people go through school and find out later that they do not like their field of work. I got lucky. Our profession is small but I have met some of the most talented people doing what we do.

Please describe any hobbies, activities, or causes you are passionate about.
I love traveling, hiking, reading, watching movies, and most importantly, spending time with my family. I recently had a baby boy named Kingston who is 6 months old.

What is your favorite vacation spot and why?
The Dominican Republic. It was one of the first places I visited with my husband. I have so many great memories. We went to an all-inclusive resort and got spoiled while we were there. The weather and people were wonderful. I cannot wait to go back again.

What is one thing that most people do not know about you that you would be willing to share?
I have an interest in anything infection control.

What accomplishment are you most proud of?
I am proud of my sons Kingston and Phoenix. Also, I am proud of becoming a certified public health inspector.

Who do you look up to and why?
My grandfather. My father was not around much when I was growing up and my grandfather really stepped up helping me in life. He has passed since and I miss him every day.

What was the best professional advice given to you?
Our profession can be extremely hard and sometimes it is not for everyone. I have learned to be more patient. The best advice given to me has been to take every experience—good or bad—and learn something from it.

Is there anything else that we did not ask that you would like to share?
I am on LinkedIn and would love to connect with others.

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

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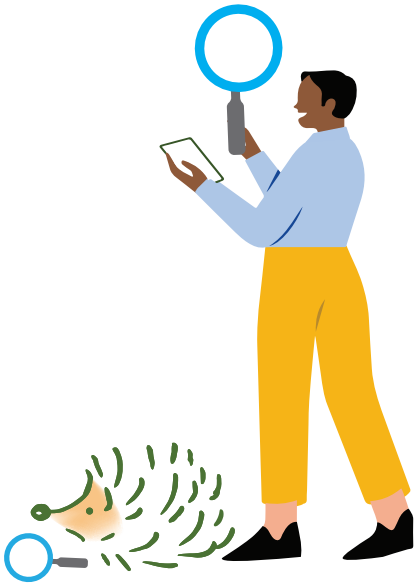

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