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# Environmental Health

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DAY 1

## Persistence and Cross-Contamination of a Coronavirus Surrogate on Food Service Fomites

DAY 13

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# Environmental Health

Dedicated to the advancement of the environmental health professional

Volume 85, No. 10 June 2023

## ABOUT THE COVER



In this month's cover article, "Coronavirus Surrogate Persistence and Cross-Contamination on Food Service Operation Fomites," the study investigated the persistence and

transfer rate of phi 6 bacteriophage (a SARS-CoV-2 surrogate) on food contact surfaces and fomites commonly present in food service operations. The results indicate that food contact surfaces, fomites, and hands can serve as sources of viral transmission within food service operations. These results can be used by the food service industry to address sanitation practices and by public health agencies to provide science-based recommendations to stakeholders.

See page 8.

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## ADVANCEMENT OF THE SCIENCE

Coronavirus Surrogate Persistence and Cross-Contamination on Food Service Operation Fomites.....	8
Special Report: <i>Federal Meat and Poultry Inspection Duties and Requirements—Part 2: The Public Health Inspection System, Marks of Inspection, and Slaughter Inspections</i> .....	16

## ADVANCEMENT OF THE PRACTICE

International Perspectives/Special Report: <i>Unfolding Outbreak Scenarios Can Be a Bite-Size Treat and Other Lessons From New Zealand's First Online Environmental Health Conference</i> .....	20
Building Capacity: <i>Build Capacity by Adding to Facility Inventory</i> .....	24
Direct From ATSDR: <i>APPLETREE: Building Local Capacity to Respond to Environmental Exposures</i> .....	26
Direct From CDC/Environmental Health Services: <i>Shine a Light on Environmental Justice Issues With the Environmental Justice Dashboard</i> .....	28
The Practitioner's Tool Kit: <i>Risk: We Assess It!</i> .....	30
Programs Accredited by the National Environmental Health Science and Protection Accreditation Council.....	33

## ADVERTISERS INDEX

Environmental Health and Land Reuse Certificate Program.....	25
GOJO Industries.....	2
HS GovTech.....	48
Industrial Test Systems, Inc.....	47
JEH Advertising.....	33
NEHA CP-FS Credential.....	15
NEHA Endowment Fund.....	19
NEHA Membership.....	4, 15, 44
NEHA REHS/RS Credential.....	5
NEHA REHS/RS Study Guide.....	5
NEHA/AAS Scholarship Fund.....	7

## ADVANCEMENT OF THE PRACTITIONER

Environmental Health Calendar.....	34
Resource Corner.....	35
Spotlight on NEHA Resources: Our Online Store.....	36

## YOUR ASSOCIATION

President's Message: <i>With You Till the End of the Line</i> .....	6
Special Listing.....	38
NEHA 2023 AEC.....	40
In Memoriam.....	42
NEHA News.....	45

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

**Erratum**

In the April 2023 *Journal of Environmental Health* (volume 85, number 8), the author listing for S. Jeon was incorrectly listed in the article, "Decreased Moderate to Vigorous Physical Activity Levels in Children With Asthma Are Associated With Increased Traffic-Related Air Pollutants," by J. Aguilera, S. Jeon, A.U. Raysoni, W.-W. Li, and L.D. Whigham. The correct listing is: Soyoung Jeon, PhD, Department of Economics, Applied Statistics, and International Business, New Mexico State University.

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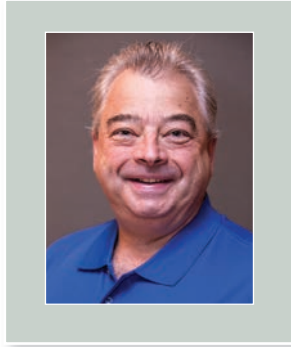
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## ▶ PRESIDENT'S MESSAGE



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

## With You Till the End of the Line

**T**hank you for the honor and privilege of allowing me to represent my fellow environmental health professionals as president of National Environmental Health Association (NEHA) for this trip around the sun. As Happy from Snow White and the Seven Dwarfs sang, “You’re never too old to be young.” This past year has invigorated me regarding the bright future of environmental health. It is hard to believe my term as president is ending, but NEHA is in great hands with outstanding board members, staff, volunteers, and members who will keep the NEHA ship steered not only in the right direction but also help our organization to gain steam.

Time flies when you are having fun. I have enjoyed working with our staff, board members, and NEHA affiliate leaders while meeting members from coast to coast. Although my term is ending, Captain America’s saying, “I’m with you till the end of the line,” rings true.

U.S. President John F. Kennedy said, “And so, my fellow Americans: ask not what your country can do for you—ask what you can do for your country.” I ask my fellow colleagues, what can you do to help NEHA improve our profession, which in turn will improve the whole wide world? Margaret Mead, an American cultural anthropologist, is attributed for saying, “Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.” The environmental health profession is the second largest sector of the governmental public health workforce—we can move mountains.

*I will continue to  
spread the word that  
environmental health  
is a hidden treasure.*

Huey Lewis and the News sang, “They say the heart of rock and roll is still beating.” Environmental health is the heart of public health. Environmental health professionals, the Swiss Army knives of scientists, are strategically positioned to identify and intervene to prevent public health issues from affecting local populations. As we do our jobs, please remember another quote from John F. Kennedy: “Change is the law of life. And those who look only to the past or present are certain to miss the future.”

Healthy People 2030 focuses on reducing people’s exposure to harmful pollutants in air, water, soil, food, and materials in homes and workplaces. The environmental health workforce will be at the forefront of this initiative, reducing and preventing illness to individuals, families, and communities caused by physical, chemical, and biological agents found in our environment. Environmental health professionals are scientifically trained and certified to not only identify but also, and more importantly, mitigate environmental dangers and promote alternatives. 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). As you do your job protecting the public, please remember what Rosa Parks said (and also attributed to Marie Curie): “You must never be fearful of what you are doing when it is right.”

NEHA Past President Dr. Priscilla Oliver coined the phrase “One NEHA” during her presidency. I would like to highlight the One Health concept. From the One Health High-Level Expert Panel et al. (2022), One Health is defined as an “integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent. The approach mobilizes multiple sectors, disciplines, and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate changes, and contributing to sustainable development.” Globally, environmental health is recognized as a critical component for assessing and protecting human, animal, and ecological health.

I hope you will be able to join me for the second One Health | One Global Environment Conference in Montego Bay, Jamaica, from October 2–6, 2023 ([www.onehealth](http://www.onehealth))

conference.com). The conference is hosted by the Jamaica Association of Public Health Inspectors in collaboration with NEHA, the Canadian Institute of Public Health Inspectors, and the Americas Regional Group of the International Federation of Environmental Health. The first conference was attended by more than 400 health practitioners and academics spanning six continents. Environmental health provides a critical link to protecting human health from human-to-human, vectorborne, and zoonotic diseases. Rachel Carson, author of *Silent Spring*, aptly stated, “The more clearly we can focus our attention on the wonders and realities of the universe around us, the less taste we shall have for destruction.”

I will continue to spread the word that environmental health is a hidden treasure, providing a world of opportunity that touches all aspects of daily life. As broadcast journalist Tom Brokaw said, “It’s easy to make a

buck. It’s a lot tougher to make a difference.” We are lucky to be in a profession where you can make a good living while making a difference. Please become involved with NEHA on a local, state, or national level and spread the word that environmental health is public health. Please emulate Bishop Desmond Tutu, who said, “Do your little bit of good where you are; it’s those little bits of good put together that overwhelm the world.”

I am proud of the work NEHA has accomplished over the past year. NEHA and my fellow environmental health professionals make a difference in the lives of people. I know NEHA will continue to do remarkable things in the years to come. We should heed the words of Mother Teresa: “Yesterday is gone. Tomorrow has not yet come. We have only today. Let us begin.”

I leave you with one last quote from *Peter Pan* written by J.M. Barrie: “Never say goodbye because goodbye means going away and

going away means forgetting” Edward Cox, a friend of mine and World War II veteran, used to say that it is not goodbye but later. Until we meet next time, remember that I am easy to recognize in a crowd due to my fashion sense and quiet voice. ✨



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## Reference

One Health High-Level Expert Panel, Adisasmito, W.B., Almuhairi, S., Behraves, C.B., Bilivogui, P., Bukachi, S.A., Casas, N., Becerra, N.C., Charron, D.F., Chaudhary, A., Ciacci Zanella, J.R., Cunningham, A.A., Dar, O., Debnath, N., Dungu, B., Farag, E., Gao, G.F., Hayman, D.T.S., Khaitsa, M., . . . Zhou, L. (2022). One Health: A new definition for a sustainable and healthy future. *PLOS Pathogens*, 18(6), e1010537. <https://doi.org/10.1371/journal.ppat.1010537>



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# Coronavirus Surrogate Persistence and Cross-Contamination on Food Service Operation Fomites

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**Abstract** This study investigated the persistence and transfer rate of phi 6 bacteriophage (SARS-CoV-2 surrogate) on food contact surfaces and fomites that are commonly present in food service operations. Coupons (e.g., stainless steel, cutting board) were inoculated with phi 6 and phi 6 survival was quantified over 30 days. The results showed that phi 6 persisted for up to 13 days on sponges, stainless steel, tabletops, countertops, cutting boards, and light switches. Additionally, phi 6 was found for 10 days on microfiber towels and wooden floors.

We examined the transfer rate of phi 6 from food contact surfaces to wiping tools, hands, and produce. Fomites and hands were inoculated with  $10^7$  or  $10^3$  PFU/cm<sup>2</sup> phi 6 to simulate high and low contamination levels, and surfaces were allowed to dry for 1 hr. The inoculated surfaces were swabbed with sponges or towels or touched with hands or produce, and then these samples were analyzed. The results indicated that food contact surfaces, fomites, and hands can serve as sources of viral transmission within food service operations. Enveloped phi 6 could persist for days on inanimate surfaces and pose a high risk of cross-contamination in food service operations. The results of this study could be used by the food service industry to address sanitation practices and by public health agencies to provide science-based recommendations to stakeholders.

## Introduction

Coronavirus disease (COVID-19) is a disease caused by a novel respiratory virus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; Pressman et al., 2020). COVID-19 symptoms include but are not limited to fever, chills, cough, loss of taste or smell, shortness of breath, and gastrointestinal disorders (Centers for Disease Control

and Prevention [CDC], 2022; Lai et al., 2020; Yang & Wang, 2020). Coronavirus (CoV) is a virus that belongs to the family Coronaviridae, which is a large family of viruses that are characterized as enveloped, single-stranded, positive-sensed RNA viruses (Yang & Wang, 2020). As of March 2023, there were more than 103 million COVID-19 cases and over 1.1 million deaths in the U.S. alone; glob-

ally, the COVID-19 pandemic has resulted in over 676 million cases and over 6.8 million deaths (Johns Hopkins University & Medicine, 2023).

Food service sectors (e.g., businesses, employees) have been adversely affected during the COVID-19 pandemic (Roy et al., 2021; Sirsat, 2021). According to the National Restaurant Association (2021), the restaurant industry finished 2020 with a total sales of \$240 billion below what was forecasted and with 2.5 million fewer jobs. Yang et al. (2020) reported that a 1% increase in daily COVID-19 cases results in a 0.056% decrease in restaurant demand. Healthcare professionals have reported detrimental effects on mental health in food service workers as a result of COVID-19 (Rosemberg et al., 2021).

Studying viral transmission and working with pathogenic viruses requires a Biosafety Level 3 laboratory. Surrogate viruses have been used successfully for many viral survival and transmission studies (Aquino de Carvalho et al., 2017; Casanova & Weaver, 2015; Turgeon et al., 2014). Our study used bacteriophage phi 6 as a surrogate (i.e., virus model) for coronaviruses because it is safe and easy to reproduce (Turgeon et al., 2014); phi 6 previously has been validated as an appropriate surrogate for enveloped viruses such as enveloped waterborne viruses (Aquino de Carvalho et al., 2017) and coronaviruses (Bailey et al., 2022; Franke et al., 2021; Serrano-Aroca, 2022).

The SARS-CoV-2 virus is transmitted primarily via droplets through coughing, sneezing, and contact with an infected person, but surface transmission is possible (Castaño et al., 2021; Mouchtouri



et al., 2020; Pressman et al., 2020). These inanimate objects or surfaces, when contaminated, can spread pathogens and are called fomites (Castaño et al., 2021). Previous studies have investigated the survival of respiratory viruses—such as the Middle East respiratory syndrome (Kampf et al., 2020; van Doremalen et al., 2013) and severe acute respiratory syndrome (Chan et al., 2011; Kampf et al., 2020)—and showed that these viruses can persist on fomites such as metal, glass, or plastic. Their persistence can last from a few hours to a few days depending on the virus, type of surface, and other environmental factors. Similar studies in hospital settings demonstrated virus survival on fomites and that transmission from these fomites is possible (Kasloff et al., 2021; Otter et al., 2016; Sizun et al., 2000).

In general, virus survival rates in the environment depend on many factors, including moisture, relative humidity, temperature, and whether a surface is porous or nonporous (Lopez et al., 2013; Tiwari et al., 2006; Whitworth et al., 2020). Studies have shown that SARS-CoV-2 can survive for as long as 3 days on plastic, 2 days on stainless steel, and up to 24 hr on cardboard (Suman et al., 2020). Kampf et al. (2020) conducted a review of persistence of coronaviruses on inanimate surfaces and found evidence that the SARS-CoV virus could survive on inanimate surfaces such as metal, glass, or plastic for as many as 5 days, 5 days, and 9 days, respectively (Duan et al., 2003; Rabenau et al., 2005). Mouchtouri et al. (2020) reported that SARS-CoV-2 particles were detected on various surfaces, in air samples, and in sewage waste from hospitals and other community settings. One study also showed that under favorable environmental conditions, SARS-CoV-2 can persist and stay viable on fomites for up to 21 days (Kasloff et al., 2021).

It is essential to understand how long viruses such as SARS-CoV-2 can persist on high-touch surfaces in food service operations and their transmission rates under various conditions, because rates can vary from hours to days (Kampf et al., 2020). In March 2021, the World Health Organization (2021) reported that SARS-CoV-2 was found on frozen and refrigerated food packaging in China. One study reported that SARS-CoV-2 attached on salmon skin could survive and

stay infectious for more than 7 days if stored at 4 °C and 2 days at 25 °C, concluding that SARS-CoV-2 attached to fish and seafood could serve as a source of contamination (Dai et al., 2020).

We selected peppers, cantaloupe, and lettuce samples because all have been associated with foodborne illness outbreaks in the past (CDC, 2023). Moreover, their diverse physical characteristics allow for a comprehensive investigation of contamination persistence and cross-contamination (Stine et al., 2005). These produce previously have been used to study viral surface contamination (Allwood et al., 2004; Cliver et al., 1983; Le Guyader et al., 2004; Stine et al., 2005). The textured surfaces of lettuce (Takeuchi & Frank, 2001) and cantaloupe (Ukuku & Fett, 2002) have been shown to protect bacteria from chemical and physical interventions, while the smooth surfaces of peppers offer a contrast for investigative purposes. These three produce items are regularly eaten raw, bypassing a lethality step that includes cooking above 140 °F (CDC, 2023).

The goals of our study were to 1) investigate the persistence of phi 6-relevant fomites within food service operations and 2) evaluate the cross-contamination and transfer rate from high-touch surfaces to wiping tools, hands, and produce, and from cutting boards to produce.

## Methods

### Reagents and Coupons

All media and reagents were purchased from VWR. The sponges, microfiber towels, and cutting boards were purchased from an online retail website. Coupons of laminate tabletop, countertop, wooden floor, and stainless steel were purchased from Thermo Fisher Scientific.

### Bacteriophage and Host

*Pseudomonas syringae* (host) and phi 6 were obtained from the Centers for Disease Control and Prevention. The host was cultivated on tryptic soy agar (TSA) and grown in tryptic soy broth (TSB). The virus stock solutions were prepared by suspending propagated phi 6 in TSB at concentrations of 8–10 log plaque forming units (PFU)/ml. Working stocks of phi 6 were prepared and stored at 4 °C. Next, *P. syringae* were streaked on TSA plates using

an inoculation loop from previously prepared TSA slant and incubated for 18 hr at 22 °C. After overnight incubation, a single colony of *P. syringae* was picked using a sterile loop and inoculated in a 250-ml flask containing 50 ml of TSB. The flask was incubated in a shaking incubator for 18 hr at 22 °C. After incubation, the density of the culture was verified using a spectrophotometer (Spectronic 20D, Thermo Fisher Scientific) at optical density (OD<sub>550</sub>) and grown until the reading output showed absorbance between 0.5 and 0.8.

After preparing the host, 1 ml of room temperature TSB was added to the tube containing the lyophilized virus and vortexed for 1 min to mix. Next, 500 µl of the rehydrated virus was added to 50 ml of TSB in a 250-ml flask, followed by adding 100 µl of overnight growth of *P. syringae*. The flask containing TSB, the virus, and *P. syringae* was then placed in a shaking incubator and incubated for 18 hr at 22 °C.

### New Stock Purification

After incubation, phi 6 was purified using a 0.22-µm PVDF membrane filter that was attached to a sterile needle-less Millipore SLGV033RS 60-cc syringe. The plunger was pulled out from the syringe and 15 cc of the overnight culture was pipetted into the syringe barrel. After the plunger was reinserted, the syringe filtered out bacterial debris and the virus was dispensed into a sterile polypropylene tube (centrifuge tube). All procedures were performed inside a biosafety cabinet.

### Plaque Assay

Plaque assays were carried out to identify the concentration of phi 6 for filtrate viruses; 10-fold serial dilutions of the phi 6 filtrate were made in 0.02% of phosphate buffered saline (PBS) and Tween (PBST, 100 ml PBS + 0.02% Tween 20) buffer. The remaining filtrate was wrapped with aluminum foil and stored in a refrigerator at 4 °C for later use. Next, 1 ml of the diluted phi 6 was mixed with 100 µl of overnight cultures of *P. syringae*. The mixture was added to a tube containing 3 ml of TSB soft agar prewarmed to 45–50 °C. The soft agar with host and phi 6 was mixed quickly in a tube and poured onto TSA plates. The plates were swirled manually to evenly distribute the soft agar. The plates were allowed to dry for 30 min, inverted,

TABLE 1

**Persistence of Phi 6 on Restaurant Surfaces Over 30 Days**

Day	Mean Log PFU/cm <sup>2</sup> and Standard Deviation on the Surface of Each Fomite <sup>a</sup>							
	Sponge	Microfiber Towel	Stainless Steel	Floor	Tabletop	Countertop	Cutting Board	Light Switch
1	5.7 ± 0.2	5.2 ± 0.3	5.4 ± 0.1	5.6 ± 0.4	5.5 ± 0.3	5.6 ± 0.4	5.5 ± 0.5	5.3 ± 0.3
2	4.0 ± 0.7	3.2 ± 0.5	3.1 ± 0.8	3.5 ± 0.5	3.4 ± 0.4	3.8 ± 0.2	3.5 ± 0.5	3.3 ± 0.4
3	2.7 ± 0.1	2.4 ± 0.1	2.6 ± 0.2	2.7 ± 0.1	2.8 ± 0.1	2.6 ± 0.1	2.6 ± 0.1	2.5 ± 0.1
4	2.3 ± 0.2	2.1 ± 0.3	2.3 ± 0.3	2.2 ± 0.1	2.4 ± 0.1	2.2 ± 0.1	2.1 ± 0.2	2.2 ± 0.4
7	1.9 ± 0.2	1.6 ± 0.1	1.7 ± 0.3	1.6 ± 0.3	1.9 ± 0.2	1.7 ± 0.3	1.7 ± 0.2	1.7 ± 0.4
10	1.5 ± 0.2	1.2 ± 0.1	1.2 ± 0.2	1.3 ± 0.1	1.5 ± 0.2	1.3 ± 0.2	1.3 ± 0.2	1.4 ± 0.1
13	1.3 ± 0.2	0.8 ± 0.5	1.0 ± 0.2	0.8 ± 0.5	1.1 ± 0.3	0.9 ± 0.4	1.1 ± 0.2	0.9 ± 0.5
16	0.7 ± 0.6	0.5 ± 0.2	0.5 ± 0.2	0.4 ± 0.2	0.8 ± 0.3	0.7 ± 0.4	0.6 ± 0.3	0.5 ± 0.2
19	0.5 ± 0.2	0.4 ± 0.2	ND ± 0.3	ND ± 0	0.5 ± 0.2	ND ± 0	0.4 ± 0.2	ND ± 0
22	0.4 ± 0.2	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0
25	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0
28	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0
30	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0	ND ± 0

<sup>a</sup> Mean and standard deviation of survival of phi 6 on each surface of each item over 30 days (N = 6). The greatest reduction of phi 6 occurred within the first 3 days postinoculation. Note. ND = none detected.

and incubated for 24 hr at 22 °C. PFUs were quantified after incubation.

**Persistence Experiment**

*Sample Preparation and Inoculation of Fomites*  
 Before the start of the experiment, all coupons were cut into either 5 x 5 cm or 10 x 10 cm squares, depending on the item. Coupons were sterilized using an autoclave for 15 min at 121 °C or by using 70% ethanol. The inoculum was prepared by adding 5 ml of phi 6 stock to 45 ml of 0.02% PBST buffer (10<sup>8</sup> PFU/ml). Each coupon surface was spot-inoculated with the inoculum and an L-shaped spreader was used to evenly distribute the phage. The coupons were air-dried for 1 hr at room temperature (23 ± 2 °C) in a biosafety cabinet. During the drying time, TSA soft agar tubes were prepared for overlay by melting prepared TSA soft agar in a 48–50 °C water bath.

After the coupons were air-dried, two inoculated coupon samples for each surface were taken and placed in a stomacher bag containing either 90 ml or 45 ml of buffer (0.02% PBST) and homogenized using a stomacher lab blender for 2 min. Next, 10-fold dilutions

were made and 1 ml from each dilution and 100 µl of the overnight host were added to one melted and tempered TSA soft agar (3 ml) overlay tube and poured onto TSA plates, which were tilted to ensure that the soft agar mixture completely coated the TSA plates.

The plates were allowed to solidify in a biosafety cabinet for 30 min before they were inverted and incubated for 18–24 hr at 22 °C in the incubator. Negative control plates were prepared using sterile phage buffer (no phi 6) to test for potential contamination. After the incubation period, plaques on each plate were quantified and recorded as PFUs. For each of three biological replicates under similar experimental conditions, the above sample plating procedures were carried out on days 1, 2, 3, 4, 7, 10, 13, 16, 19, 22, 25, 28, and 30. After 30 days of sampling, no phi 6 was detected; therefore, 30 days was chosen as the sampling plan for our study.

**Simulation Experiment**

We conducted a simulation experiment to understand the potential for phi 6 cross-contamination in a food service operation setting and quantify the rate of cross-contamination

from surfaces to wiping tools, and from hands or cutting boards to produce. The experiments were performed using high and low (10<sup>7</sup> and 10<sup>3</sup> PFU/cm<sup>2</sup>, respectively) phi 6 concentrations to simulate different contamination levels. In total, three biological replicates were conducted.

*Contamination of Surfaces With a High or Low Level of Phi 6*

For the first scenario, 0.2 ml of phi 6 suspension (10<sup>7</sup> and 10<sup>3</sup> PFU/ml, respectively) was inoculated onto tabletop, countertop, and stainless steel (5 cm x 5 cm) coupons and held at room temperature (23 ± 2 °C) for 1 hr to facilitate attachment. Next, a sponge or microfiber towel was used to swab each surface. Then, each sponge or microfiber towel was placed into a stomacher bag and mixed using a stomacher lab blender for 2 min. Each item was then subjected to microbiological analysis as described in the previous section.

*Cross-Contamination From Surfaces to Hands*

Hands were washed for 30 s using soap and warm water (40 °C), dried using paper tow-

TABLE 2

**Transfer Rate of Phi 6 From Food Contact Surfaces (Stainless Steel, Tabletop, and Countertop) to Wiping Tools (Sponge and Microfiber Towel) and Hands**

Surface	Log and Transfer Rate With High Level Inoculation (10 <sup>7</sup> PFU/cm <sup>2</sup> )		Log and Transfer Rate With Low Level Inoculation (10 <sup>3</sup> PFU/cm <sup>2</sup> )	
	Log PFU/cm <sup>2</sup> <sup>a</sup>	Transfer Rate <sup>b</sup> (%)	Log PFU/cm <sup>2</sup>	Transfer Rate (%)
Stainless steel to sponge	2.3 ± 0.3	38	0.7 ± 0.5	35
Tabletop to sponge	1.8 ± 0.4	30	0.6 ± 0.3	30
Countertop to sponge	2.2 ± 0.1	37	0.9 ± 0.2	45
Stainless steel to microfiber towel	1.6 ± 0.1	26	0.9 ± 0.3	45
Tabletop to microfiber towel	1.7 ± 0.4	28	0.4 ± 0.2	20
Countertop to microfiber towel	2.1 ± 0.1	35	0.3 ± 0.3	5
Stainless steel to hand	2.4 ± 0.2	40	0.5 ± 0.3	25
Tabletop to hand	2.1 ± 0.3	35	1.2 ± 0.1	60
Countertop to hand	2.2 ± 0.1	37	0.6 ± 0.3	30

<sup>a</sup> Mean and standard deviation of phi 6 from the inoculated stainless steel, tabletop, or countertop (10<sup>7</sup> or 10<sup>3</sup> PFU/cm<sup>2</sup>) to sponge or microfiber towel when used to wipe each surface, or to hands when hands touched each surface for 20 s (N = 6).

<sup>b</sup> The transfer rate (percentage) of mean and standard deviation of phi 6 from the inoculated stainless steel, tabletop, or countertop (10<sup>7</sup> or 10<sup>3</sup> PFU/cm<sup>2</sup>) to sponge or microfiber towel when used to wipe each surface, or to hands when hands touched each surface for 20 s (N = 6).

els, sprayed with 70% ethanol, and allowed to air-dry. The index finger (primary transfer) of each hand was used to touch the contaminated surfaces for 20 s. Samples from hands were collected using a glove-juice method (Larson et al., 1980; Sirsat et al., 2013) with brief modifications as detailed. The index finger from each hand that touched the contaminated surfaces for 20 s was placed in a sterile surgical glove containing 1 ml of sterile 0.02% PBST virus buffer in the index finger section. Next, the finger with the glove on was vortexed for 60 s. The sample was then transferred from the glove index finger region to a sterile 10-ml conical tube using a sterile pipette; the sample then underwent further dilution and viability plate count analyses.

*Contamination of Cutting Boards and Hands With a High or Low Level of Phi 6*

For the second scenario, cutting boards and hands were inoculated with 0.2 ml of phi 6

suspension (10<sup>7</sup> and 10<sup>3</sup> PFU/ml, respectively). Samples of produce (pepper, cantaloupe, and lettuce) were placed on an inoculated cutting board. After marking the portion of the produce that was placed on the cutting board, it was left in contact for 1 hr at room temperature (23 ± 2 °C). The marked (inoculated) portion of each produce sample was swabbed using an alginate cotton swab and placed into a tube containing 5 ml of 0.02% PBST. Additionally, produce samples were placed in contact with inoculated hands for 1 min by touching marked portions of the produce. Next, 1 ml from each collected sample (after touching either cutting boards or hands) and 100 µl of overnight host were added to a tube containing 3 ml of TSA soft agar. The contents were shaken by hand, quickly poured onto TSA plates, allowed to solidify, and incubated for 24 hr at 22 °C. After the incubation period, PFUs were quantified.

**Statistical Analyses**

PFUs from all experiments (persistence and simulation) were converted to log<sub>10</sub> and the survival rate curve was constructed using Microsoft Excel. The transfer rate is defined as: log PFU/cm<sup>2</sup> on recipient surface divided by log PFU/cm<sup>2</sup> on the original surface (source) multiplied by 100.

**Results and Discussion**

**Persistence of Phi 6—Food Service Fomites**

Table 1 shows the persistence of phi 6 on sponges, microfiber towels, stainless steel, wooden floors, tabletops, countertops, cutting boards, and light switches over a period of 30 days. The results indicate that phi 6 can persist for as long as 13 days on the following coupons: sponges, tabletops, countertops, cutting boards, and light switches. In addition, phi 6 persisted for as long as 10 days on microfiber towel and wooden floor coupons. Rapid reductions of phi 6 were observed within the first 2 days for all fomites, where reductions of more than 2 logs PFU/cm<sup>2</sup> were recorded on all surfaces except sponges and countertops. After day 2, the reductions of the phi 6 levels remained constant until day 13, at which point phi 6 fell below the detection limit of 0.9 logs PFU/cm<sup>2</sup> for all surfaces.

Previous literature has shown that food and food contact surfaces in food service operations could be a source for the cross-contamination and transmission of bacteria and viruses (Gibson et al., 2012). Santarpia et al. (2020) reported that a person infected with SARS-CoV-2 could contaminate the room environment where they were cared for—including air and environmental surfaces such as personal items, room surfaces, and toilets. SARS-CoV-2 was also detected on food preparation surfaces, service areas, hospital isolation wards, air conditioning filters, sewage treatment units, and in air samples (Mouchtouri et al., 2020). These findings are significant because there is scientific evidence of potential viral transmission from contaminated fomites to a person's mouth (Rusin et al., 2002).

**Cross-Contamination of Phi 6—Surfaces**

Table 2 shows the transfer rate of phi 6 from food contact surfaces to wiping tools

and hands. Simulation experiments were designed to quantify transfer rates of phi 6 bacteriophage from fomites to hands. Microfiber towels had the lowest transfer rates in each group at high ( $10^7$  PFU/cm<sup>2</sup>) and low concentrations ( $10^3$  PFU/cm<sup>2</sup>) except from stainless steel at low concentration. These results are consistent with previous studies that found microfiber towels, along with cotton/cellulose towels, transferred significantly less virus compared with nonwoven and cotton terry bar towels (Gibson et al., 2012).

At both high and low concentrations, hands have the highest phi 6 transfer rates for all surfaces; the exception was stainless steel at low phi 6 concentration, where it had the lowest transfer rate. The transfer rate from tabletops to hands at low phi 6 concentration was the highest observed in our experiment. These results would have the greatest impact on food service customers, who come into contact with countertops and tabletops. A study by Choi et al. (2014) showed that nonfood contact surfaces that customers interact with have the potential for cross-contamination. Their experiment focused on bacteria and restaurant menus while reinforcing the importance of regular cleaning to minimize the risk of spreading pathogens.

**Cross-Contamination of Phi 6—Produce**

The transfer rate of phi 6 from plastic cutting boards and hands to produce (cantaloupes, peppers, and lettuce) are listed in Table 3. At high-level inoculation ( $10^7$  PFU/cm<sup>2</sup>), the transfer rate from surface to produce was similar. The cutting board to produce transfer rate ranged from 32–33% and hand to produce ranged from 33–37%.

At low-level inoculation ( $10^3$  PFU/cm<sup>2</sup>), the transfer rate from surfaces to bell peppers were the highest in the cutting board (40%) and hand (60%) experiments. Lettuce, by contrast, had the lowest transfer rate in both cases: cutting boards (35%) and hands (25%). The widest range for transfer rate was found from hands to produce (25–60%). Our results show, therefore, that cross-contamination is a risk even with a low viral concentration.

Lettuce and cantaloupes historically have been associated with multiple foodborne ill-

**TABLE 3**  
**Transfer Rate of Phi 6 From Cutting Board and Hands to Produce**

Item	Log and Transfer Rate With High Level Inoculation ( $10^7$ PFU/cm <sup>2</sup> )		Log and Transfer Rate With Low Level Inoculation ( $10^3$ PFU/cm <sup>2</sup> )	
	Log PFU/cm <sup>2</sup> <sup>a</sup>	Transfer Rate <sup>b</sup> (%)	Log PFU/cm <sup>2</sup>	Transfer Rate (%)
Cutting board to bell pepper	1.9 ± 0.2	32	0.8 ± 0.5	40
Cutting board to cantaloupe	2.0 ± 0.3	33	0.7 ± 0.1	35
Cutting board to lettuce	2.0 ± 0.3	33	0.7 ± 0.5	35
Hand to bell pepper	2.1 ± 0.1	35	1.2 ± 0.4	60
Hand to cantaloupe	2.0 ± 0.2	33	0.9 ± 0.3	45
Hand to lettuce	2.2 ± 0.2	37	0.5 ± 0.3	25

<sup>a</sup> Mean and standard deviation of phi 6 from the inoculated cutting board or hands ( $10^7$  or  $10^3$  PFU/cm<sup>2</sup>) to the produce when the produce was left on the cutting board for 1 hr or when hands touched the produce for 20 s ( $N = 6$ ).

<sup>b</sup> The transfer rate (percentage) of mean and standard deviation of phi 6 from the inoculated cutting board or hands ( $10^7$  or  $10^3$  PFU/cm<sup>2</sup>) to produce when produce was left on the cutting board for 1 hr or when hands touched the produce for 20 s ( $N = 6$ ).

ness outbreaks; however, bell peppers demonstrated a higher transfer rate compared with the other produce. It is possible that the smooth skin of the pepper allowed for more of the phi 6 samples to be collected, whereas the ridges in the other produce samples inhibited collection. The same difficulty of removing contamination from melon rinds in postharvest processing (Gagliardi et al., 2003) could account a lower transfer rate of phi 6 from the cantaloupes. These transfer rate results have increased importance due to the fact that respiratory viruses have the ability to survive on produce for several days (Yépiz-Gómez et al., 2013).

**Conclusion**

Data from our study suggest that enveloped phi 6 bacteriophages can persist on food service operation surfaces for an extended period of time. From a practitioner perspective, it is crucial for food handlers in food service operations to be aware of pathogens (foodborne or respiratory) that can lead to cross-contamination and cause illness among employees and customers. Therefore, additional care should be taken to prevent cross-contamination among surfaces, hands, and

food by implementing effective food safety and hygiene practices.

Our results also provide new insight for food service operations on the factors that affect viral transmission rates on different surfaces. Additionally, by improving food service sanitation programs, our study can inform the industry on the risks posed by fomites. Future research could investigate if pathogenic coronaviruses such as SARS-CoV-2 show a similar persistence and transfer rate on food contact surfaces. ❁

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continued on page 14

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## ► SPECIAL REPORT

# Federal Meat and Poultry Inspection Duties and Requirements—Part 2: The Public Health Inspection System, Marks of Inspection, and Slaughter Inspections

Roger W. Amery, CP-FS

**Abstract** This 4-part series aims to inform environmental health specialists of the duties and requirements for federal meat and poultry inspectors and the companies they regulate. Part 1 provided general attributes of Food Safety and Inspection Service inspection personnel and regulated companies (Amery, 2023). Part 2 covers 1) the computer-based system used to communicate to upper management the results of inspection tasks so that authorities can decide what further action to implement against noncomplying companies, 2) the marks of inspection, and 3) slaughter inspection duties and company responsibilities. The remaining two parts of the series will be presented in subsequent issues.

## Introduction and Overview

The Food Safety and Inspection Service (FSIS) comes under the authority of the U.S. Department of Agriculture (USDA). 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, 2023). 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 (EIAOs) 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.

Within FSIS, a computer-based system is used to communicate inspection results to the circuit and higher levels. Stamp brands with edible ink are used to identify the companies for which the products have passed inspection. Food inspectors (FIs) on the line at slaughter companies condemn unfit products with “condemn” brands and those condemned products are routed either for pet or zoo food, or for destruction by the slaughter companies.

After FSIS inspectors inspect the live animals, companies humanely kill the livestock and prepare the harvested products for inspection by FIs on the slaughter lines. The presumably contamination-free products are to be presented in a manner that facilitates inspection. FIs determine what is to be condemned and whether each unit (e.g., head, viscera,

carcass) is to be segregated for veterinary disposition. Only the products passed by FIs are marked “pass” by the companies. The companies then chill or freeze the products for further processing. Consumer safety inspectors (CSIs) inspect off the slaughter lines (i.e., “off-line”) either at slaughter plants or at plants that further process products. CSIs review and observe the sanitation and hazard analysis critical control point (HACCP) programs as the companies conduct these activities.

## The Public Health Inspection System

In April 2011, FSIS launched a computer-based system called the Public Health Inspection System (PHIS). From this system, CSIs and public health veterinarians (PHVs) can schedule inspection and labeling tasks related to public health for each day at each company. The CSI or PHV document the regulations considered and the inspection results. If there is noncompliance, a noncompliance record is documented on PHIS. Also, memoranda of interviews are documented on PHIS whenever FSIS inspectors meet with companies for important matters concerning nonregulatory public health or labeling issues.

These data are monitored, consolidated, and analyzed, via PHIS, by the upper levels of FSIS. From these data, companies that have a trend of noncompliances may receive visits from EIAOs to determine if action should be taken against the company (Rules of Practice, 2023). Also, national trends from these data can be observed that might result in policy or regulation changes. Whenever such changes occur, they are downloaded to FSIS inspectors in the form of online directives or notices.



## Marks of Inspection

Each company that manufactures products that contain 2% or more meat and/or poultry and that are sold and shipped into commerce beyond state lines must come under FSIS regulations. Companies must apply for FSIS inspection prior to any production. Once inspection is granted by FSIS, a company is assigned an establishment number to be inserted in the inspection legends. Inspection legends with the establishment numbers are the marks of inspection that are branded directly onto the products or preprinted on the product packaging. These marks of inspection indicate to consignees and consumers that FSIS has inspected these products and they have passed inspection.

In some instances, such as canned products, the establishment number is not within the inspection legend but on the lid of the can or elsewhere on a package along with the production code. The marks of inspection on packages or cans are used to facilitate tracing the origins of the products. Inspection legends are circular except for those used for equine meat, which are pentagonal (Official Marks, Devices, and Certificates, 2023).

On the slaughter lines, carcasses and offal (i.e., the edible products harvested from the viscera, heads, and kidneys) that pass inspection are hot branded or rubber stamped with edible blue ink by the companies or placed in packaging preprinted with the marks of inspection. Of note, marks of inspection are placed by the companies after the products have passed inspection. FSIS inspectors do not apply marks of inspection.

Products or product parts that do not pass inspection are slashed or ink-stamp branded “condemned” by FIs. The companies must reroute, denature, and discard the condemned products. When FIs detect that possibly an entire mammal unit (e.g., head, viscera, carcass) is diseased, it is tagged to be rerouted and segregated for veterinary disposition by a PHV. If the unit passes PHV inspection, it is placed back into production. If a product passes inspection for cooking only, a special brand is applied to indicate its cooking-only status, and the carcass must be cooked at that plant before being sent out into commerce. In red meat inspection, only PHVs can condemn entire units. On poultry slaughter lines, FIs can condemn entire bird

units, which are placed in “condemned” containers and disposed of.

All animal units that have passed antemortem (i.e., before slaughter) inspection are inspected again postmortem (i.e., after slaughter). All animal units that have passed postmortem inspection on the slaughter floor are subject to reinspection at any point before the products are shipped into commerce (Reinspection, Retention, and Disposal of Meat and Poultry Products at Official Establishments, 2023). Companies are given a chance to recondition failed products to regulatory standards, if possible.

In fabrication companies, CSIs condemn products or retain them for reconditioning to acceptable standards and attach a tag indicating condemnation or retention. They then inform company management of the action and the reason why. Not every step in the process or every finished product is organoleptically (i.e., involving use of vision, touch, smell) inspected by an FSIS inspector at fabrication. Inspection legends on containers and packaging represent only the fact that the meat and poultry products have been produced under FSIS regulations.

A different brand is used for exporting meat and poultry products to other countries. The companies stamp the boxes with square export marks that contain the certificate numbers for the products being shipped. An export verification inspection is performed by FSIS on each lot of products to be shipped overseas, including to Mexico and Canada. This inspection is to verify that the packaged product is in good condition and meets the requirements of both FSIS and the countries where the product is to be shipped.

## Slaughter Inspections

### Antemortem Responsibilities of FSIS

Before livestock (mammals and birds) are slaughtered for human consumption, they must be inspected while alive by FSIS inspectors on the premises of registered companies to ensure that 1) only wholesome animals are slaughtered for human consumption and 2) the livestock are slaughtered in a humane manner. FSIS takes humane handling of livestock seriously (Humane Slaughter of Livestock, 2023).

The livestock are observed at rest in the pens and then are slowly driven in motion

by company employees for the inspector to observe. Livestock that FSIS find abnormal are moved to segregation pens and PHVs determine their disposition. Then livestock are either euthanized on the spot; denatured and destroyed; or tagged for disposition at postmortem with ear tags labeled U.S. Suspect, USDA Reactor, or U.S. Condemned.

Livestock are identified with initialed pen cards informing postmortem FIs that the livestock contained in these pen numbers have undergone antemortem inspection. More details regarding antemortem inspection are found in the regulations for red meat (Antemortem Inspection, 2023) and regulations for poultry (Subpart J—Ante Mortem Inspection, 2023).

### Postmortem Responsibilities of Slaughter Companies

The slaughter companies prepare each animal—that has either passed antemortem inspection or has been labeled suspect, reactor, or condemned—for a postmortem inspection by FIs. Once the slaughter companies corral the livestock to the knocking box, the livestock are humanely stunned, shackled with the heads toward the floor, and suspended by chains. Carotid arteries are severed to exsanguinate the animals. After the animals have sufficiently bled out, the cadavers are transferred to overhead rails, suspended by the hind feet. With the heads facing downward, hooves (or poultry feet) and hides (or poultry feathers) are removed. Then the cadavers are decapitated, and the heads are placed on hooks attached to a wall or on racks, in preparation for inspection by FIs. Once the heads pass inspection, edible tissues such as cheek meat and tongue are harvested and trimmed, then boxed or placed in temporary containers, and chilled by the company.

The rectums and esophagi are tied off to prevent spillage of the contents (i.e., ingesta) during evisceration. Market hog cadavers may be dehaired (i.e., hair is removed but not the entire hide) and scalded. Poultry is defeathered and scalded. The scalded and dehaired cadavers are polished, then partially opened to prepare for evisceration. The sternums of the mammal cadavers are sawed open to facilitate evisceration. Company personnel eviscerate the cadavers and place the viscera on pans for inspection by FIs. The

viscera found acceptable by FIs are then harvested, segregated, packaged, and chilled by the company. After evisceration, bovine and equine carcasses are sawed in half. Most porcine carcasses are partially sawed down the backbone; other species do not go through this processing step. The eviscerated cadavers, at this point called carcasses, continue through the postmortem process.

The companies trim and prepare the carcasses for carcass rail inspection by FIs. After inspection, the carcasses are moved to a final wash. The company stamps the FI-passed carcasses with the “U.S. Inspected and Passed” blue edible ink brand. Poultry carcasses are not directly stamped but are placed in pre-labeled packaging further in the processing at the slaughter facility. The carcasses are then placed in a cooler and chilled to safe temperatures for further processing or shipped in a cooler truck to other companies.

**Postmortem Responsibilities of FSIS**

Companies are responsible to present the carcasses and parts in a clean, sanitary, and presentable manner to facilitate FSIS inspection. There are usually three stations on the slaughter line where FIs inspect: 1) head inspection, 2) viscera inspection, and 3) carcass inspection. The number of FIs at each station depends on the species and the line speed. Large companies with fast line speeds that slaughter the larger livestock species require more FIs, and the stations are further apart. At slower line speeds and smaller companies, one FI can cover all three stations at one spot in the line where heads, viscera, and carcasses can be presented for inspection.

Each species has differences in the on-line inspection procedures. In all cases, FIs are inspecting for diseases or injuries that can cause illnesses to humans on consumption or for other reasons that render the products undesirable or inedible. FIs inspect for any missed contamination such as hair, hide, feces, and fallout debris from the overhead structures. FIs direct designated company employees to trim these contaminants from the carcasses, heads, and viscera.

FIs use knives and hooks as tools when organoleptically inspecting bovine, porcine, and equine species. The knives and hooks are used to slice open lymph nodes of the

heads, tongues, lungs, and livers. The outer and inner cheek muscles of bovine and equine heads are also sliced and viewed for signs of diseases and conditions such as tapeworm cysts that would render the meat undesirable. Bovine and equine hearts are sliced open to observe all four heart chambers. FIs palpate bovine tongues, lungs, livers, hearts, and the reticule-rumen junction of the paunches in cattle to detect conditions that might not be visible, such as abscesses inside the livers or arthritis at a leg joint. Additionally, the bile ducts of cattle livers are sliced open to inspect for parasites. Knives and hooks are not used to inspect sheep, goats, and poultry. Rather, inspection is conducted visually and by palpation.

FIs condemn diseased or abnormal heads, tongues, or viscera via a “condemn” brand stamped with blue edible ink. FIs then direct the company trimmers to trim off the offending parts. If this process is not possible on the line due to line speed, then the carcasses are segregated by company employees to another rail. Carcasses are reinspected after the trimming is completed and then placed back on the production line if the FI deems the carcass has passed reinspection. At any station when FIs think that cadavers or carcasses might be diseased entirely, they direct companies to segregate those units for PHV disposition. PHVs determine whether entire units or only parts pass inspection or are condemned.

Poultry inspection requires just one station. FIs visually inspect the outside and inside surfaces of the carcasses. FIs palpate the viscera, which has been pulled out of the carcasses by company personnel. FIs can condemn whole poultry carcasses.

Slaughter companies may request a new voluntary system of postmortem inspection called the HACCP-Based Inspection Model Project (HIMP) to increase production. This system entails company personnel conducting the actual postmortem inspection while FSIS inspectors monitor the companies to verify that the postmortem techniques are performed correctly, and that the companies are producing wholesome and edible products for human consumption. This system also reduces the number of FSIS inspectors required.

Every time a slaughter establishment kills livestock for human food, a PHV or inspector-in-charge enters data into PHIS. These

data include the class of livestock, the live weights, the dressed weights, the number of livestock condemned by PHVs at antemortem and postmortem inspections, and the reasons why livestock were condemned. These data are available to relevant government agencies and are statistically analyzed for various disease trends.

**Conclusion and Summary of Part 2**

Each FSIS inspector uses a computerized system to schedule daily tasks. The results of each task performed are recorded and available to higher authorities, who use these data to recognize trends that might result in policy changes.

FIs on the slaughter lines use “condemn” brands to label parts of carcasses and viscera not suitable for consumer consumption. Companies use brands to indicate which products have passed the online postmortem inspection by FIs. Inspected food products that have passed inspection are subject to reinspection by FSIS inspectors throughout the processing, up to the point that food products are shipped to consumers.

All livestock entering a slaughter establishment must be FSIS inspected before (antemortem) and after slaughter (postmortem). No livestock showing disease symptoms are to enter the companies. After the livestock pass FSIS inspection and are killed humanely, FIs determine at postmortem inspection what parts of the livestock are acceptable for further processing into meat and poultry products. Carcasses determined by FIs to possibly be diseased are segregated for disposition by PHVs. Carcasses that pass inspection are sent into production and/or to consignees. ❁

*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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## ▶ INTERNATIONAL PERSPECTIVES / SPECIAL REPORT

# Unfolding Outbreak Scenarios Can Be a Bite-Size Treat and Other Lessons From New Zealand's First Online Environmental Health Conference

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**Abstract** The New Zealand Institute of Environmental Health (NZIEH) is a nongovernmental institute for all environmental health professionals in New Zealand. In 2021, NZIEH held its annual conference as an online virtual event for the first time. One inclusion to the program was an evolving outbreak scenario delivered in installments including “injects” of information (i.e., inserts of information relevant to the scenario) that mimic the evolution of a real-life epidemiological outbreak investigation. Questions were posed to attendees related to each added information inject. The scenario also included discussion in virtual breakout rooms that allowed attendees to network and reach consensus before responding to questions; discussions were also initiated by the scenario facilitators. Details of the scenario, its aims, evaluation of success, and limitations of this approach are discussed.

## Introduction

The New Zealand Institute of Environmental Health (NZIEH) is a not-for-profit, nongovernmental institute for all environmental health professionals within New Zealand. Established in 1920, NZIEH has >300 members who make up >75% of the environmental health officers in New Zealand. Members are employed by local or central government, private industry, the New Zealand Defense Force, district health boards, and tertiary institutions.

NZIEH has a close working relationship with Massey University, which offers the environmental health officers qualification either as a full bachelor's degree or as a postgraduate diploma. Although Massey University has campuses throughout the country, it

offers many of its courses online for distance learners. To bring together key learnings, in-person courses are often held, especially for environmental health specialty courses, such as those focusing on monitoring methods where practical skills can be demonstrated and applied.

## Background

In the face of the ongoing global COVID-19 pandemic, everyone's lives worldwide have been affected, including our work lives. How we used to meet and interact, especially at conferences and training events, seems a distant memory at times. So, when NZIEH's Annual National Conference was due to be held in March 2021, the executive leadership

of NZIEH considered carefully how this event might go ahead safely. It was mere days after the last face-to-face conference held in March 2020 in Wellington, where 100 years of NZIEH was celebrated, that New Zealand went into nationwide lockdown. At that centennial conference, Dr. David Dyjack, executive director of the National Environmental Health Association (NEHA), acted as master of ceremonies, though his kiwi experience was cut short due to having to return home as COVID-19 started to rapidly spread around the globe.

The executive leadership of NZIEH weighed the option of holding a face-to-face event versus going virtual for the first time. It was decided that the gamble was not worth the risk to host a safe event in uncertain times. Fortunately, in deciding to go virtual, the executive leadership drew from the NEHA Digital Defense Virtual Conference held in August 2020, which inspired NZIEH's first-ever virtual conference in March 2021.

Going virtual was brand new to NZIEH. Questions about how the platform initially would work, what was required of the organizing committee, and if a virtual conference could attract as many attendees as normal were raised. Although the use of technology was the “new normal” way of working and could provide fantastic tools, keeping people engaged virtually over 2 days was one of the biggest challenges to tackle.

NZIEH Vice President Jason Rosenbrock suggested the possibility of an evolving outbreak scenario to be delivered during the conference. The inspiration for this idea came from an online workshop he had attended

through Massey University, whereby over the duration of that course, an evolving outbreak scenario was presented with students being tasked with investigating and identifying the source of the outbreak. We did not believe such an idea had been tried before at a conference, so we looked in to the feasibility of this idea to explore if it could be implemented.

Environmental health staff from Massey University were able to adapt a course module to fit this idea. Due to COVID-19, the delivery of traditional in-person courses also changed and moved to virtual ways of delivering information. The virtual platform for the conference, fortunately, had gamification elements. Attendees could earn points by completing quiz questions and other tasks. Points determined who won an overall prize of a \$1,000 charitable donation made in the winning attendee's name by NZIEH to a registered New Zealand charity of the winner's choice.

Most attendees were environmental health officers, though we were aware that, for many, it could have been several years since they had been presented with particular facts, figures, and graphs of an epidemiological nature. Therefore, we consciously presented the outbreak and information provided at a level such that those who were inexperienced with outbreak investigations could participate and try to solve the mystery, yet experienced officers would still be challenged enough to be motivated to find the answers. Two of the authors from this special report wrote the scenario and delivered the content.

## Rationale

Unfolding case studies are considered best practice for teaching outbreak investigations around the world (Cremin et al., 2018; Dicker, 2017; Nelson et al., 2018). These types of case studies are particularly appropriate for learners with a range of experience with disease investigations (Dicker, 2017; Nelson et al., 2018) and have been used for ongoing professional development of non-epidemiologists with potential roles in outbreak investigations (Barrett et al., 2018; Burckhardt & Kissling, 2020; White et al., 2018). While there are examples of using unfolding outbreak exercises in short courses or summer school symposium sessions (Cremin et al., 2018; University of Otago, 2020), to our knowledge there are no published examples of using an unfolding outbreak scenario in a virtual conference.

## Basis for the Case Study

The basis for the example developed for the conference was the 214.311 Epidemiology and Communicable Diseases course offered by Massey University. As part of this course, students take part in a typical disease outbreak scenario entitled "Hotel M" that a local public health unit might investigate. The scenario was developed and adapted from a Centers for Disease Control and Prevention (CDC, 2019) example to ensure the content and tasks reflect current practice in New Zealand. Students working in groups receive "injects" of information (i.e., inserts of information relevant to the scenario) and were asked to answer questions, make decisions, and complete typical tasks required of an outbreak investigation team over 3–4 hr.

In 2020, in response to COVID-19 and the decision to have our conference be virtual, we adapted the Hotel M scenario for use in a course with online conferencing software (i.e., Zoom), drawing on software features and other technology to support learner engagement and collaboration such as employing breakout rooms, polls, and virtual whiteboards. We also engaged the support of a public health colleague, who oversees outbreak investigations, to record some simple videos where he provided updates and asked the learners to complete tasks, which we edited into short clips to guide students through the scenario.

For the conference, the challenge was to create a much shorter scenario that would be introduced in snippets of information throughout the day, interspersed with other presentations, rather than the dedicated 3- to 4-hr exercise offered in our course workshop. At a practical level, we also wanted to develop a new study so that any former students attending the conference would not already know the answers.

Our new example, "Workshop X," used data provided by our local public health unit from one of their recent investigations, which we adapted to protect privacy. We simplified the information for use in this conference context. The scenario involved several workshop participants becoming ill shortly after a shared meal at a weekend workshop and the subsequent investigation. We reviewed the framework of questions and tasks that the Hotel M scenario was built on and from these tasks chose questions and tasks that a) would cover important aspects of an outbreak inves-

tigation, b) could be solved mostly by using information introduced through short video injects, and c) could be answered through a multiple-choice question format.

We wrote a script and developed a series of eight short videos that each ended with a multiple-choice question. Several sessions allowed time for participants to discuss the question in small groups in a virtual breakout room. The outbreak was introduced live at the start of day 1 of the conference and ended with a live final wrap-up session at the end of day 2, where attendees could ask questions and discuss their findings.

The virtual platform featured a resources section where we could add materials used in the outbreak scenario as they were introduced across the 2-day conference for attendees who missed an earlier installment of the unfolding outbreak scenario. The last part of the puzzle was to ensure that our virtual master of ceremonies was able to keep the scenario in the forefront and assist with information injects throughout the conference.

## Response and Evaluation

Data from the conference platform showed between 88 and 107 attendees signed into the 16 sessions offered over the 2 days of the conference. Using the highest number of unique logins as the reference denominator, 93% (99/107) of attendees attended the introduction to the outbreak scenario session and 80% (86/107) of attendees attended the final wrap-up of the scenario.

Response data were available for all scenario questions asked during the conference, including the nine posed at the end of each outbreak inject. Using the same denominator, 86% of session attendees attempted at least one of the questions, with most of the questions attempted by at least one half of the attendees. The percentage of attendees who attempted questions declined throughout the conference, but did increase, with the final question attempted by 52% of attendees (Figure 1). Questions requiring the interpretation of laboratory results and identifying the number of cases matching the case definition had the lowest number of attempts; the question asking if the outbreak should be investigated (following small group discussion) had the greatest number of answer attempts (Table 1).

The postconference survey was completed by 66 respondents but did not ask specifi-

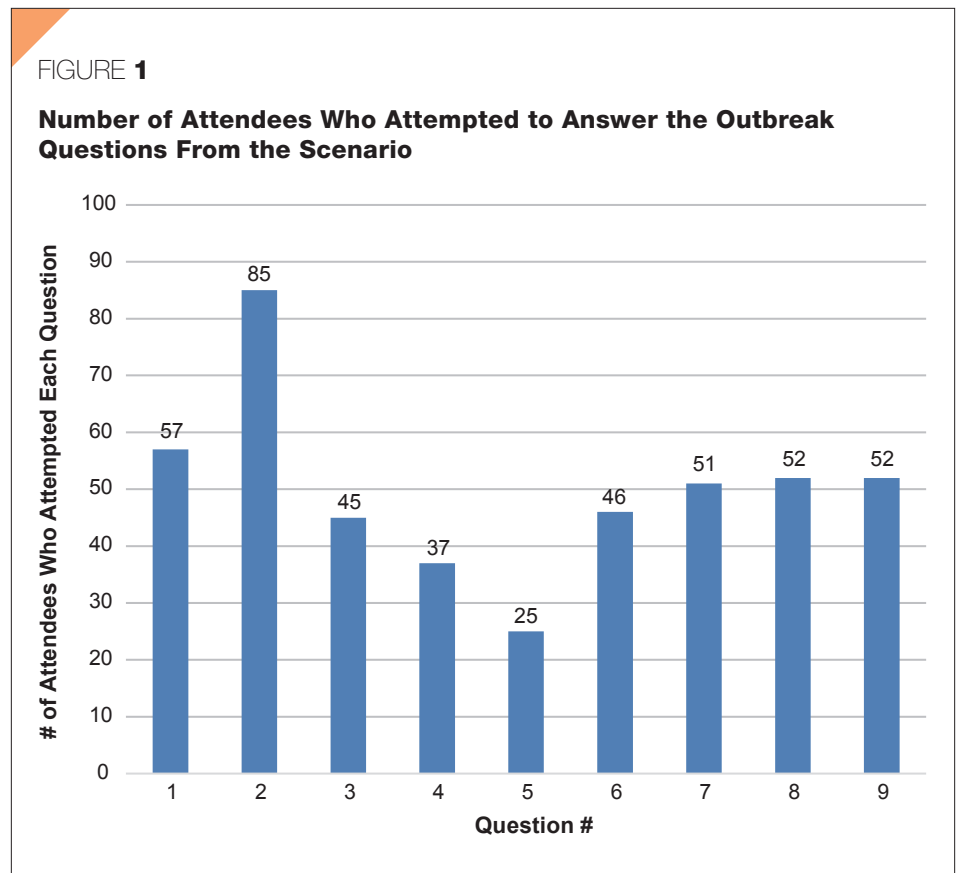
cally about the outbreak scenario. On a scale of 1–5 (1 = poor and 5 = excellent), 83% rated their overall event experience as 4 or 5, 90% rated it as better or a lot better than expected, and none rated it as worse than expected.

In an open-ended question about the presentations that attendees enjoyed the most, the outbreak scenario was mentioned by two respondents. In another open-ended question about the presentations that attendees enjoyed the least, the outbreak scenario was mentioned by four respondents, with comments that the outbreak was “a little disjointed” and “too drawn out.” Additionally, in response to the question about topics for future conferences, one respondent asked for more information on infection control and epidemiology and one asked for more on pathogen outbreaks. There was also one request to “definitely have some sort of outbreak scenario” included again at a future event.

**Discussion, Limitations, and Potential Improvements**

Our experience of implementing an unfolding outbreak scenario, supported by discussion rooms and associated questions, suggests this kind of activity has several benefits: 1) the scenario gives conference attendees an opportunity to engage with each other and problem solve, while reinforcing some important epidemiological concepts and 2) it provides the opportunity for attendees to network and make useful connections with others who they might not otherwise meet. The scenario also potentially increased the length and quality of attendee engagement with the virtual conference overall, but it is difficult to judge how well this objective was achieved in this situation.

Making support resources easy to find and access is essential, as it allows those who attend virtual meetings intermittently—rather than for the complete program—to engage fully. The outbreak scenario information was accessible in a folder in the conference Resource Gallery, where information in the form of injects was built up over time and attendees could catch up on any information they had missed during the conference. Having information delivered in installments, however, relied heavily on the attendee being able to find previously released information to follow along with the investigation fully. Some attendees highlighted connectivity as



an issue, although this problem appeared to relate to individuals’ internet connectivity rather than the platform itself.

We believe it is important to make scenarios about outbreak investigations relevant, presented at a suitable level, and with features that make each scenario believable and authentic. We tried to ensure authenticity by working with our local public health agencies to adapt a typical example designed for training purposes and present the questions at a level typically asked in CDC introductory outbreak investigation exercises. We assumed most attendees would be familiar with this type of content, as it is covered in environmental health undergraduate or graduate training. One or two attendees commented that they found the scenario quite easy. Attendees who found the content difficult might have struggled with the installment nature of the content delivered or might not have experienced similar exercises before.

In the usual outbreak investigation case studies we run, discussions are a way for attendees of various levels of experience to

contribute and learn from each other. Conference feedback suggested some attendees enjoyed the breakout sessions offered in the conference, but that the quality of the experience and degree of participation varied. It would be useful to learn more about the level of value added by the breakout rooms in the evaluation of any future events.

Reflecting on attendee experience and feedback, we considered what an individual expects to gain from attending a conference as opposed to a university course or workshop. While attendees should expect to learn something from a conference, it is possible this expectation would differ compared with attendees participating in more of a classroom learning environment. It is possible that we pushed the boundaries of what would normally be expected from a conference by delivering an outbreak scenario in this manner. As we did not specifically ask attendees about the outbreak scenario content and process, it is difficult to fully evaluate their experience with the scenario. Advance knowledge that there would be a scenario, including breakout rooms where

TABLE 1

**Outline of Scenario Injects, Questions Posed, and Supporting Resources Provided**

Inject #	Focus of Video Inject and Video Duration (min:s)	Question Posed	Supporting Resources Provided
1	Introduction/overview (05:52)	Is this an outbreak? Should it be investigated?	Live video link
2	Information on symptoms (1:30)	Which pathogen do you suspect?	Handout on characteristics of common bacterial foodborne pathogens
3	Interpreting laboratory results (static image of results displayed)	Which pathogen is present?	Sample laboratory results
4	Case definition (0:57)	Based on the case definition, how many cases of illness are there?	List of the case definition
5	Epidemic curves (0:30)	Does this exposure seem like a single occurrence or an ongoing issue?	Epidemic curve
6	Update on scale of outbreak and decision to go ahead with an epidemiological study. List of meals at event provided.	Based on what we know so far (i.e., the pathogen and the epidemic curve), which meal should we focus on?	Event menu
7	Interpreting an attack rate table (1:48)	Which food or foods would you be most suspicious of?	Attack rate table
8	Environmental inspection (1:42)	Which process in the food-preparation environment is deficient?	Summary of findings from the environmental inspection report
9	Debrief (live discussion session)	Answers to the quiz questions provided with brief explanations.	Live video link and open chat with attendees

*Note.* “Injects” of information are inserts of information relevant to the scenario that mimic the evolution of a real-life epidemiological outbreak investigation.

knowledge had to be practically applied in real time, might have altered attendee expectations and overall takeaway learnings from this experience.

Competitions to earn points toward prizes or recognition are common features of traditional and virtual conferences, but these competitions do not usually have educational aims. It is worth considering linking professional development to question results, which would require some sophisticated implementation of identity verification so as not to undermine the integrity of professional development accreditation.

While data available from our online platform gave us useful insight into the level of engagement achieved, there are still many unknowns. There are also some limitations on our estimates of participation. While we controlled for multiple logins during a session, multiple attendees might have accessed the activity simultaneously from a single device. Overall, however, despite one or two comments that the experience was disjointed, participation and engagement was high.

## Recommendations

Our advice to others who would like to try a similar exercise are:

- The CDC outbreak investigation studies are a good framework to begin with for typical outbreak investigation questions, activities, and discussion points.
- Consider partnering with universities and local public health agencies to identify a local example that some of the CDC questions could be applied to.
- Consider giving attendees advance notice about the exercise and make it clear that a degree of participation will be expected.
- Consider whether to split up injects of information or deliver more information in dedicated session blocks.
- Ask specific questions about the exercise in the conference evaluation.

## Conclusion

Including questions about an outbreak scenario for attendees to consider and answer in a multiple-choice-question format as part of a competition running throughout the program was an innovative aspect of NZIEH's first-ever vir-

tual conference. The outbreak scenario was a positive feature that increased attendee engagement. An alternative would have been to use these questions as a separate activity, at a higher level. Such an approach could be considered as a component of professional development and allow attendees to earn continuing education credit toward a professional credential.

A theme of the overall conference feedback was that attendees missed the opportunity to network with their colleagues, which is a challenge for any online event, no matter the subject matter. We will consider exploring ways to allow for more networking and interactions among attendees for any future online conferences. ✨

**Acknowledgement:** The authors thank Conference & Events for providing data for our analysis.

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*References on page 32*

## ▶ BUILDING CAPACITY



Darryl Booth, MBA

## Build Capacity by Adding to Facility Inventory

**Editor's Note:** A need exists within environmental health agencies to increase their capacity to perform in an environment of diminishing resources. With limited resources and increasing demands, we need to seek new approaches to the practice of environmental health. Acutely aware of these challenges, the *Journal* publishes the Building Capacity column to educate, reinforce, and build upon successes within the profession using technology to improve efficiency and extend the impact of environmental health agencies.

This column is authored by technical advisors of the National Environmental Health Association (NEHA) data and technology section, as well as guest authors. The conclusions of this column are those of the author(s) and do not necessarily represent the views of NEHA.

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The phrase “facility inventory” just makes sense to me. Facility inventory is the list of known entities that are monitored and served by environmental health, usually through annual permit or license fees and routine surveillance inspections. These entities are your restaurants, pools, tattoo shops, etc., that are often divided into health programs and inspection districts.

If one multiplies the facility inventory of their department by the various annual fees, we have some idea of the budget for that department. And as you know, budgets are a key factor in hiring, facilities, equipment, and training, to name a few.

So, a larger facility inventory usually points to a larger budget.

I will acknowledge that a larger inventory also implies more work (i.e., more inspections, more education, more phone calls, etc.) and more work requires more resources. So, why expand and add to facility inventory if the expansion offsets the increases?

Aside from the obvious public health benefits of more monitoring, organizations benefit from economies of scale. Remember learning about economies of scale from your early college days?

### An Easy Economics Review

The phrase “economies of scale” refers to the organizational advantages that come from increasing the scale of operations. As the facility inventory and budget of a health

department grow, fixed costs—such as buildings, computers, software, equipment, and vehicles—are divided among more and more permitted facilities, which results in net incremental increases to the available budget. In addition, a denser inspection district means more time inspecting and less time driving.

### Expanding Inventory

While environmental health departments routinely maintain their inventory through new applications and renewals (removing those who do not renew), departments could also purposefully set expansion goals. Through outreach and enforcement, “discovered” facilities can be added.

### Complaints

Public complaints might prompt an inspector to visit a facility not previously licensed or permitted. But also, complaints might come from businesses who object to competing businesses that might be “skirting the rules.”

### Harvesting Inspector Insights

Routine inspections conducted once or more each year should be a primary dataflow. As inspectors visit each business, they will know promptly if a business has closed or has changed its regulated activities. In both cases, a procedure (e.g., a service request) should direct office staff to make those changes to inventory, which result in rightsizing the inventory based on inspector notes.

Also, never discount what can be learned by an inspector just walking around the district since businesses with similar activities pop-up in the same commercial and



retail areas. This concept holds true for hazardous material programs as smaller auto shops are dense in areas zoned for light industrial use.

### **Collaborating With Business Licensing Departments**

Whether your agency represents a county working with many cities or a health district working with many counties and cities, it is reasonable to request business licensing transactions as a professional courtesy. The licensed businesses, when compared with the environmental health facility inventory, will almost always expose businesses that should also be regulated under environmental health regulations.

Better still, a regular or real-time dataflow between governments and departments can operationalize the processes for opening new businesses.

It is confusing and frustrating for businesses to engage the city, the county, and the state—each with very different processes. It would be great if a business could expect a single point of application to meet all their obligations.

### **Searching the Internet and Paid Lists**

It is simple enough to use your favorite search engine and search, “restaurants near me.” That list might yield some surprises, but it is not very structured.

Another approach is to buy business lists. Many companies publish business lists primarily for marketing purposes. A list of restaurants (with names and addresses) would augment the known restaurant inventory.

### **Referrals**

When the fire department or code enforcement officer leaves a property, they might have learned what regulated activities (or unregulated activities) are going on there. Make that referral easy and environmental health will receive direct information for enforcement or permitting activities.

### **Community Outreach**

Environmental health departments can also work with associations and community organizations to identify unpermitted or unlicensed facilities in the area. This work could

involve conducting surveys or holding public meetings to gather information about local businesses and to make the community aware of regulations and laws.

### **Planning to Expand**

In the same ways that fees rise incrementally, it is reasonable to expect a modest expansion, perhaps 3–5% in most years, within the context of a strategic plan and public health goals.

Ensure that both individual contributors and leadership are made aware of the plan and the expected benefits. Then, execute the plan, prioritizing higher risk health programs and monitoring the program overall. ✨

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

## ▶ DIRECT FROM ATSDR

Audra Henry,  
MSJanet Cowins,  
PhD

## APPLETREE: Building Local Capacity to Respond to Environmental Exposures

**Editor's Note:** As part of our continued effort to highlight innovative approaches to improve the health and environment of communities, the *Journal* is pleased to publish regular columns from the Agency for Toxic Substances and Disease Registry (ATSDR) at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment, its impact on human health, and how to protect public health.

The findings and conclusions in this column are those of the author(s) and do not necessarily represent the official position of CDC, ATSDR, or the National Center for Environmental Health.

Audra Henry is the program services section chief in the Office of Capacity Development and Applied Prevention Science at ATSDR. She serves as the program officer for the APPLETREE program. Dr. Janet Cowins is an environmental health scientist in the Office of Capacity Development and Applied Prevention Science at ATSDR. She serves as a technical project officer for the APPLETREE program.

### Introduction

In 1987, the Agency for Toxic Substances and Disease Registry (ATSDR) developed a nonresearch cooperative agreement program to help accomplish its public health mission. That program is known as the Partnership to Promote Local Efforts to Reduce Environmental Exposure (APPLETREE). APPLETREE funds 30 state health departments that work closely with communities; local, state, and federal agencies and organizations; tribal governments; and other entities to address site-specific issues and recommend actions to protect public health. It is the largest cooper-

ative agreement program within ATSDR and builds state capacity to:

- respond to threats from human exposure to hazardous substances in the environment,
- engage communities with site contamination and potential health effects, and
- implement activities to address local environmental health issues of concern.

APPLETREE activities are primarily focused on protecting public health through site health assessments, community engagement, and capacity building and prevention activities such as Choose Safe Places for Early Care and Education (CSPECE; Grants.gov, 2022).

### Site Health Assessments

Site health assessments help determine if and how people might be exposed to harmful site-related releases and recommend actions to protect people's health. As part of the ATSDR (2022a) public health assessment process, ATSDR and its APPLETREE partners do the following:

- Establish communication mechanisms, including engaging communities, before and throughout the process.
- Collect various types of site information.
- Obtain, compile, and evaluate the usability and quality of environmental and biological sampling data.
- Conduct sequential scientific evaluations, including exposure pathways evaluation, screening analysis, exposure point concentrations and calculations, and in-depth toxicological effects evaluation.
- Conduct exposure investigations, when appropriate, to fill data gaps and better understand potential site exposures.

Site health assessments are done for various hazardous waste sites, including those on the U.S. National Priorities List (NPL), brownfields, community-petitioned sites, and other facilities. ATSDR and its APPLETREE partners consider demographics, environmental health burden, health equity, and other factors for each site. They then write public health assessments and health consultations to summarize site health assessment findings and recommend health-protective actions. For example, the New Jersey Department of Health (2023) prepared a public health assessment focused on the public health implications of exposure to arsenic, lead, and other contaminants in soil, sediment, drinking water, and surface water at

the former Kil-Tone Company NPL site. The APPLETREE program at the New Jersey Department of Health worked closely with local health departments and federal agencies, shared public health assessment findings, and provided outreach to community members on ways to reduce their exposures and protect their health.

The closeness of APPLETREE partners to site-specific issues enhances the public health assessment process and the ability of ATSDR to protect people's health. Strong local partnerships also support timely site health assessments and recommendations.

### Community Engagement

Community engagement is critical to understanding the needs of a community and involving them in the public health assessment process. ATSDR (2021) and APPLETREE partners seek an in-depth understanding of the unique attributes, historical experiences, and goals of a community to inform a successful engagement strategy. Community engagement helps accomplish the following goals (ATSDR, 2022a):

- Build trust, support, and open dialogue between community members and the site team.
- Identify and understand the health concerns, unique needs, and preferences of the community.
- Promote community participation in the public health assessment process.
- Obtain community support for taking actions that will protect people from harmful exposures to site-related contaminants.
- Engage new resources and allies.
- Address overall community health concerns and improve community health outcomes.

ATSDR and APPLETREE partners develop outreach materials such as facts sheets, videos, and training, as well as participate in public meetings and workshops (Grants.gov, 2022). They also conduct Soil Screening, Health, Outreach, and Partnership (soilSHOP) events that provide community members with free lead screening of soil gathered from their gardens or outdoor play areas. These soilSHOP events provide health education and outreach about potential lead exposures and ways to protect communities from lead (ATSDR, 2022b). For example, the APPLETREE program at the Tennessee Department of Health conducted a soilSHOP to screen soil for lead

from the Southside Chattanooga Lead NPL site neighborhood. Their efforts helped inform community members about the importance of testing their soil for lead and actions that can reduce or prevent lead exposure. Community engagement activities ensure that community members understand the findings of health assessments and, where applicable, adopt behavioral changes to reduce harmful environmental exposures and improve health (ATSDR, 2022a).

### Choose Safe Places for Early Care and Education

Newly licensed early care and education centers might inadvertently locate learning facilities in areas where children could be exposed to harmful environmental substances (ATSDR, 2017). To help support children's health, APPLETREE integrated the CSPECE initiative into the program in 2017. CSPECE promotes environmentally safe siting of early care and education (ECE) centers through local partnership building, improved data use, pilot programs, and other activities.

APPLETREE state partners create innovative solutions such as training programs, voluntary property questionnaires, videos, and other resources to help ECE facility owners make informed decisions. For instance, the APPLETREE program at the Pennsylvania Department of Health developed a voluntary online survey for childcare owners and operators that encouraged having a healthy environment for ECE centers. Several state programs have realized positive effects of CSPECE on local, state, and federal childcare policies and procedures, and in preventing unsafe siting of ECE centers. Sustainability planning for partner CSPECE programs is encouraged and important to achieve positive health outcomes.

### Appletree Effects and Successes

APPLETREE has had positive effects on public health in many communities. In its 36 years, APPLETREE has funded programs in 39 states and awarded more than \$250 million. Nearly two thirds of all ATSDR site investigations are conducted through the APPLETREE program. Those investigations have reduced or prevented harmful environmental exposures from many hazardous waste sites.

Over the past 3 years, APPLETREE assessed approximately 2.5 million people for hazardous exposures. Funded partners also developed innovative ways to engage and educate communities about public health risks from potential exposures to site contaminants. CSPECE programs are helping childcare operators make informed decisions about potential ECE locations. APPLETREE partners continue to achieve positive effects through innovative prevention-based activities.

APPLETREE started a new 5-year program period on April 1, 2023. To learn more, visit [www.atsdr.cdc.gov/states/index.html](http://www.atsdr.cdc.gov/states/index.html). 🌸

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▶ **DIRECT FROM CDC** ENVIRONMENTAL HEALTH SERVICES

Jena Losch, MPH

## Shine a Light on Environmental Justice Issues With the Environmental Justice Dashboard

**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.

Jena Losch is a public health advisor at the CDC Environmental Public Health Tracking Program, part of National Center for Environmental Health. She has more than 10 years of experience working in environmental health and has special interest in health communication, improving access to health and environmental data, and improving data literacy.

### Working Toward Environmental Justice Through Improved Access to Data

Some communities are facing environmental injustice—disproportionate burdens from environmental exposures, damaging land uses, psychosocial stressors, and historical and structural racism—that can be linked to short- and long-term health disparities. These communities are often composed of people from racial and ethnic minority groups and from communities with lower access to resources.

Environmental justice can be achieved when everyone has the same degree of protection from environmental and health hazards and equal representation in the decision-making process to have a healthy

environment. An important step toward achieving environmental justice is improving access to data and information that can be understood and used by communities facing environmental injustice and used by decision makers, environmental health practitioners, and health officials to identify and address environmental injustices.

A major part of achieving environmental justice is valuing, elevating, and amplifying the stories and lived experiences of people living in communities that face environmental injustices—the *qualitative* side to environmental justice. The Environmental Justice (EJ) Dashboard from the Centers for Disease Control and Prevention (CDC) is an important tool that looks at the *quantitative* side to environmental justice—using data to shine

a light on injustices, make decisions, and be a foundation for community narratives and environmental justice initiatives and actions.

### Environmental Justice Dashboard Delivers Data for Your Community

The EJ Dashboard allows users to enter their ZIP Code or county and obtain personalized data on environmental exposures, community characteristics, and health burden information (Figure 1). All of these topics are important factors in understanding and addressing environmental justice issues in a community.

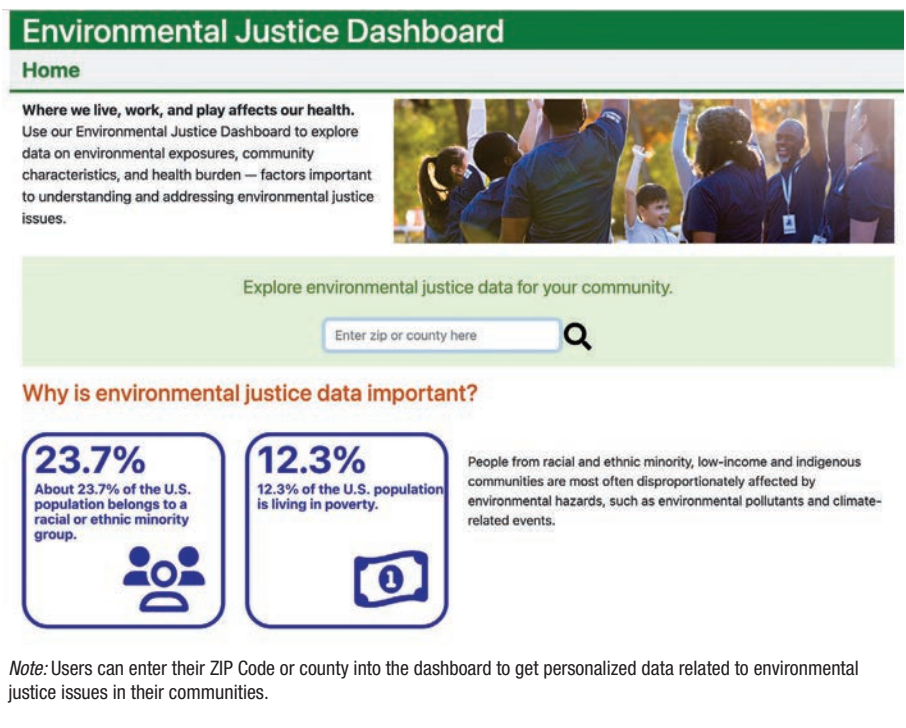
The EJ Dashboard is unique from other data tools because it considers health literacy and incorporates climate change and health outcome data. The bite, snack, meal approach to health communication was used to design the EJ Dashboard. It has easy to digest infographics (bites), alongside maps and contextual information (snacks), that can lead to further research or use of more advanced tools (meals), such as the CDC Data Explorer (Figure 2). This method helps prevent information overload and it gets the right portion of information to the people who need it.

### Using the Environmental Justice Dashboard to Shine a Light on Environmental Justice

The EJ Dashboard is a useful tool to identify community vulnerabilities, such as higher risk for adverse effects of climate change. The information can help inform city and state planning and better allocate resources and efforts to address those vulnerabilities. This information is important when preparing for potential natural disasters such as droughts, hurricanes, and floods. You can view data on

FIGURE 1

### Screenshot of the Environmental Justice Dashboard Home Page



### Resources From the Centers for Disease Control and Prevention

- Environmental Justice Dashboard: <https://ephtracking.cdc.gov/Applications/ejdashboard>
- Data Explorer: <https://ephtracking.cdc.gov/DataExplorer>
- National Environmental Public Health Tracking Network: <https://ephtracking.cdc.gov>

the EJ Dashboard around areas of increased precipitation and flooding, alongside data about impervious (paved) surfaces. Precipitation in areas with highly impervious surfaces can overwhelm sewer systems, which can lead to flooding and potential pollution in drinking water. These data also can be used to better plan city roads and drainage systems in the future.

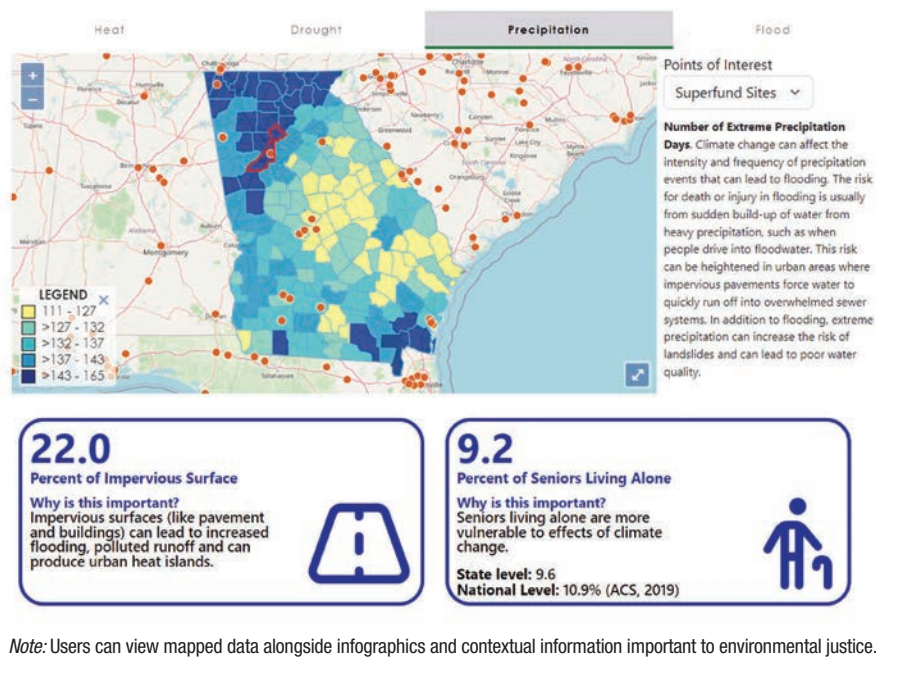
You can also use the EJ Dashboard to inform health policy change. Community stories are compelling and important to share for others to understand the lived experiences of people who live in communities that face environmental injustices. Many organizations, however, also need to supplement their stories with quantitative data. You can use data on the EJ Dashboard to apply for a state or community grant, such as funding for a new park. Data on access to parks, adults reporting “not good” mental health days, and impervious surfaces, for example, can be helpful in writing your grant narrative.

You might also discover information on the EJ Dashboard that you would like to further research. For example, by exploring the EJ Dashboard, you might discover interesting trends in PM<sub>2.5</sub> (outdoor particles associated with air pollution) and asthma in your area. You might ask, “Are there clusters of high PM<sub>2.5</sub> concentration in the same areas where there is a high percent of adults with asthma?” You can also look at other data, such as proximity to parks and other social determinants of health, in your research. All data on the EJ Dashboard are available on the CDC Data Explorer for download and further exploration.

*continued on page 32*

FIGURE 2

### Example of Maps and Infographics Found on the Environmental Justice Dashboard



## ▶ THE PRACTITIONER'S TOOL KIT

# Risk: We Assess It!

**Editor's Note:** The National Environmental Health Association (NEHA) strives to provide relevant and useful information for environmental health practitioners. In a recent membership survey, we heard your request for information in the *Journal* that is more applicable to your daily work. We listened and are pleased to feature this column from a cadre of environmental health luminaries with over 300 years of combined experience in the environmental health field. This group will share their tricks of the trade to help you create a tool kit of resources for your daily work.

The conclusions of this column are those of the authors and do not necessarily represent the official position of NEHA, nor does it imply endorsement of any products, services, or resources mentioned.

Environmental health professionals—including sanitarians, environmental health specialists, environmental health officers, industrial hygienists, safety professionals, environmental protection specialists, and environmental managers, to name a few—are by their very nature risk assessors and risk communicators. All the actions taken during the conduct of an inspection or investigation develop the information used for a risk assessment whether you realize it or not. Depending on your professional position, you could also be considered a risk manager.

Just so we are all on the same page, we begin by defining some risk terms.

- **Hazard** is any physical, chemical, biological, or other agent present in the human environment that could cause human injury, disease, or death.
- **Exposure** is the pathway through which the hazard could come into contact with

the human host, typically through eating, drinking, breathing, or skin absorption.

- **Risk** is the result of the interaction of hazard and exposure. If a substance or condition (due to the amount or potency) does not cause injury, disease, or damage, then there is no risk. Likewise, if there is no possible exposure (due to the absence, containment, or treatment of the substance) there is no risk.

Figure 1 shows the major factors involved in characterizing the risk or threats to the life, health, and safety of human populations.

An example would be an environmental health specialist, we will call them Gerry, who is conducting a routine inspection of a restaurant while working as a food service inspector. During the inspection, Gerry finds a jar of home-canned corn in the stock room, which is a violation of the code. Gerry also notices that the lid on the jar is bulging. Suspecting that this bulging could be the result

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of the growth of *Clostridium botulinum*, Gerry orders the immediate safe destruction of the jar's contents and decontamination of the jar.

If the bulging lid was caused by the production of botulinum toxin, then the contents of the jar were extremely hazardous. As long as the corn and toxin remain safely in the sealed jar, no one would be exposed and therefore there was no risk at that time. If the jar, however, was opened and people consumed the corn and were then exposed to the toxin, the risk is extreme. By destroying the corn and any toxin, Gerry has removed the hazard and thus eliminated the risk. In this example, Gerry has conducted a risk assessment, risk communication, and risk management through the actions taken!

At its simplest level, the primary task of any environmental health professional is to assess the risk to the public of being exposed to a hazard present in their work, home, recreational, or community environments. Increasingly we need to consider the vulnerability of the population potentially affected. That is, some people or populations are more or less susceptible to hazards than are others due to genetics, physiology, lifestyle, socioeconomics, etc. Figure 2 shows how all of these factors work together to characterize risk.

## Risk Assessment

Risk assessment is the systematic, scientific evaluation of potential adverse health effects resulting from human exposures to hazardous agents or situations. Risk assessment can be qualitative or quantitative depending on the type of information used to evaluate the risk. A set of observations that includes sighting of roaches, hazardous food sitting

FIGURE 1

**Classic Characterization of Risk in Environmental Public Health**

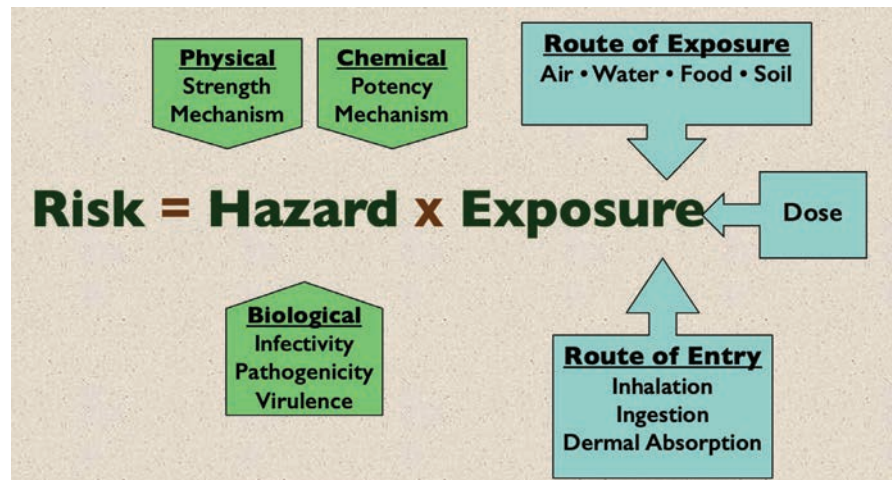
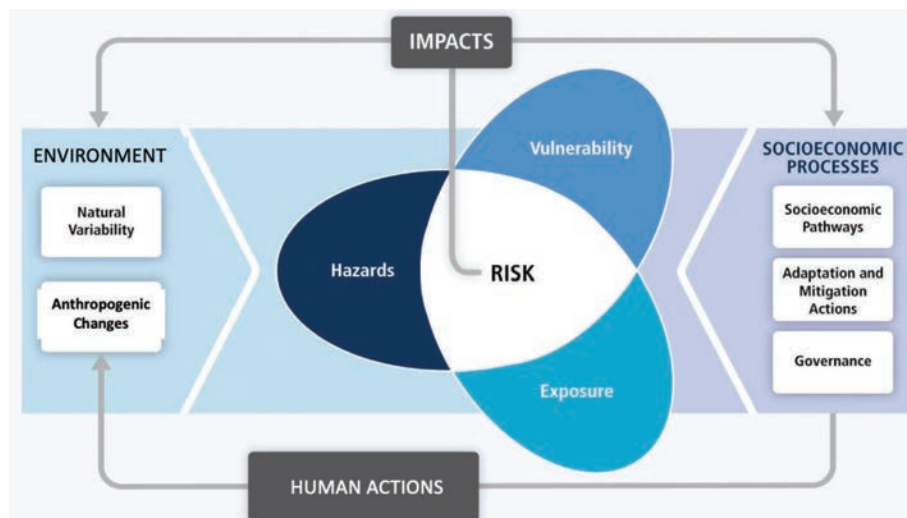


FIGURE 2

**Risk Framework**



*Note.* Adapted from the risk framework presented at the National Institute of Environmental Health Sciences Disaster Research Response (DR2) Workshop held on August 10, 2022, in Seattle, Washington.

on a counter, or an inoperable dishwasher could be used to qualitatively determine that a food service operation has the potential to present a risk to the public health. If soil and groundwater concentrations are used to calculate the additional lifetime cancer risk associated with contaminants found during environmental media sampling, we are then

conducting a quantitative risk assessment. We could be called on to conduct both types of risk assessments.

The observations, measurements, and/or sampling conducted by environmental health professionals are a key part of the risk assessment process. The risk assessment will only be as accurate as the data used to make the

assessment. Therefore, it is incumbent on us to make and record high-quality observations, such as adding a temperature estimate to the observation of the hazardous food sitting on the counter or providing documentation of the roaches with a photograph to enhance the validity of the risk assessment. Selection of the appropriate direct measurements (e.g., temperature) and the documentation of how the measurements were conducted, as well as equipment calibration, time, etc., are necessary. Similarly, the selection of samples to be taken (e.g., water, soil, air, food), the selection of sampling locations (e.g., sampling the water from the kitchen tap or the pressure tank tap), and the number of samples to achieve statistical validity become critical in building the data set required to make a good risk assessment.

**Risk Communication**

Risk communication is the second imperative in dealing with risk. Environmental health professionals must effectively communicate the risk to the potentially exposed population. Communication is an interactive process of exchanging information and opinions on risk among risk assessors, risk managers, and stakeholders. Risk communication can be with individuals, groups, or both. Notice the words “interactive” and “with.” Risk communication involves an exchange of information, answering questions, and being truthful. Proper risk communication messages include the following:

- Uncomplicated language
- Clear statements and recommendations
- Active language
- Cultural sensitivity

Regardless of the risk outcome, it is important to communicate risks to the public. It is also important to communicate what is not known to the public and what is being done about it. Effective risk communication helps to build our professional credibility within the communities we practice.

**Risk Perception**

Risk perception is another important consideration. We need to try to understand how risks could be viewed by the various groups involved in a situation. Risk is perceived by individuals and groups differently based on numerous factors, including prior knowledge and experience with the risk

and trust in the risk communicator and the risk assessment process. Someone who has already had cancer may have less tolerance for an increased lifetime cancer risk than someone who has never experienced cancer. Someone who has had food poisoning may be more outraged by the sanitation failures in a school or hospital kitchen than someone who has not.

It is critical for a risk communicator to be aware of these types of issues when preparing risk communication messages to avoid creating or fueling outrage. The COVID-19 pandemic has certainly taught us lessons about the effects of risk perception on compliance with risk mitigations measures, such

as masking or getting vaccinated, even when the risk communication is effective.

### Risk Management

Risk management is the process of weighing policy alternatives and selecting the most appropriate action by integrating the results of risk assessment with engineering data in addition to social, economic, and political concerns to reach a decision. In some cases, and in some situations, environmental health professionals might also be risk managers. Risk management involves evaluating data from the risk assessment and determining the best approach to address a hazard or exposure issue, taking into account the physical

and societal environment in which the hazard exists.

### Summary

Our job in dealing with any risk to human life, health, or safety comes down to these basic steps:

- Recognize and understand the risk
- Understand who is at risk
- Characterize the risk
- Consider the alternatives
- Consider protective measures
- Communicate the risk
- ACT! 🌸

Contact: toolkit@sanitarian.com.

▶ INTERNATIONAL PERSPECTIVES / SPECIAL REPORT *continued from page 23*

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▶ DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES *continued from page 29*

### Get Involved

The EJ Dashboard from CDC can be used in various ways to inform decision making, help with education, support studies, and even help change policy. How will you use the EJ Dashboard to help supplement environ-

mental justice stories in your environmental health work?

Do you work with national-level data sets that would be good to include on the EJ Dashboard? Let the EJ Dashboard team know at [trackingsupport@cdc.gov](mailto:trackingsupport@cdc.gov). 🌸

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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](http://www.nehspac.org).

### Baylor University<sup>†</sup>

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Note. G = graduate; UG = undergraduate.

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## 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: 77th Interstate Environmental Health Summit in conjunction with the GEHA Annual Educational Conference, Georgia Environmental Health Association (GEHA), Jekyll Island, GA, <https://geha-online.wildapricot.org>

**Illinois**

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

**Indiana**

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

**Nebraska**

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

**North Carolina**

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

**North Dakota**

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

**Oregon**

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

**Texas**

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

**Wisconsin**

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

**TOPICAL LISTINGS****Food Safety**

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

**One Health**

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

**Water Quality**

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

## Did You Know?

World Food Safety Day is held every year on June 7. The United Nations has declared this day as a global observation to draw attention to the health consequences of contaminated food and water. You can learn about the observation and what the Food and Drug Administration is doing to celebrate at [www.fda.gov/food/consumers/world-food-safety-day](http://www.fda.gov/food/consumers/world-food-safety-day). Also, stay tuned to our website at [www.neha.org](http://www.neha.org) for news on what we are doing to celebrate the day!

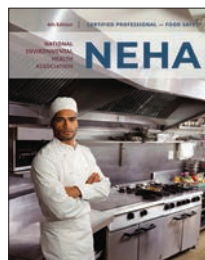
# RESOURCE CORNER

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](http://www.neha.org/store) for additional information about these and many other pertinent resources!



## CP-FS Study Guide (4th Edition)

National Environmental Health Association (2022)



The National Environmental Health Association (NEHA) has released an updated edition of the *Certified Professional–Food Safety (CP-FS) Study Guide*. The fourth edition of the study guide has been updated to the current FDA *Food Code* and includes information and requirements from the Food Safety Modernization Act. It was developed by retail professionals to help

prepare candidates for the NEHA CP-FS credential exam with in-depth content, an examination blueprint, practice test, and many helpful appendices. The study guide is the go-to resource for students of food safety and food safety professionals in both regulatory agencies and industry. Chapters in the new edition include causes and prevention of foodborne illness, HACCP plans, cleaning and sanitizing, facility and plan review, pest control, inspections, foodborne illness outbreaks, sampling food for laboratory analysis, food defense, responding to food emergencies, and legal aspects of food safety. Also now available as an e-book!

358 pages, spiral-bound paperback

Member: \$199/Nonmember: \$229

## Control of Communicable Diseases Manual (21st Edition)

Edited by David L. Heymann, MD (2022)



The 21st edition of the *Control of Communicable Diseases Manual (CCDM)* was updated to include new chapters on SARS-CoV-2, Zika virus, and many other pathogens and infectious diseases. This landmark publication is essential to people working in and around public health. The manual is one of the most widely recognized sourcebooks on infectious diseases and provides detailed, accurate, and informative text for public

health workers. Each listing is easy to read and includes identification, infectious agent, occurrence, mode of transmission, incubation period, susceptibility, and resistance. The CCDM is a study reference for the NEHA Registered Environmental Health Specialist/Registered Sanitarian and Certified Professional–Food Safety credential exams.

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## Management and Supervisory Practices for Environmental Professionals: Basic Principles, Volume I (4th Edition)

Herman Koren and Alma Mary Anderson (2021)



The fourth edition of this bestseller provides up-to-date information for newly promoted or management-aspiring professionals and engineers in the fields of environmental health, occupational health and safety, water and wastewater treatment, public health, and other environmental professions. The book is also an excellent resource for students interested in learning management skills prior to entering

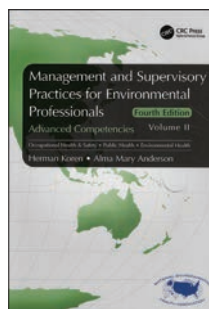
the workforce. Through nine sets of tools, the first volume explains the basic principles supervisors need to understand the structure of their organization, what leadership is, how to effectively plan and budget, how to manage other people, and best practices for achieving success in a management position.

258 pages, paperback

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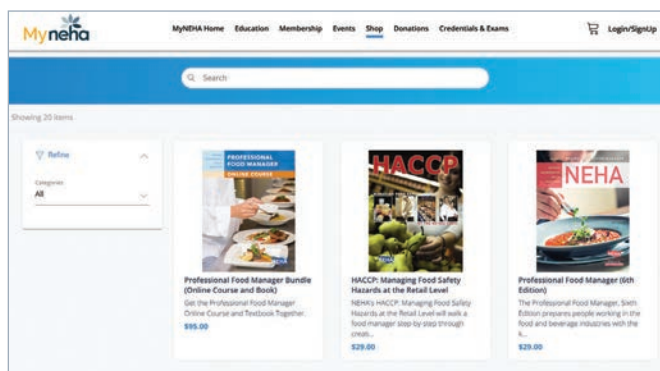
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the workforce. The second volume explains the advanced principles that supervisors need to understand the art of communications and resolving communications problems, as well as the role of supervisors and managers in teaching, counseling, and managing employee performance, health, and safety.

276 pages, paperback

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# SPOTLIGHT ON NEHA RESOURCES: OUR ONLINE STORE



The mission of the National Environmental Health Association (NEHA) is to build, sustain, and empower an effective environmental health workforce. We strive to do that through many different ways—including our Annual Educational Conference (AEC) & Exhibition, advocacy for the profession, webinars and trainings, resources and guides, credentialing, our *Journal of Environmental Health*, and much more. Our online store is also a hidden treasure of resources that can help you further your knowledge and career.

Behind the link to our online store—[www.neha.org/store](http://www.neha.org/store)—is a wealth of resources available (some at no cost to our members). These resources go beyond just books and include a wide variety of items that we have curated for environmental health professionals. We wanted to shine a spotlight on all that is available through our online store. The online store offers several different categories you can explore to find a variety of resources offered.

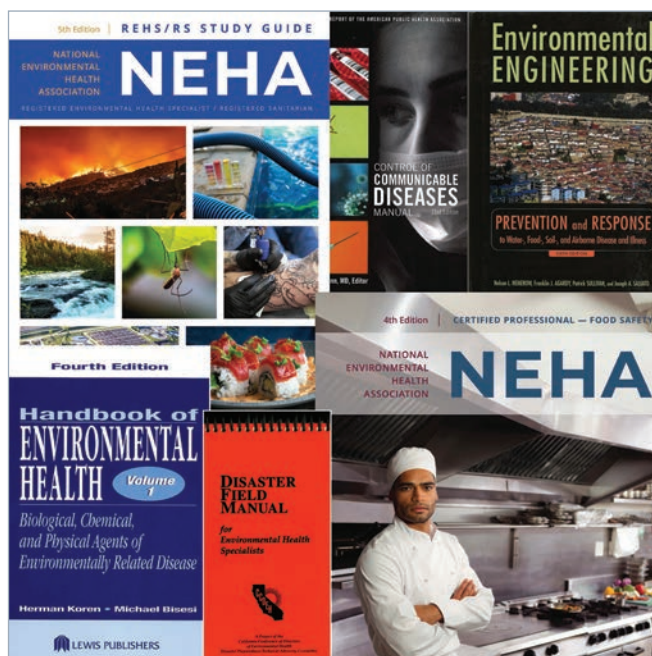
## NEHA Bookstore

Within the NEHA Bookstore category—similar to most traditional online stores—we offer a selection of curated books and study guides that are geared toward helping environmental health professionals prepare for one of our credential examinations. Many of the books offered are recommended references to supplement the study guides we offer. The books are also a valuable resource for personal and health department libraries. And we offer discounted rates for our members on most of the books.

### Resources for Our Credentials

For our credentials, you can find in this category:

- Resources for the Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential, including our recently updated study guide and an online practice exam.



- Resources for the Certified Professional–Food Safety (CP-FS) credential, including our study guide and flash cards, both available in print or electronically.
- The study guide for the Certified in Comprehensive Food Safety (CCFS) credential.

### Other Resources

You can also find valuable food safety resources related to HACCP (hazard analysis critical control point) programs and food manager and food handler certifications. Rounding out the NEHA Bookstore category is a selection of tried and true reference books to help further knowledge in specific areas of environmental health:

- *Handbook of Environmental Health, Volumes 1 and 2:* Covers environmental health factors in the indoor and outdoor environments.
- *Environmental Engineering:* A definitive resource for generations of environmental health and environmental engineering professionals.
- *Control of Communicable Diseases Manual:* Now in its 21st edition, this manual is the most widely recognized reference on public health prevention of infectious diseases.
- *Disaster Field Manual for Environmental Health Specialists:* A recognized and useful field guide for environmental health professionals following a disaster.

## SPOTLIGHT ON NEHA RESOURCES: OUR ONLINE STORE



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### E-Learning

Our E-Learning is an online education platform that contains a library of trainings and webinars that are free to our members and can be used to earn continuing education contact hours toward a NEHA credential. The E-Learning category in our store is where members can peruse and select courses that we offer. Once members check out with their selected courses, instructions are emailed on how to view the courses through our online learning management system. Details about our E-Learning and how it works can be found at [www.neha.org/e-learning](http://www.neha.org/e-learning).

Our most popular E-Learning offerings are the recorded sessions from recent AECs. Currently, members can access recordings from the 2018, 2019, 2021, and 2022 AEC in topic areas including children's environmental health, climate and health, data and technology, emergency preparedness and response, environmental justice, food safety, general environmental health, healthy communities, infectious and vectorborne diseases, water quality, workforce and leadership, and more. Our members can access hundreds of hours of continuing education at their own time and from the comfort of their homes or offices.

### NEHA Partner Courses and Webinars

We also have categories in our store for NEHA Partner Courses and Webinars. These resources are available to anyone and are a part of our E-Learning. You can find courses and webinars on topics including body art, food safety, private wells, radon, recreational waters, vector control, and more. In June 2022, the NEHA-FDA Retail Flexible Funding Model (RFFM) Grant Program hosted the Retail Program Standards Symposium. You can find the recorded sessions from that symposium—with up to 15 hours of continuing education—under the NEHA Webinars category. Also in the NEHA Webinars category is a recent 5-part webinar series we hosted: 2022 Surveillance, Treatment, and Well Testing Approaches for Safe Groundwater and Private Wells.

### Certification Courses

We offer several online certification and credential courses in our store. These online trainings help you prepare for a certification or credential without having to travel or attend an in-person training.

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- Environmental Health and Land Reuse Certificate Program
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Through our online store you can access a variety of HACCP trainings that we have available. The courses are self-paced and include a test after each module. These trainings include:

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- HACCP: Managing Food Safety at the Retail Level

### Journal of Environmental Health



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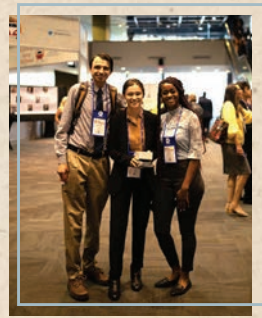
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## IN MEMORIAM

The National Environmental Health Association (NEHA) was saddened to learn of the deaths of the following individuals. We extend our sympathies to the families, friends, and colleagues of these individuals. Each had a profound impact on our profession and the people around them. All will be greatly missed.



### Celeste Davis

Celeste Davis passed away on April 5, 2023. Davis was a citizen of the Chickasaw Nation. She was born in Alaska and grew up in Oklahoma. She was a Registered Environmental Health Specialist/Registered Sanitarian who earned her

bachelor of science in environmental health science from East Central University. She went on to earn a master of public health in occupational and environmental health from the University of Oklahoma. She was working on her doctor of philosophy in health systems management and policy at the Oregon Health & Science University–Portland State University (OHSU–PSU) School of Public Health.

Davis retired from the U.S. Public Health Service (USPHS) Commissioned Corps after a 20-year service career in February 2017. Her last USPHS assignment was as the director of the Division of Environmental Health Services and the emergency management coordinator for the Indian Health Service, Portland Area. During her career, she served 130 tribal jurisdictions and Alaska Native villages through a variety of environmental public health positions in southeastern U.S., Alaska, New Mexico, and the Pacific Northwest.

After retirement from USPHS, Davis joined the Northwest Portland Area Indian Health Board (NPAIHB) as its environmental public health program director in February 2020. She led the establishment and strategic management of the NPAIHB Environmental Public Health Program. She was instrumental to leading the COVID-19 response as the NPAIHB incident commander in service to Northwest Tribes. Her vision and team received the highest American Indian/Alaska Native Environmental Health Recognition Award in 2022 from NEHA in partnership with the Centers for Disease Control and Prevention and Agency for Toxic Substances and Disease Registry. Information about the award-winning program can be found at [www.neha.org/ai-an-awards-2022](http://www.neha.org/ai-an-awards-2022).

When Davis started at NPAIHB in 2020, she stated, “I hope my broad work experience in public health—assessment and inspection, environmental and epidemiological investigations, training, policy development, program and project management, and evaluation—will be valuable to the Tribes of the Pacific Northwest.” She was valuable to NPAIHB, the Northwest Tribes, and the Tribal Nations across Indian Country. Her legacy will continue in tribal environmental public health long into the future.

For people who worked with Davis, they will remember her tenacity, kindness, and tireless advocacy for tribal environmental public health programs. She had a passion and skill for mentoring and developing people to their full potential. As was shared by a close friend, “Where you can, Celeste would want us all to do better and be better to each other.”

Two of Davis’s greatest passions were improving public health service delivery and supporting Native American youth. A memorial fund at OHSU has been established in her name to honor her contributions and memory. The fund has been established to support Native American students pursuing graduate degrees in the OHSU–PSU School of Public Health who are enrolled members of a federally recognized tribe.

Contributions in Davis’s memory can be made at <https://give.ohsufoundation.org/?pid=tribute>. Please select “Other Area” from the “Select Gift Designation” drop-down menu, click on “write in your own,” and enter “In Memory of Celeste Davis.”

Source: CDR Matthew R. Ellis, USPHS, Northwest Portland Area Indian Health Board.

### Vartkes “Vic” Karaian

Vartkes “Vic” Karaian passed away on February 23, 2023, at the age of 94. He was born in Watertown, Massachusetts, and was the son of Armenian immigrants. Karaian graduated from Watertown High School in 1947 and continued his education at Tufts University. He graduated in 1951 with a bachelor of science in chemistry and biology. He earned a master of science in sanitary science and public health from the University of Massachusetts in 1953. Prior to attending and graduating from Tufts University with his second master’s degree in civil engineering, he served 2 years in the U.S. Army as a preventative medicine technician during the Korean War.

Karaian was employed by the state of Massachusetts as a registered sanitarian engineer. He worked for the Massachusetts Department of Public Health, followed by the Massachusetts Department of Environmental Quality Engineering, and ended his career with the Massachusetts Department of Environmental Protection in 1992. He was one of the pioneers in developing safe food handling processes and procedures for Massachusetts. After retirement, he remained active as an environmental public health consultant. He was particularly interested in all matters relative to solid waste management in Massachusetts and the surrounding region.

Throughout his career, Karaian was the recipient of many awards, including Dr. Joseph S. Goldfarb Award in 1979 from the Massachusetts Environmental Health Association (MEHA). The award recognized his exemplary service and achievement in the professional practice of environmental and public health in Massachusetts. He received the Curtis M. Hillard Award in 1992 for outstanding achievement in public health and the Robert C. Perriello Memorial Award in 1993 in the field of environmental health. Vartkes also received the Governor’s Citation in 2008 in recognition of the 37 years he dedicated to the Massachusetts Board of Sanitarians.

# IN MEMORIAM

Karaian had strong ties to MEHA and served as president of the association from 1963–1964. In 1997, MEHA created an award in his name to honor his dedication and longstanding service. The award recognizes an individual, organization, or agency for outstanding contributions to and support of the practice of environmental health in Massachusetts. Karaian was the first recipient of the award, which continues to be awarded annually by MEHA.

Source: Vartkes “Vic” Karaian obituary, [www.giragosianfuneral-home.com/obituary/vartkes-vic-karaian](http://www.giragosianfuneral-home.com/obituary/vartkes-vic-karaian)



## Richard K. Rowe

Richard K. Rowe passed away on April 8, 2023. Born on January 11, 1945, in Limestone, Tennessee, he worked on his family’s dairy farm until he earned his undergraduate degree from East Tennessee State University. After graduation, Rowe was

commissioned as an officer in the U.S. Army and served as a ranger with the 82nd Airborne in Vietnam where he earned a Purple Heart. After his military service, he returned to East Tennessee State University and obtained his master’s degree in environmental health.

His career in environmental health started at the South Carolina Department of Health and Environmental Control. In 1989 he was promoted to the position of environmental health director in Raleigh, North Carolina. He finished his professional career as the director of environmental services for Wake County, North Carolina, where he retired in 2007.

Rowe was an active member of NEHA. He was a lifetime member and joined NEHA in 1972. He went on to be a regional vice-president for 4 years and was elected as a national officer in 1981. He served as the president of NEHA from 1984–1985. Rowe was also the recipient of the Walter S. Mangold Award in 1988, the highest honor bestowed by NEHA.

Rowe was a strong leader. He understood the challenges environmental health professionals faced but did not allow those challenges to deter his work or diminish his passion. Further, he was a strong believer in the collective power of the people within the profession and of NEHA’s potential. This belief was demonstrated in his final President’s Message column in the May/June 1985 issue of the *Journal of Environmental Health*: “I do know we have a lot of problems but I don’t see any of them as insurmountable if we work on them as a group. Attacking separately means we do not have coordination nor do we have direction to our final accomplishments. Environmental health people nationwide will have to band together, synchronize, communicate, and promote as a unified organization. The National Environmental Health Association is the forum in which all of these things can be carried to fruition.”

After retirement, Rowe was active in his community, providing leadership to several different local boards and associations. He was also a faithful member of Washington Street United Methodist Church, serving on numerous committees and cofounding the Active Faith Ministry.

Rowe dedicated his life to service—whether it was farming, protecting the environment, fighting to preserve freedom, enriching the community, or ensuring that each individual be afforded basic human rights.

Source: Richard Keith Rowe obituary, [www.dignitymemorial.com/obituaries/columbia-sc/richard-rowe-11239424](http://www.dignitymemorial.com/obituaries/columbia-sc/richard-rowe-11239424). Photo courtesy of Andre Pierce.



## Janet Williams

Janet Williams passed away on February 21, 2023, at the age of 66. Her career in environmental public health spanned more than 30 years at local, state, and federal levels. She began her career as a field investigator in Kansas City, Missouri, and went on to ascend to a leadership position as the district supervisor. In this position she managed staff who were responsible for enforcing

local regulations. Williams then accepted a supervisory environmental public health specialist position for the state of Missouri and managed staff who were responsible for conducting contract Food and Drug Administration (FDA) inspections, administering comprehensive and statewide environmental activities and programs, and training local regulators within five eastern Missouri counties.

Williams went on to work as the division director for the Environmental Protection Division within the St. Louis County Department of Health. She led a division of five branches with over 125 employees and managed an annual budget of over \$18 million. She managed, organized, planned, directed, and coordinated an array of environmental programs. Williams also provided fiscal stewardship for general revenue funds, permit fees, and contracts and grants for operational programs in air quality, food inspections, milk and dairy, solid waste, recycling, lead, healthy homes, vector control, animal control, and rodent control.

The next step in her career was with FDA. Williams served in various positions within FDA in support of the Office of Training, Education, and Development (OTED) with the Office of Regulatory Affairs (ORA), namely the Division of Programmatic Training. She has served as a training specialist, branch manager, and was promoted to division director in 2020. She had an unwavering dedication to the mission and strategic goals of FDA, a gift for partnering across ORA and FDA, and a keen aptitude for coordinating efforts to provide high-quality learning opportunities to not only FDA staff but also state, local, tribal, and territorial partners.

Williams was a member of NEHA for over two decades and earned her Registered Environmental Health Specialist/Registered Sanitarian

## IN MEMORIAM

credential in 2007. She was a graduate of the Environmental Public Health Leadership Institute from the Centers for Disease Control and Prevention. She was a frequent presenter at numerous conferences, including the NEHA Annual Educational Conference & Exhibition, where she drew in large crowds with her storytelling ability, passion for environmental health, and desire to share her knowledge.

Outside of work, Williams enjoyed spending time with her two daughters, loved to travel, and especially enjoyed cruises. She loved all things cooking, including exploring new recipes, spices, or watching the *Food Network*. She had a passion for mentoring the people around her and imparting her knowledge regardless of if you knew her for 5 seconds or for 5 years. Williams had a great sense of humor, a zest for life, and would always garner a crowd with her storytelling abilities about her real-life experiences.

Words from the in memoriam released by FDA provide a good picture of who Williams was and her impact: “Janet Williams was a force—there were no strangers for Janet. She could spark conversations with anyone and sought to nurture those around her. Above all, Janet was a dear colleague and friend to many. Her

quick wit, intellect, and humor will be missed by all who knew and held her dear.”

A kudoboard ([www.kudoboard.com/boards/V4f4fw9](http://www.kudoboard.com/boards/V4f4fw9)) was created to share thoughts, pictures, and videos in memory of Williams, which will be shared with her family. Memorials can be made in her name to Casey House at the Montgomery Hospice at <https://montgomeryhospice.org/donate-now/>.

Sources: Janet D. Williams obituary, [www.baue.com/obituaries/janet-williams](http://www.baue.com/obituaries/janet-williams); In memoriam and internal announcements, OTED/FDA. ❁

*Editor's Note:* If you would like to share information about the passing of an environmental health professional to be mentioned in a future In Memoriam, please contact Kristen Ruby-Cisneros at [kruby@neha.org](mailto:kruby@neha.org). The *Journal* will publish the In Memoriam section twice a year in the June and December issues, or in other issues as determined appropriate.

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## NEHA 2023 General Election Results

Elections are a critical part of the democratic process and are one way in which members have a voice in the running of the National Environmental Health Association (NEHA). Voting members of NEHA have an opportunity to vote for candidates of contested board of directors and regional vice-president positions, as well as cast votes regarding proposed Articles of Incorporation and Bylaws changes. National officers of the NEHA Board of Directors serve a 1-year term in each officer position (second vice-president, first vice-president, president-elect, president, and immediate past-president) for a total of 5 years. Regional vice-presidents (RVPs) serve 3-year terms.

Eligible voters were encouraged to vote during the month of March and the deadline to vote was March 31, 2023. The following are results from the 2023 general election.

### Second Vice-President

There was one qualified candidate for the second vice-president position: Scott Holmes, MS, REHS. Holmes will assume the second vice-president position at the close of the NEHA 2023 Annual Educational Conference (AEC) & Exhibition. As a national officer, Holmes will serve a 5-year term that progresses through the national officer positions and will serve as NEHA president in 2026–2027.

### Regional Vice-Presidents

Our membership is broken down into nine regions that represent U.S. geographic areas, as well as members in the U.S. military and abroad. The terms of three RVP positions expire in 2023—Region 1: Bill Emminger; Region 5: Traci (Slowinski) Michelson; and Region 7: Tim Hatch.

Regions 5 and 7 each had one eligible candidate and did not appear on the election ballot. There were two candidates for Region 1 and our voting members within that region were provided an election ballot to select a candidate. The unopposed candidates in Regions 5 and 7 and the winner of the Region 1 election will assume their RVP roles at the close of the 2023 AEC. Their terms will expire in 2026:

- Region 1: Bill Emminger (represents Alaska, Idaho, Oregon, and Washington);
- Region 5: Jaime Estes (represents Arkansas, Kansas, Louisiana, Missouri, New Mexico, Oklahoma, and Texas); and
- Region 7: M.L. Tanner (represents Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee).

A listing of our current national officers and RVPs, along with state breakdowns for each region, can be found on page 38. More information about our governance, including our Articles of Incorporation and Bylaws, the election process, and associated deadlines, is available at [www.neha.org/election-process](http://www.neha.org/election-process).

Thank you to all members who participated in the 2023 election!

## Raise Awareness of Local Food Safety

You know more than anyone how important food safety is to the health and economy of a community. That is why the Retail Food Safety Regulatory Association Collaborative is sharing its Food Safety Heroes Campaign with you.

The campaign aims to raise awareness about the value and importance of food safety and food safety professionals by telling food safety stories from local experts across the country. In April, the Collaborative partners started to share video stories across social media. In addition, the Collaborative will be gathering signatures on an open letter that highlights the important work of food safety professionals and calls for support of local health departments. This open letter will become available on the Collaborative website ([www.retailfoodsafetycollaborative.org](http://www.retailfoodsafetycollaborative.org)) to use as a tool when discussing the importance of your work with decision makers in your community.

You are invited to share the videos and messages widely with your local communities, including leaders and decision makers. Visit [www.retailfoodsafetycollaborative.org/food-safety-heroes](http://www.retailfoodsafetycollaborative.org/food-safety-heroes) to watch the videos, sign the letter, and share the message!

## NEHA Releases Best Practice Guide for SAFE-D

Each of the more than 3,000 environmental public health programs across the country collects and manages aquatic information differently. The Standard for Aquatic Facility Environments—Data (SAFE-D) model is a standardized format for publishing aquatic facility inspection information across jurisdictions consistently. The design is based on the critical fields within the Model Aquatic Health Code ([www.cdc.gov/mahc](http://www.cdc.gov/mahc)) and a scan of more than 1,000 environmental health agency inspections. The model has already been tested in four demonstration sites.

The SAFE-D model allows jurisdictions to accurately share and compare aquatic facility inspection data from numerous agencies to:

- make informed decisions,
- share data with your community, and
- advocate for support using data.

Learn more about SAFE-D and access the best practice guide at [www.neha.org/safe-d-best-practices-guide](http://www.neha.org/safe-d-best-practices-guide).

## New Tool Kit Focuses on Top Contaminants in Private Wells

Our new Private Well Contaminant Treatment Tool Kit includes fact sheets for each of the five leading private well contaminants: arsenic, nitrates and nitrites, lead, coliform bacteria, and radon. Each fact sheet describes the health risks posed by these contaminants and the recommended treatments.

You can share the link to the tool kit or print the fact sheets to share with your community and private well owners. This resource was developed in collaboration with the Rural Community Assistance Partnership. View the tool kit at [www.neha.org/private-drinking-water](http://www.neha.org/private-drinking-water).

## NEHA NEWS

**NEHA Government Affairs Updates**

Doug Farquhar, JD ([dfarquhar@neha.org](mailto:dfarquhar@neha.org))

**Recent Activities in Washington, DC**

Doug Farquhar, our director of Government Affairs, visited the office of Representative Robert Aderholt (R-AL). Photo courtesy of Doug Farquhar.

We have been busy advocating for the environmental health profession. Here is a summary of our continued work to promote the interests of our members and the environmental health workforce.

*Meeting With Leadership From the Food and Drug Administration*

We were in our nation's capital the first week of April visiting the Food and Drug Administration (FDA) headquarters in White Oak, Maryland. Executive

Director Dr. David Dyjack, Director of the Entrepreneurial Zone Rance Baker, Director of Government Affairs Doug Farquhar, and Past President Bob Custard had a lengthy meeting with FDA Commissioner Dr. Robert Califf and Principal Deputy Commissioner Dr. Janet Woodcock to discuss retail food safety and the environmental health workforce.

The meeting began as an overview of retail food safety but soon expanded as Dr. Califf and Dr. Woodcock had many questions as to how retail food safety operates at the local level and its relationship with FDA. They were pleased to hear how effective the NEHA-FDA Retail Flexible Funding Model Grant Program operated and the effectiveness of both the FDA model *Food Code* and Voluntary National Retail Food Regulatory Program Standards.

We addressed certain concerns regarding FDA, emphasizing that:

- Retail food safety is performed by state, local, tribal, and territorial agencies.
- The FDA food safety system promotes public health.
- A strong, qualified environmental health workforce is necessary to meet the public health mandate around food and human food needs.

We agreed to work together to advance the joint goal of improving retail food safety in this country.

*Promoting the Environmental Health Workforce Before Congress*

Farquhar also visited Congress in early April to promote the inclusion of the environmental health workforce within the Public Health Workforce Loan Repayment Program.

The Inflation Reduction Act passed last year included a student loan repayment provision for public health workers. The law is being implemented by the Health Resources and Services Administration (HRSA). HRSA has the ability to include the environmental health workforce within this loan repayment,

but there are no assurances that HRSA will cover environmental health workers.

We visited the offices of Representatives Rosa DeLauro (D-CT), Andy Harris (R-MD), Robert Aderholt (R-AL), and Mariannette Miller-Meeks (R-IA) to discuss this concern and to request that they agree to sign-on to a letter we are circulating to HRSA Administrator Carole Johnson.

We also visited David Reynolds of the U.S. Senate Committee on Health, Education, Labor, and Pensions. The committee oversees the U.S. Department of Health and Human Services and is very concerned about student loan forgiveness and workforce issues. He was very appreciative of our insights into the environmental health workforce.

*Submitting Testimony to Senate Appropriations*

We also submitted testimony in March to the Senate Appropriations Subcommittee, which has jurisdiction over FDA. The message we advocated was that retail food safety is performed by state, local, tribal, and territorial environmental health agencies, the FDA food safety system promotes public health, and a strong and qualified environmental health workforce is necessary to meet the public health mandate around food and human food needs. Corresponding testimony will be submitted to the House Subcommittee as well.

Read the entire blog of our recent activities in Washington, DC, at [www.neha.org/meeting-with-fda-commissioner](http://www.neha.org/meeting-with-fda-commissioner).

**Updates on Legislation**

We recently posted summaries of state legislation introduced so far in 2023 related food safety and climate change and health.

*Food Safety Legislation*

At the halfway point of the 2023 state legislative sessions, 161 bills have been introduced regarding food. The bills cover topics such as cannabis in food, raw milk and dairy, food delivery, food donation, food safety, retail food, manufactured food, meat production, food freedom, nutrition, food deserts, and mobile food delivery. Visit [www.neha.org/2023-state-food-safety-legislation](http://www.neha.org/2023-state-food-safety-legislation) for a summary of enacted legislation, as well as a breakdown of the bills by topic area.

*Climate Change and Health Legislation*

There are approximately 70 bills in the state legislatures addressing climate change and health. Bills have been introduced in the states of Alaska, Arizona, California, Colorado, Connecticut, Hawaii, Illinois, Louisiana, New Jersey, New Mexico, New York, and Washington.

Currently, 13 of the bills have failed, none have passed, and the rest remain pending. California and Connecticut had the most bills (13 and 12, respectively), while Louisiana, New Hampshire, and New Jersey had only one bill. Bill topics include climate resiliency, zero-emission vehicles, carbon pricing markets, and climate response, among others. Details on each state's legislation is posted at [www.neha.org/2023-climate-change-health-legislation](http://www.neha.org/2023-climate-change-health-legislation). ❁



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