Occupational Health and Safety Issues Faced by Environmental Health Officers

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Environmental health officers are exposed to various physical, chemical, biological, and psychosocial hazards as frontline public health professionals. These exposures to workplace hazards, however, can be overlooked. This month’s cover article, “Occupational Health and Safety Issues Faced by Environmental Health Officers: A Perspective From Western Australia,” surveyed environmental health officers about occupational health and safety hazard concerns in the workplace, job demands, workplace violence, and physical demands in the workplace. Environmental health officers perceive themselves as being at risk of exposure to a range of workplace hazards, with the ones of most concern being workplace stress; workplace violence; sharps injury; and slips, trips, and falls. This study provides useful preliminary information in understanding occupational health and safety issues in the environmental health profession. While more research is warranted, this study can help inform guidance and strategies to better protect environmental health professionals.

See page 20.

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- Health Risks Associated With the Use of Water Mist Systems as a Cooling Intervention in Public Places
- Use of an Environmental Swabbing Strategy to Support a Suspected Norovirus Outbreak Investigation at a Retail Food Establishment

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I would like to start this column by acknowledging the members of the National Environmental Health Association (NEHA). Thank you for your continued membership. Throughout 2020, membership numbers remained strong at around 6,500, which is a testament to your dedication to the field of environmental health. In addition to the support of our members, we have been noticing a change in the membership that is significant.

Based on observations of the attendees at the NEHA Annual Educational Conference & Exhibition in 2019 (Nashville, Tennessee), 2018 (Anaheim, California), and 2017 (Grand Rapids, Michigan), we recognize that NEHA members come from a variety of backgrounds and ethnicities. We also recognize an increase in the number of women working in the environmental health profession. It is important that we celebrate our diversity, equity, and inclusiveness of the profession.

As we look at some of the leaders and innovators of the profession, we acknowledge that the environmental health profession not only continues to evolve but also welcomes contributions from all disciplines of the profession without prejudice.

Many events in 2020 have reminded us that diversity, equity, and inclusion (DEI) are not just “nice” initiatives or boxes to be check off on a “to-do list,” but rather, they are goals we should strive for. DEI is multifaceted and understanding how each element builds upon the other is important.

Diversity is the presence of differences, specifically differences in race, ethnicity, gender, gender identity, sexual orientation, age, and socioeconomic class, just to name a few. Diversity allows for people from different backgrounds and varying experiences to provide new perspectives that contribute to developing and refining ideas and processes.

Equity is the act of ensuring impartiality, fairness, and equal possible outcomes for everyone. To ensure equal possible outcomes, equity requires that there be recognition of barriers and advantages. In this manner, these barriers and advantages can be addressed and overcome.

Inclusion ensures that people feel a sense of belonging, which means that everyone feels comfortable and supported when it comes to being authentically themselves. Inclusion is what maintains diversity. If a person does not feel included, they will leave.

DEI promotes diverse perspectives to be heard while valuing individual differences and promoting values that minimize bias. My hope is that all NEHA members feel heard and included, and are treated equitably.

More than ever right now, with significantly changing demographics, DEI should be practiced. As we look at our workplaces, coworkers, and communities, we should strive to eliminate bias, practice inclusiveness, support diversity, and exert leadership. DEI can be reflected in mission and vision statements and incorporated in strategic plans.

When it comes to DEI, it is important to practice basic courtesy and pay attention to how you embrace nondiscriminatory practices and policies. Everyone should feel safe to voice their concerns and opinions without criticism or discrimination, which are elements that divide and destroy. As leaders, we need to help create safe environments for ideas, opinions, and points of view to be heard, as well as foster collaboration. Differences allow for creative thought, new ideas, new strategies, and new processes to be developed.

NEHA is dedicated to DEI, which means we are dedicated to efforts to create a welcoming, equitable environment that allows people of different backgrounds to succeed. Organizations progress if DEI exists. NEHA’s newest award, the Dr. Bailus Walker, Jr. Diversity and Inclusion Awareness Award, celebrates an individual or group who has made significant achievements in the development or enhancement of a diverse, inclusive, and competent environment. Dr. Walker was a long-time member and supporter of NEHA who wrote and spoke on public health, toxicology, and diversity in the field of environmental health.

Through my career I have experienced and witnessed the changes taking place in the environmental health profession. Without the diversity of creative minds, inclusion
allows ideas to be expressed, and equity to be heard, so many of the processes and procedures we currently use—in food safety, emergency management, water, stormwater, public health, and other areas of environmental health—would not have progressed or changed.

Looking at DEI, I am proud and support all the women who have pursued environmental health as a career. Women are a growing part of all areas of the environmental health workforce, a workforce that has historically been mostly male.

As I close this column, I would like to put an “inclusion” thought in your mind. Please consider running for positions within the NEHA Board of Directors. Each August we begin the process of nominating members for open positions on the board. Members interested in participating on the board are encouraged to contact NEHA. My experience on the board has been a rewarding experience both professionally and personally. I have had the opportunity to represent members, participate in NEHA Hill Days in our nation’s capital, and make contributions to the profession.

I leave you with the following quote from Pat Wadors, former head of human resources at LinkedIn: “When we listen and celebrate what is both common and different, we become a wiser, more inclusive, and better organization.”

President@neha.org

Thank you.

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Sophia P. Boudinova
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D. Gary Brown
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Sandra Long
John A. Marcello
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Priscilla Oliver
Larry A. Ramdin
Matthew Reighter
Michélle Saranya-Timm
William Scott
Jill M. Shugar
Jacqueline Taylor
Anthony Tovarek
Linda Van Houten
Sandra Whitehead

21st CENTURY CLUB ($500–999)
Name submitted in drawing for a free 1-year NEHA membership and name in the Journal for 1 year.
Amer El-Ahraf
Ned Therlen
Leon F. Vinci

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Name submitted in drawing for a free 2-year NEHA membership and name in the Journal for 1 year.
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Brian K. Collins
Harry E. Grenawitzke
George A. Morris
Robert W. Powitz
Peter H. Sansone
Walter P. Saraniecki
Peter M. Schmitt
James M. Speckhart

AFFILIATES CLUB ($2,500–4,999)
Name submitted in drawing for a free AEC registration and name in the Journal for 1 year.
Robert W. Custard
David T. Dyjak

EXECUTIVE CLUB AND ABOVE (>=$5,000)
Special invitation to the AEC President’s Reception and name in the Journal for 1 year.
Vincent J. Radke
Evaluating the Impact of Food Safety Training: A Look at the Self-Analysis for Food Excellence Program

Danny Ripley
Metro Public Health Department of Nashville/Davidson County
Caleb Wiedeman, MPH
Craig Shepherd, MPH, REHS/RS, DAAS
Douglas J. Irving, MPH
Tennessee Department of Health

Abstract
Understanding basic food safety is essential to preparing and serving safe food. The Self-Analysis for Food Excellence (SAFE) program was developed to promote food safety and improve restaurant sanitation scores in Nashville and Davidson County, Tennessee. SAFE is a food safety training program emphasizing high-risk food practices from receiving to service. The program was offered to restaurants that had performed poorly on routine food service inspections. Restaurant management and key personnel were encouraged to participate in SAFE.

To assess the effectiveness of SAFE, we compared participating restaurants to nonparticipating restaurants with similar food service inspection performance during 2009–2010 in Nashville and Davidson County. We evaluated and analyzed inspectional observations before and after SAFE training. While both groups improved their food safety inspection performance, no statistically significant differences regarding critical violations were noted between restaurants that participated in the SAFE program and restaurants that did not. This study, however, does not account for regulatory impact or other variables that could provide more clarity in the results of food safety training.

Introduction
According to the Centers for Disease Control and Prevention (CDC), every year foodborne pathogens infect 1 in 6 people in the U.S. and cause an estimated 3,000 deaths (Scallan et al., 2011). In addition, approximately 900 foodborne illness outbreaks are reported annually in the U.S. It is estimated that 60% of these outbreaks are associated with food prepared in a restaurant (Dewey-Mattia et al., 2017). Reducing foodborne illness by just 10% would prevent 5 million people in the U.S. from getting sick each year and result in significant healthcare cost savings, as foodborne illness is estimated to cost $15.6 billion each year (Centers for Disease Control and Prevention [CDC], 2020).

Public health agencies across the U.S. incorporate regulatory food service inspections as a tool to help promote food safety. In addition, most public health agencies are tasked with providing food safety training—a widely recognized and significant component of a food protection program. According to CDC, food safety training is an integral part of public health strategy for communicating and promoting food safety (CDC, 2018).

In Tennessee, regulations for food service establishments are written and adopted into law by the Tennessee Department of Health and enforced throughout the state. All Tennessee Department of Health regions and the five contract counties, including Davidson County (Nashville), employ personnel to enforce food regulations within their respective jurisdictions.

At the time of this study, the population in Nashville and Davidson County was approximately 601,222 with >4,200 licensed food establishments. Additionally, food regulations were based on the 1976 Food and Drug Administration (FDA) Food Code model. These regulations did not require food safety training for restaurant staff or demonstration of knowledge by a designated person in charge. Recognizing this gap in regulations, the Metro Public Health Department of Nashville/Davidson County developed the Self-Analysis for Food Excellence (SAFE) program. Funding by the CDC Environmental Health Specialists Network (EHS-Net) cooperative agreement provided personnel to facilitate this program. EHS-Net is a network of environmental health specialists and epidemiologists focused on investigating environmental factors that contribute to foodborne illness. EHS-Net is a collaborative project of the CDC, FDA, U.S. Department of Agriculture, and state and local health departments.

Methods
The SAFE program consisted of classroom and field training provided to food establishments located within Nashville and Davidson County. All training emphasized risk factors for foodborne illness as defined by CDC (Olsen et al., 2000). These risk fac-
titors included approved food sources, food temperature control, employee hygienic practices, ill employee exclusion, and cross-contamination prevention.

Classroom training was prescheduled once a month at the Nashville and Davidson County Metro Public Health Department. Class was limited to a 2-hr duration and scheduled from 8:30–10:30 a.m. to facilitate participation. Participants were not limited to the number of classes they could attend. Monitoring and training documents, including temperature, hand washing, and sanitizing logs, were provided to participants during SAFE classroom training. In addition, a reporting policy for ill workers and self-assessment worksheets were provided.

One field training exercise was scheduled within 2 weeks of SAFE classroom training at

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### Retail Food Service Establishment Score Sheet With Critical Items and Misdemeanor Violations

**Critical Items Require Immediate Attention**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*01</td>
<td>Source, sound condition, no spillage</td>
<td>5</td>
</tr>
<tr>
<td>02</td>
<td>Original container, properly labeled</td>
<td>1</td>
</tr>
</tbody>
</table>

**FOOD PROTECTION**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*03</td>
<td>Potentially hazardous food meets temperature requirements during storage, preparation, service, transportation</td>
<td>5</td>
</tr>
<tr>
<td>*04</td>
<td>Facilities to maintain product temperature</td>
<td>4</td>
</tr>
<tr>
<td>05</td>
<td>Thermometers provided and conspicuous</td>
<td>1</td>
</tr>
<tr>
<td>06</td>
<td>Potentially hazardous food properly thawed</td>
<td>2</td>
</tr>
<tr>
<td>*07</td>
<td>Unwrapped potentially hazardous food not reserved, cross-contamination prevented: damage/detained food segregated</td>
<td>4</td>
</tr>
<tr>
<td>08</td>
<td>Food protection during storage, preparation, display service, transportation</td>
<td>2</td>
</tr>
<tr>
<td>09</td>
<td>Handling of food (ice) minimized</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>In-use food (ice) dispensing utensils properly stored</td>
<td>1</td>
</tr>
</tbody>
</table>

**PERSONNEL**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*11</td>
<td>Personnel with infections restricted</td>
<td>5</td>
</tr>
<tr>
<td>*12</td>
<td>Hands washed and clean, good hygienic practices</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>Clean clothes, hair restraints</td>
<td>1</td>
</tr>
</tbody>
</table>

**FOOD EQUIPMENT AND UTENSILS**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Food (ice) contact surfaces designed, constructed, maintained, installed, located</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>Non-food (ice) contact surfaces designed, constructed, maintained, installed, located</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Dishwashing facilities designed, constructed, maintained, installed, located, operated</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>Accurate thermometers, chemical test kits provided, gauge cock [1/4 in. PSI valve]</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>Preflushed, scraped, soaked</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>Wash, rinse water clean, proper temperature</td>
<td>2</td>
</tr>
<tr>
<td>*20</td>
<td>Sanitization rinse clean, temperature, concentration, exposure time, equipment utensils sanitized</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>Wiping cloths clean, used, restricted</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>Food contact surfaces of equipment and utensils clean, free of abrasives, detergents</td>
<td>2</td>
</tr>
<tr>
<td>23</td>
<td>Nonfood contact surfaces of equipment and utensils clean</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>Storage, handling of clean equipment and utensils</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>Single-service articles, storage, dispensing</td>
<td>1</td>
</tr>
<tr>
<td>26</td>
<td>No re-use of single service articles</td>
<td>2</td>
</tr>
</tbody>
</table>

**WATER**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*27</td>
<td>Water source, safe, hot and cold under pressure</td>
<td>5</td>
</tr>
</tbody>
</table>

**Other Operations**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*41</td>
<td>Toxic items properly stored, labeled, used</td>
<td>5</td>
</tr>
<tr>
<td>42</td>
<td>Premises maintained free of litter, unnecessary articles, cleaning maintenance equipment properly stored, authorized personnel</td>
<td>1</td>
</tr>
<tr>
<td>43</td>
<td>Complete separation of living and sleeping quarters, laundry</td>
<td>1</td>
</tr>
<tr>
<td>44</td>
<td>Clean, soiled linen properly stored</td>
<td>1</td>
</tr>
</tbody>
</table>

**Administrative**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*45</td>
<td>Current permit posted</td>
<td>0</td>
</tr>
<tr>
<td>*46</td>
<td>Most current inspection report available</td>
<td>0</td>
</tr>
</tbody>
</table>

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### Table 1

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
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<td>2</td>
</tr>
<tr>
<td>10</td>
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<td>1</td>
</tr>
</tbody>
</table>

**SEWAGE**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*28</td>
<td>Sewage and wastewater disposal</td>
<td>4</td>
</tr>
</tbody>
</table>

**PLUMBING**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>Installed and maintained</td>
<td>1</td>
</tr>
<tr>
<td>*30</td>
<td>Cross-connection back siphonage, backflow</td>
<td>5</td>
</tr>
</tbody>
</table>

**TOILET AND HAND-WASHING FACILITIES**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*31</td>
<td>Number, convenient, accessible, designed, installed</td>
<td>4</td>
</tr>
<tr>
<td>32</td>
<td>Toilet rooms enclosed, self-closing doors, fixtures in good repair, clean, hand cleaner, sanitary towels, hand drying devices provided, proper waste receptacles</td>
<td>2</td>
</tr>
</tbody>
</table>

**GARBAGE AND REFUSE DISPOSAL**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Containers or receptacles, covered, adequate number, insect and rodents proof, frequency, clean</td>
<td>2</td>
</tr>
<tr>
<td>34</td>
<td>Outside storage areas enclosures properly constructed, clean, controlled incineration</td>
<td>1</td>
</tr>
</tbody>
</table>

**INSECT, RODENT, ANIMAL CONTROL**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>*35</td>
<td>Presence of insects and rodents, outer openings protected, no birds, no turtles, no other animals</td>
<td>4</td>
</tr>
</tbody>
</table>

**FLOORS, WALLS, & CEILING**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Floors, constructed, drained, clean, good repair, covering, installation, dustless cleaning methods</td>
<td>1</td>
</tr>
<tr>
<td>37</td>
<td>Walls, ceiling, attached equipment, constructed, good repair, clean surfaces, dustless cleaning methods</td>
<td>1</td>
</tr>
</tbody>
</table>

**LIGHTING**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>Lighting provided as required, fixtures shielded</td>
<td>1</td>
</tr>
</tbody>
</table>

**VENTILATION**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>Rooms and equipment: vented as required</td>
<td>1</td>
</tr>
</tbody>
</table>

**DRESSING ROOMS**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>WT</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Rooms clean, lockers provided, facilities clean, located</td>
<td>1</td>
</tr>
</tbody>
</table>

---

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each participating establishment. This training emphasized the identification, monitoring, and control of risk factors for foodborne illness. Both general and site-specific food safety opportunities were addressed. Reports from past inspections were reviewed with management and key personnel. Additionally, monitoring tools provided during classroom training were discussed during field training.

All training was conducted by the same environmental health specialist who was standardized according to the FDA Procedures for Standardization of Retail Food Safety Inspection Personnel (Food and Drug Administration, 2020). All SAFE training was provided free of charge to encourage participation.

Establishments that scored below 70 on a routine inspection during 2009 and 2010 were included in this study. Among these locations, two study groups were formed: establishments that participated in SAFE and establishments that did not. These study groups were compared based on three routine unannounced inspections occurring after the initial routine inspection that scored below 70. Data for the three subsequent inspections following SAFE training were collected during 2009–2012.

Unannounced inspections occurred in all permitted locations at least 2 times per calendar year. Inspection grading criteria were based on a 44-item inspection form created by the Tennessee Department of Health (Figure 1). The inspection form included 13 critical violations (CVs) and 31 non-critical violations, totaling 100 points. These violations were not weighted to how many times they occurred in a single inspection. Critical violations ranged from 4–5 points and non-critical violations were 1–2 points each. For study purposes, CVs were placed into two groups. Risk factor violations (RFVs) included violations 1, 3, 4, 11, 12, and 20. All other CVs included 7, 27, 28, 30, 31, 35, and 41.

Locations that scored below 70 were verbally encouraged to enroll in SAFE and were provided an official Repeat Critical Item Notice letter. This letter included verbiage strongly encouraging the restaurant’s management and key personnel to participate in SAFE training. Restaurants that did not voluntarily participate in SAFE could have been required to attend as a result of a department-mandated initiative.

Unannounced inspections conducted during the assessment phase were completed per the health department’s routine protocols. Each participating location could have been inspected by different inspectors during the study period. During these inspections, identified violations associated with foodborne illness, inspectors documented the violations and discussed them with the establishment’s management. These violations were not weighted to how many times they occurred in a single inspection (i.e., a violation would only be debited once against the overall inspection score) regardless of if multiple infractions of the same violation were observed. Additionally, the mean inspection scores and mean number of violations on each inspection were compared across both groups using Student’s t-test in SAS version 9.4. Violations not directly associated with established risk factors for foodborne illness were not individually evaluated in this study; however, these violations did influence inspection scores.

### Results

During the period of 2009–2010, 13,622 routine inspections were conducted in approximately 3,400 restaurants. Out of these restaurants, 222 locations scored below 70 on an inspection. From the 222 restaurants, 48 enrolled in SAFE. Of those enrolled, 38 had complete data for the three following routine inspections; we used these for our data analysis. Of the 174 restaurants not enrolled in SAFE, 160 had complete data for the three subsequent routine inspections. Demographic data are shown for participating and nonparticipating SAFE restaurants in Table 1.

The menu types for SAFE and non-SAFE restaurants were mostly traditional American (58% and 66%, respectively). SAFE restaurants were more likely to have complex operations (97% versus 72%, $p \leq .001$) and less likely to be quick serve/fast food (16% versus 36%, $p = .02$). Both SAFE and non-SAFE restaurants had a higher percentage of

<table>
<thead>
<tr>
<th>Demographic</th>
<th>SAFE Restaurants ($n = 38$) # (%)</th>
<th>Non-SAFE Restaurants ($n = 160$) # (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Menu type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>7 (18)</td>
<td>23 (14)</td>
</tr>
<tr>
<td>Indian</td>
<td>0</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Italian</td>
<td>1 (3)</td>
<td>5 (3)</td>
</tr>
<tr>
<td>Mexican</td>
<td>8 (21)</td>
<td>16 (10)</td>
</tr>
<tr>
<td>Traditional American</td>
<td>22 (58)</td>
<td>106 (66)</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>9 (6)</td>
</tr>
<tr>
<td>Ownership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chain</td>
<td>20 (53)</td>
<td>71 (44)</td>
</tr>
<tr>
<td>Nonchain</td>
<td>18 (47)</td>
<td>89 (56)</td>
</tr>
<tr>
<td>Process type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complex</td>
<td>37 (97)</td>
<td>115 (72)</td>
</tr>
<tr>
<td>Cook serve</td>
<td>1 (3)</td>
<td>27 (17)</td>
</tr>
<tr>
<td>Prep serve</td>
<td>0</td>
<td>18 (11)</td>
</tr>
<tr>
<td>Service type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffet</td>
<td>6 (16)</td>
<td>11 (7)</td>
</tr>
<tr>
<td>Cafeteria</td>
<td>0</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Quick serve/fast food</td>
<td>6 (16)</td>
<td>57 (36)</td>
</tr>
<tr>
<td>Sit-down</td>
<td>26 (68)</td>
<td>88 (55)</td>
</tr>
</tbody>
</table>
Discussion

Our study used convenience sampling from routine inspection reports for the assessment of a local food safety program. We learned that both groups improved following SAFE training. The lack of significant statistical difference in restaurant scores between SAFE and non-SAFE restaurants, however, suggests motivations beyond SAFE training might have improved performance. The impact of regulatory enforcement was not evaluated, but could explain similar changes among the SAFE and non-SAFE restaurants.

Furthermore, inspection data alone might not have provided an effective means for measuring the impact of SAFE. Variables such as sample size, employee turnover, individual food safety perceptions, knowledge gaps, inspector bias, and language barriers should be quantified and controlled for in future studies. Food safety training and knowledge among restaurant operators and staff can have a positive effect on the sanitary conditions of restaurants and offers the potential to reduce the incidence of foodborne illness (Cotterchio et al., 1998). Additionally, research shows that restaurants in which supervisiors and food handlers had completed food handler education courses had better inspection scores than those without (Mathias et al., 1995).

Agencies provide food safety training to participants in an effort to improve their food safety understanding and encourage behavior change in kitchen environments. Measuring the success or impact of food safety training, though, is challenging. Studies indicate that education is important for food safety; however, food safety education alone is not enough to ensure behavior change. A number of factors can affect the ability to implement or adopt food safety education and create sustained behavioral changes (Green & Selman, 2005). Even when food workers demonstrate knowledge of safe food preparation practices, they do not always engage in those practices (Clayton & Griffith, 2002; Clayton et al., 2002; Howes et al., 1996; Manning & Snider, 1993). Therefore, evaluating the impact of food safety training within a controlled group of participants has proved challenging.

The impact of SAFE training during this study was measured by evaluating routine restaurant inspections. Improvements in inspection scores were seen within SAFE restaurants: average inspection scores improved by more than 20% and were maintained over the study period (Table 2). At first glance, these improvements appear to suggest a positive impact on food safety resulting from SAFE participation. When comparing routine inspection results between SAFE and non-SAFE restaurants of equal inspection histories, no statistically significant differences were identified. Nearly identical reductions in average scores, RFVs, and total CVs were seen in both groups. These similarities in performance among SAFE and non-SAFE restaurants could support the importance of regulatory enforcement as an impetus to practice and behavior change.

Multiple limitations within the study could account for the similar performance of both restaurant groups. The study used a convenience sample that was limited to the records available at that time and complete inspection data were limited to only 38 of the 48 restaurants that participated in SAFE. In all, 10 locations were deemed ineligible due to missing inspection data (n = 6), ownership change/out of business (n = 2), or enrollment with a score ≥70 (n = 2). More robust data from a larger number of participants over a longer study period would have allowed for more power to detect differences between SAFE and non-SAFE restaurants.

Furthermore, we did not capture information regarding employee turnover during the study period. This information could have provided greater insight into each location’s performance. The employee turnover rates for the restaurant and accommodations sector during this study period ranged from 56.6–61.0% (National Restaurant Association, 2015). A UK study found that many small- and medium-sized enterprises did not send staff to food hygiene courses due to the cost and high staff turnover (Yapp & Fairman, 2006). Employee turnover can negatively impact development and retention of strong food safety cultures within an establishment following food safety training interventions.

Individual motivation, knowledge, and language barriers were important variables that were not measured in this study. Some restaurant personnel were self-motivated to attend SAFE while others were not. We did not evaluate aptitude and language barriers. In addition, we did not measure food safety knowledge before and after the training. Providing pre- and post-exams might have allowed for

---

**Table 2**

<table>
<thead>
<tr>
<th>Inspection Type</th>
<th>SAFE Restaurants (n = 38)</th>
<th>Non-SAFE Restaurants (n = 160)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Score</td>
<td>Average # of RFVs</td>
</tr>
<tr>
<td>Low scoring</td>
<td>63.00</td>
<td>2.18</td>
</tr>
<tr>
<td>1st scheduled</td>
<td>77.08</td>
<td>1.13</td>
</tr>
<tr>
<td>2nd scheduled</td>
<td>77.97</td>
<td>1.13</td>
</tr>
<tr>
<td>3rd scheduled</td>
<td>81.87</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Note: There were no statistically significant differences among the data (p > .05).
a better understanding of knowledge gaps, opportunities for training improvement, language barriers, and participant engagement. Additionally, assessing knowledge through surveys or assessments could have provided more insight into the long-term effectiveness of the training, as well as identified appropriate future training interventions. Understanding individual or group motivations could provide better insight into environmental antecedents (i.e., root causes of contributing factors to food safety hazards) such as economics, employee morale, regulatory influence, fear of litigation, and brand preservation.

Perhaps the most significant limitation to our study was the nuanced nature of the inspection process. Research suggests that both inspector and facility type can affect inspection scores (Lee et al., 2012). For future studies, it is recommended that establishment type (i.e., complexity of food preparation and style of food) and inspector bias be accounted for in the analysis. Also, the data collected were limited to normally scheduled inspections. Inspections occurred biannually during the study period and were estimated to be of a 1-hr duration, on average. An establishment open for 365 days/year, 8 hr/day would have only 0.068% of their operating hours evaluated during an annual inspection cycle. Restaurants are dynamic in nature and the limited inspection time might not reflect normal day-to-day operations.

Finally, the number and severity of RFVs and CVs found during inspections were not individually weighted, which likely reduced the granularity of these violations as a measure of performance. For example, if one establishment had multiple food items out of temperature (Figure 1, Item 03) and another establishment had one food item out of temperature, both would have received a single 5-point reduction. The evaluation of each individual infraction could have presented a more accurate description of food safety risk.

Equal regulatory enforcement protocols were applied to both study groups. The measured improvement experienced by both groups suggests that regulatory enforcement, including permit suspensions and closures, likely influenced the outcome of routine food safety inspections.

**Conclusion**

While both study groups improved their food safety inspection performance, no statistically significant differences regarding CVs were noted between SAFE and nonSAFE restaurants. This lack of significant improvement in SAFE restaurants might not be representative of the true impact of food safety training. Instead, it might be an outcome of the study limitations. Findings from this study were based on inspection data alone. We did not evaluate variables associated with the establishments, employees, and inspectors, which might have provided an impact distinction between training and regulatory enforcement.

This study illustrates the limitations of using inspection data alone to evaluate food safety training. Additional training criteria should be considered to more effectively evaluate the impact of a food safety training program.

**Acknowledgements:** The authors would like to thank Drs. Timothy F Jones and John Dunn for their insight and direction in finalizing this article.

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**References**

References


Cooking with gas releases combustion-generated nitrogen dioxide and other pollutants into household air. Both nitrogen dioxide in household air and cooking with gas are associated with increased risk and severity of childhood asthma. The impact on children can be substantial because at least one third of households in the U.S. cook with gas stoves, children spend most of their time indoors, indoor air is unregulated, and asthma is the most common chronic disease in children. The association between gas cooking stoves, household air pollution, and childhood asthma is not widely appreciated. We propose a public information campaign, public policies addressing household air pollution risks associated with cooking with gas, requirement of warning labels on gas cooking stoves, and further research on the efficacy of available interventions.
fossil fuel combustion-generated air pollution, including from natural gas (Jarvis et al., 2010).

**Cooking With Gas Increases Household Nitrogen Dioxide Levels**

Levels of NO₂ are significantly higher in homes with gas stoves than homes with electric stoves. U.S. EPA estimates that homes with gas cooking appliances have approximately 50% to >400% higher NO₂ levels than homes with electric cooking stoves (U.S. EPA, 2008). In a study of children with active asthma, NO₂ levels were measured in homes with electric and gas cooking stoves. The mean NO₂ levels were 8.6 ppb in homes with electric ranges and 3 times higher in homes with gas stoves (25.9 ppb) (Belanger et al., 2006).

A study of 1,400 homes in Albuquerque, New Mexico, analyzed the impact of housing characteristics, occupant behaviors, and weather on indoor NO₂ levels. Higher NO₂ levels in bedrooms were predominantly associated with the presence of gas cooking ranges with continuously burning pilot lights (10 ppb higher than gas cooking stoves without pilot lights), the use of the gas cooking stove for space heating, and fewer square feet of living space (Spengler et al., 1996).

A study of NO₂ levels in 352 homes in California found median kitchen NO₂ levels were highest in homes with gas cooking stoves with pilot lights (gas stove with pilot, 22 ppb; gas without pilot, 15.4 ppb; and electric stoves, 6 ppb). Levels of NO₂ were higher in homes that cooked with gas ≥4 hr/week (gas >8 hr/week, 24 ppb; gas >4 hr/week, 19 ppb; gas <4 hr/week, 18 ppb; electric >8 hr/week, 6.5 ppb) and that reported not using over-the-stove exhaust fan hoods that vented outdoors, hereafter referred to as exhaust fans (gas stove with exhaust fan never used, 34 ppb; gas with exhaust fan used one half of the time, 22 ppb; gas with exhaust fan used most/all the time, 16 ppb; and electric, 6.6 ppb) (Mullen et al., 2016).

**Nitrogen Dioxide May Cause Asthma and Aggravate Symptoms**

Associations between higher outdoor NO₂ levels and increased risk of asthma are well established (Guarnieri & Balmes, 2014). In 2016, the U.S. EPA Integrated Science Assessment for Oxides of Nitrogen upgraded its assessment of the relationship of short periods of NO₂ exposure to aggravated respiratory diseases, particularly asthma, from “likely causal” to “causal,” and longer exposures to elevated levels of NO₂ to “likely causal” of respiratory effects, including asthma (U.S. EPA, 2016).

Indoor studies find associations between higher NO₂ levels and risk of asthma symptoms. A meta-analysis found that higher levels of household NO₂ were associated with a 15% (95% confidence interval [CI] [1.06, 1.25]) increased risk of current wheeze in children (Lin et al., 2013). A prospective study of 1,342 children with asthma between the ages of 5 and 10 years found that above a 6 ppb threshold, every 5 ppb increase in NO₂ levels was associated with a dose-dependent increase in risk of wheeze (1.49, 95% CI [1.09, 2.03]), night symptoms (1.32, 95% CI [1.16, 2.00]), and need for rescue medication (1.78, 95% CI [1.33, 2.38]) (Belanger et al., 2013). A prospective study of children ages 2–6 with asthma in Baltimore, Maryland, found each 20-ppb increase in NO₂ levels was associated with significant increases in risk of both cough (1.10, 95% CI [1.02, 1.18]) and nocturnal symptoms (1.09, 95% CI [1.02, 1.16]) (Hansel et al., 2008).

Cooking with gas is associated with increased risk of asthma. A meta-analysis showed that children living in a home with a gas cooking stove have a 42% increased risk of current asthma (95% CI [1.23, 1.64]) and a 24% increased lifetime risk of asthma (95% CI [1.04, 1.47]) (Lin et al., 2013).

**Children’s Exposure to Gas Cooking Stoves Is Substantial**

Approximately one third of households in the U.S. cook with gas stoves, with regional variability (U.S. Census Bureau, 2011). A Lawrence Berkeley National Laboratory modeling study of homes in Southern California estimated that during winter, when ventilation in homes is lowest, 51–64% of homes using natural gas cooking stoves regularly experienced household NO₂ levels that exceeded health-based outdoor air standards (Logue et al., 2014). Current efforts to reduce energy consumption in homes and other buildings by reducing air flow into and out of buildings will increase household air pollution. A modeling study estimated that tightening building envelopes without repairing kitchen exhaust fans or eliminating gas stoves would lead to 20% more childhood asthma events (Fabian et al., 2014).

**Exhaust Fans Can Decrease Household Nitrogen Dioxide Levels, With Limitations**

Exhaust fans that are vented to the outdoors can reduce household air pollution. A study
of NO\textsubscript{2} levels in 352 homes in California found median NO\textsubscript{2} levels in the kitchen were significantly lower in homes where people reported cooking with gas and using exhaust fans all the time (16 ppb) compared with those who never used them (34 ppb) (Mullen et al., 2016). Many people, however, do not turn on exhaust fans when they cook with gas stoves. Respondents to a California web-based survey reported using exhaust fans only one third of the time when cooking dinner and less for other meals (Klug et al., 2011). Exhaust fans that do vent to the outdoors might not capture all the pollutants generated by gas cooking stoves. It depends, in part, on the amount of air the exhaust fan can capture and move to the outdoors (Singer et al., 2017). Exhaust fans that recirculate air inside the home and that are not vented to the outdoors remove very little NO\textsubscript{2} and other pollutants from household air.

Other Interventions That Can Reduce Household Nitrogen Dioxide Levels
A randomized study evaluating three interventions to lower household NO\textsubscript{2} levels in homes with gas cooking stoves found that replacing gas cooking stoves was the most effective way to lower household NO\textsubscript{2} levels. Median NO\textsubscript{2} levels were 42% lower when electric cooking stoves replaced gas cooking stoves and 27% lower when air purifiers with high-efficiency particulate air (HEPA) and activated carbon filters (hereafter referred to as air purifiers) were placed in the homes. Levels of NO\textsubscript{2} were not significantly lower in homes where new exhaust fans were installed over gas stoves (Paulin et al., 2014). It is not known why NO\textsubscript{2} levels were not reduced by the exhaust fans. Perhaps the fans were not turned on or the exhaust fans were used but did not expel enough of the NO\textsubscript{2} coming from the gas cooking stove. A study of commonly used exhaust fans in the U.S. found that exhaust fans captured <30% of the pollutants coming from the front stove burners (Delp & Singer, 2012).

Cooking With Gas Is an Unrecognized Risk
In Massachusetts, informal questioning of more than 100 parents, health professionals, staff of local health departments, and local boards of health, among others, found that most did not know about the association between cooking with gas stoves, household air pollution, and increased risk of asthma among children living in the home (T.S. Jones, personal communication, April 30, 2019).

Implications for Public Health Practice
1. Inform healthcare professionals, health departments, families, and others that gas cooking stoves are associated with childhood asthma. The association between gas cooking stoves, household NO\textsubscript{2} levels, and childhood asthma is not widely known and has been insufficiently addressed in public policy. Information that cooking with gas is associated with increased asthma risk and severity should be widely disseminated to parents, healthcare professionals, public health staff, and government agencies that fund new housing, set safe housing standards, and inspect homes.

Healthcare professionals could ask families whose children have asthma what kind of stove is used for cooking and encourage families who cook with gas stoves to: reduce use, improve ventilation, and replace gas stoves with electric or electric induction stoves (Table 2). These interventions could include assessing the presence of gas cooking stoves as part of multifaceted, home-based interventions for asthma recommended by the Community Preventive Services Task Force (Crocker et al., 2011).

2. Healthcare organizations should invest in population health programs to prevent asthma and reduce asthma-related healthcare costs. Many families whose children have asthma have limited resources to address the multiple factors that contribute to their children's asthma, including gas cooking stoves. Healthcare organizations, including accountable care organizations, should implement population health policies to address the root causes of asthma, and thereby, reduce healthcare expenditures. As part of multifaceted, home-based interventions, these organizations could provide families with 1) electric induction burners to reduce the use of gas cooking stoves and 2) air purifiers to reduce household air pollution to improve health and reduce asthma-related healthcare expenditures.

3. Government agencies that set safe home standards, plumbing standards, and inspect homes should review and revise existing standards and procedures to help reduce children's exposure to air pollution generated by gas cooking stoves. State health departments issue safe housing standards. Staff from local health departments frequently inspect apartments and homes to ensure that residences meet existing safe housing standards. State plumbing boards issue codes for installation of gas appliances. These agencies should review and revise existing standards and procedures to help reduce children's exposure to air pollution generated by gas cooking stoves.

4. Inform consumers that gas cooking stoves are associated with childhood asthma.

### TABLE 2

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce use of the gas stove</td>
<td>Use electric appliances instead of the gas stove. Alternative appliances include microwaves, toaster ovens, rice cookers, crockpots, and portable single electric induction burners.</td>
</tr>
<tr>
<td>Remove gas cooking stove-related pollution from household air</td>
<td>If there is an exhaust fan above the gas stove that pushes gas fumes out of the home, turn it on when cooking with the gas stove and consider leaving it on after turning the stove off. When possible, use the back burners because the exhaust hood captures more pollutants from back burners. If the gas stove does not have a working exhaust fan or the fan does not exhaust to the outdoors, use a HEPA air purifier with a carbon filter to remove pollution, or open a window.</td>
</tr>
<tr>
<td>Replace the gas cooking stove with an electric stove</td>
<td>Consider replacing the gas stove with an electric or electric induction stove.</td>
</tr>
</tbody>
</table>
Warning labels could be required on gas cooking stoves stating the stoves are associated with childhood asthma and should be used only with exhaust fans that vent to the outdoors and/or air purifiers.

5. Further research. Additional randomized trials to determine the impact of gas cooking stoves interventions on asthma can help guide intervention implementation. The studies could evaluate the effect on childhood asthma of reducing gas stove use, using exhaust fans, using air purifiers, and replacing gas cooking stoves with electric or electric induction stoves.

Conclusion

Household air pollution is not monitored or regulated and is often overlooked as a potential health risk. Cooking with gas increases combustion-related household air pollutants, such as NO₂, and increases the risk of both childhood asthma and asthma severity. Cooking with gas has widespread potential impact on childhood health because 1) more than one third of homes in the U.S. cook with gas, 2) children are more susceptible to the effects of air pollution, and 3) children spend the majority of their time in homes.

Household air pollution generated by gas cooking stoves can be reduced by simple interventions: reducing the use of the stove, improving and using ventilation, and replacing the gas stove with an electric one. These interventions are likely to improve childhood health because exposure to gas cooking stoves is common and asthma is the most common childhood disease in the U.S.

The risks of household air pollution and cooking with gas are not widely recognized and should be considered when developing policies for reducing children’s exposure to air pollution. We recommend a public information campaign, warning labels on gas cooking stoves, population health policies addressing the risks of gas cooking stoves, and further research on the efficacy of interventions.

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References


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Introduction

Environmental health officers (EHOs) are exposed to various physical, chemical, biological, and psychosocial hazards as frontline public health professionals. These exposures to workplace hazards, however, can be overlooked by EHOs. This study investigates occupational health and safety (OHS) issues faced by EHOs in Western Australia. We conducted an online questionnaire-based cross-sectional study. In total, 75 EHOs completed the survey. We analyzed differences in the general demographic profile, occupational profile, and OHS perception of participants. EHOs perceived themselves as being at risk of exposure to workplace stress; workplace violence; injury from sharps; and slips, trips and falls. Most participants also identified job demands, work-life balance, and biomechanical demands to be other important risks. This study provides useful preliminary information in understanding OHS issues in the environmental health profession.

Abstract

Environmental health officers (EHOs) are exposed to various physical, chemical, biological, and psychosocial hazards as frontline public health professionals. These exposures to workplace hazards, however, can be overlooked by EHOs. This study investigates occupational health and safety (OHS) issues faced by EHOs in Western Australia. We conducted an online questionnaire-based cross-sectional study. In total, 75 EHOs completed the survey. We analyzed differences in the general demographic profile, occupational profile, and OHS perception of participants. EHOs perceived themselves as being at risk of exposure to workplace stress; workplace violence; injury from sharps; and slips, trips and falls. Most participants also identified job demands, work-life balance, and biomechanical demands to be other important risks. This study provides useful preliminary information in understanding OHS issues in the environmental health profession.

Environmental health (EH) is one of the oldest public health professions and arguably the bedrock of public health of the Western world; however, there is limited information about occupational health exposure for this professional group. In Australia, despite tremendous improvements in EH, the profession often is devalued (Whiley et al., 2019). We could not find specific research that clearly identifies and describes OHS issues experienced by EHOs. Safe Work Australia, the Australian government statutory body responsible for national policy related to OHS and workers’ compensation, does not have any data specific to EHOs.

Despite the lack of reliable scientific information about OHS in the EH profession, anecdotal evidence suggested that there are broad OHS issues within this sector. For example, verbal aggression, physical violence, and threat of violence are occasionally discussed among EHOs, but these issues are often normalized as being part of the job. As part of their compliance work, EHOs are involved in regulatory inspections, complaint investigations, and surveillance work that places them directly in contact with dissenting business owners, offenders, and irate individuals.

In June 2000, three government food inspectors were shot to death while inspecting a sausage factory in San Leandro, California (Glionna, 2000). In July 2001, an attack on an EHO in connection to a crackdown on illegal hawkers, slaughterhouses, and meat roasting factories was reported in Hong Kong (Lo, 2001). In Zambia, in May 2014, two EHOs working for a local council were attacked by food vendors (“Shebeen Dealers Attack,” 2014). These examples highlight the potential for threats of violence in the EH profession. Furthermore, incidents of violence against EHOs are often underreported.

EHOs are subject to a wide variety of physical hazards due to the diverse range of industries they inspect and the multifaceted environments and situations they operate in. Protocols and legal requirements exist in Western Australia for the management of risks from exposure to physical hazards such as a noise,
As with other professions, there are barriers and facilitators that influence safety behaviors and practices among EHOs. In order to comprehend OHS issues experienced by EHOs, it is important to recognize the underlying concepts within the professional culture that explicitly influence safety behaviors and practices. In a study conducted in a cohort of 18 EHOs working in the UK, it was suggested that EHO perceptions on workplace health improvement are not a priority and instead, the focus was on fulfilling their EH roles and that they were not overly concerned about work-related ill health (Reynolds & Wills, 2012). This study echoes anecdotal evidence that EHOs are more concerned about the safety and well-being of others than their own. This mindset of selflessness to protect others exceeds any kind of self-preservation behavior that is essential in the management of workplace risks. This altruistic mentality has also been observed in the nursing sector; for example, the “supernurse” culture has been identified as a barrier in addressing fatigue in hospital nurses (Steege & Rainbow, 2017).

EHOs have long been criticized for their narrow approach to public health, which is conservatively a protective and enforcement-based approach (Campbell et al., 2011; Reynolds & Wills, 2012). Reynolds and Wills (2012) suggested that EHOs regard themselves as enforcement officers when it comes to their understanding of OHS and do not feel conversant to address and promote the broader determinants of health, especially the psychosocial elements. This assertion is reinforced by a Maguire (1997) qualitative study that assessed the attitudes and perceptions of EHOs toward people with mental illness in a region of the UK. The study showed that EHOs view their contribution as marginal when it comes to mental illness.

Our study attempts to identify and explore OHS hazards from the EHO perspective and experience to better understand the affect of occupational exposures on this profession. The fact that OHS issues in the EH profession are not frequently reported and have not been carefully studied strengthens the purpose for examining OHS practices in this sector. To our knowledge, there have not been any studies that investigate OHS issues faced by EHOs in Western Australia. This study aims to address this gap.

**Methods**

This questionnaire-based cross-sectional study used a modified version of the Employee Core Module from the National Exposures at Work Survey developed by the National Institute for Occupational Safety and Health (NIOSH) (Boiano & Hull, 2001). Participants were registered members of the Western Australia branch of Environmental Health Australia.

The original NIOSH survey instrument considers some aspects that were not relevant to the EH profession or the Australian context, and therefore, we slightly modified the questionnaire. The amended survey contained 34 questions, some of which had multiple parts, structured around 8 key themes (Table 1). The Edith Cowan University Human Research Ethics Committee (2019-00402-DINE) approved the research project proposal and survey instrument.

The survey link, using Qualtrics, and information letter were emailed to all registered Environmental Health Australia members who were registered as working in Western Australia and had an email address on file. Although it is not possible to know the exact number of potential participants who viewed the email invitation, it was sent to 348 members. In total, 75 EHOs responded to the survey, which is approximately 19% of the estimated 400 active EHOs working in local governments in Western Australia.

Participants were given 2 weeks to complete the survey. At the end of 2 weeks, a

---

**TABLE 1**

**Survey Themes and Data Collected**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Data Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td>Age, sex, level of education</td>
</tr>
<tr>
<td>Job descriptions</td>
<td>Employer, employment status, length of employment, supervisory role, job duties</td>
</tr>
<tr>
<td>Health and safety hazard concerns</td>
<td>Physical, chemical, psychosocial, and biological hazards; safety culture; work conditions; safety management; workplace bullying; workplace stress</td>
</tr>
<tr>
<td>Job demands</td>
<td>Job training, workload, support, job control, skill discretion, decision authority</td>
</tr>
<tr>
<td>Violence in the workplace</td>
<td>Physical violence, verbal abuse, workplace security, threats of violence</td>
</tr>
<tr>
<td>Physical and ergonomic demands</td>
<td>Physical demands, musculoskeletal demands, repetitive work</td>
</tr>
<tr>
<td>Personal protective equipment and clothing</td>
<td>Control measures provided at work, personal protective equipment training</td>
</tr>
<tr>
<td>Medical evaluation</td>
<td>Blood test, urine test, physical examination</td>
</tr>
</tbody>
</table>

- Ratnapradipa, 2015.
- Reynolds & Wills, 2012.
follow-up email was sent with the survey link thanking those who had participated. Those who had not yet completed the survey were given 1 week more. The survey was estimated to take 15 min to complete. The data from Qualtrics were exported into Excel. Differences in the general demographic profile, occupational profile, and OHS issues of participants were analyzed. The Kruskal–Wallis test was used to identify significance differences between variables.

**Results**

Table 2 displays the demographic characteristics of the 75 survey participants. This included 36 (48%) who identified as male, 38 (51%) who identified as female, and 1 (1%) who preferred not to say. The age range of participants was 25–73 years, with the average age being 46.6 years. Male participants were older than female, with the male average age being 51.0 years and the female average age being 40.1 years. Approximately 90% of participants had completed a relevant bachelor's degree or postgraduate qualification. The majority (55%) of the participants worked for a metropolitan local government and 39% worked for a country local government.

Participants were asked to specify their agreement with statements relating to the management of OHS in their workplace. Overall, most participants reported positively about their current organization’s OHS work arrangements (Table 3). There was, however, significant acknowledgement of exposure to dangerous or risky situations. For example, when asked if “People working at my workplace are frequently exposed to dangerous or risky situations,” 43% agreed or strongly agreed. For the statement, “I am often required to do a task that makes me feel like I might be at risk of getting hurt,” 35% agreed or strongly agreed.

On a risk scale of 1 to 5 (5 being a higher risk), participants were asked to estimate the level of risk from the OHS hazards item statements as related to their job (Table 4). Workplace stress appears to be a significant workplace issue among EHOs, with 25% of participants rating it as a level 3 risk, 33% as a level 4 risk, and 13% as a level 5 risk. On average, female EHOs rated workplace stress at a risk level of 3.42 and male EHOs rated workplace stress at a risk level of 3.08. The difference was not statistically significant (p = .216). Exposure to needlesticks and sharps injuries was rated as an important hazard to EHOs, as was the risk of slips, trips and falls. A considerable proportion of participants indicated that they were concerned about infectious disease agents in their workplaces. Of the participants, 40% rated infectious disease agents at a level 3 risk and higher. The survey shows that female EHOs tended to have a higher risk perception than their male counterparts. The differences in how male and female EHOs perceived different OHS risks, however, were not statistically significant.

Figure 1 presents an overview of EHO responses related to the prevalence of violence in the workplace. For this theme of questions, EHOs were asked to report on their exposure to and witness of violence in their workplace in the past 12 months. Of the participants, 26% reported having witnessed acts of violence ≥1 time against another person while at work in the past 12 months. Approximately one third (23.9%) indicated that they have been threatened with physical violence or with a weapon (e.g., gun, knife, club, sharp object) at least once while at work in the past 12 months. Most (75%) indicated that they have experienced verbal violence at least once in the past 12 months. On average, females perceived the risk of workplace violence higher (3.0) than males did (2.7). This difference, however, was not statistically significant (p = .369). Approximately one third (31%) of participants had reported an incident of violence to their employer at their workplace at least once over the past 12 months. More than one third (34%) indicated that they have not been trained how to rec-

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>Demographic Characteristics of Environmental Health Officers (N = 75)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic</strong></td>
<td><strong># (%)</strong></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>36 (48.0)</td>
</tr>
<tr>
<td>Female</td>
<td>38 (50.7)</td>
</tr>
<tr>
<td>Prefer not to say</td>
<td>1 (1.3)</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>Average age (all participants)</td>
<td>46.6</td>
</tr>
<tr>
<td>Average age (male)</td>
<td>51.0</td>
</tr>
<tr>
<td>Average age (female)</td>
<td>40.1</td>
</tr>
<tr>
<td>Range</td>
<td>25.0–73.0</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>TAFE associate diploma</td>
<td>4 (5.3)</td>
</tr>
<tr>
<td>TAFE advanced diploma</td>
<td>2 (2.7)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>31 (41.3)</td>
</tr>
<tr>
<td>Postgraduate diploma/master’s degree</td>
<td>36 (48.0)</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>1 (1.3)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (1.3)</td>
</tr>
<tr>
<td>Employment description</td>
<td></td>
</tr>
<tr>
<td>Metropolitan local government</td>
<td>41 (54.7)</td>
</tr>
<tr>
<td>Country local government</td>
<td>29 (38.7)</td>
</tr>
<tr>
<td>Western Australia Department of Health</td>
<td>1 (1.3)</td>
</tr>
<tr>
<td>Other</td>
<td>4 (5.3)</td>
</tr>
<tr>
<td>TAFE = Technical and Further Education.</td>
<td></td>
</tr>
</tbody>
</table>
Most EHOs expressed general satisfaction with work conditions relative to their personal life. Of the participants, 63% agreed to the statement, “After work I come home too tired to do some of the things I’d like to do.” When it comes to job demands, it appears that they were not entirely sure how job demands relate to their job. For example, for the statement, “My job requires working very fast,” 46% of participants neither agreed nor disagreed, 14% disagreed, and 31% agreed. Similarly, EHO responses differed significantly for the statement, “I’m not asked to do

<table>
<thead>
<tr>
<th>Statement</th>
<th>Male (n = 36)</th>
<th>Female (n = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agree/</td>
<td>Disagree/</td>
</tr>
<tr>
<td></td>
<td>Strongly Agree</td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>The health and safety of workers is a major priority with top management at your workplace.</td>
<td>33 (91.7)</td>
<td>3 (8.3)</td>
</tr>
<tr>
<td>I feel safe from work-related injury or illness in my current work environment.</td>
<td>34 (94.4)</td>
<td>2 (5.6)</td>
</tr>
<tr>
<td>I usually have enough time to take safety precautions while completing my duties.</td>
<td>35 (97.2)</td>
<td>1 (2.3)</td>
</tr>
<tr>
<td>I feel free to express my concerns about health and safety conditions to management.</td>
<td>34 (94.4)</td>
<td>2 (5.6)</td>
</tr>
<tr>
<td>Proper personal protective equipment is made readily available by my employer.</td>
<td>35 (97.2)</td>
<td>1 (2.3)</td>
</tr>
<tr>
<td>I know how to reduce the risk of accidents and incidents in the workplace.</td>
<td>36 (100)</td>
<td>0</td>
</tr>
<tr>
<td>I am often required to do a task that makes me feel like I might be at risk of getting hurt.</td>
<td>11 (30.6)</td>
<td>25 (69.4)</td>
</tr>
<tr>
<td>People working at my workplace are frequently exposed to dangerous or risky situations.</td>
<td>13 (36.1)</td>
<td>23 (63.9)</td>
</tr>
<tr>
<td>Employees have sufficient access to workplace health and safety training programs.</td>
<td>30 (83.3)</td>
<td>6 (16.7)</td>
</tr>
<tr>
<td>The safety procedures and practices in this organization are useful and effective.</td>
<td>30 (83.3)</td>
<td>6 (16.7)</td>
</tr>
<tr>
<td>Managers and supervisors set proper examples by following safety rules and work practices.</td>
<td>31 (86.1)</td>
<td>5 (13.9)</td>
</tr>
<tr>
<td>I know how to use safety equipment and standard work procedures.</td>
<td>36 (100)</td>
<td>0</td>
</tr>
<tr>
<td>Work areas are periodically inspected to identify potential health and safety hazards.</td>
<td>28 (77.8)</td>
<td>8 (22.2)</td>
</tr>
<tr>
<td>Unsafe working conditions are corrected in a reasonable time period.</td>
<td>28 (77.8)</td>
<td>8 (22.2)</td>
</tr>
<tr>
<td>I have received adequate training from my current employer to recognize health and safety hazards in my job.</td>
<td>32 (88.9)</td>
<td>4 (11.1)</td>
</tr>
<tr>
<td>I have been trained by my current employer in how to recognize and deal with potential incidents of workplace violence.</td>
<td>26 (72.2)</td>
<td>10 (27.8)</td>
</tr>
<tr>
<td>I could talk to my employer if I had a problem with violence or aggression in my workplace.</td>
<td>33 (91.7)</td>
<td>3 (8.3)</td>
</tr>
<tr>
<td>My work area is adequately staffed.</td>
<td>24 (66.7)</td>
<td>12 (33.3)</td>
</tr>
<tr>
<td>I can report injuries to my manager without worrying about how it will affect my job.</td>
<td>34 (94.4)</td>
<td>2 (5.6)</td>
</tr>
<tr>
<td>I can report injuries to my manager without worrying about how it will affect my workplace safety record.</td>
<td>34 (94.4)</td>
<td>2 (5.6)</td>
</tr>
</tbody>
</table>
an excessive amount of work.” Specifically, 42% neither agreed nor disagreed, 21% disagreed, and 29% agreed. A majority of EHOs (69%) indicated that over the past few years their job had become more demanding. Of the participants, 36% disagreed or strongly disagreed that their work area was adequately staffed. Most responded positively about the level of support they received from their supervisors and the people they work with.

Table 4 presents the responses of the participants on item statements related to physical demands and ergonomic issues. It appears that most participants were not concerned about the level of physical demands associated with their current job. For the statement, “My job requires lots of physical effort,” about 87% disagreed or strongly disagreed. Most participants (94%) disagreed or strongly disagreed with the statement. “I am often required to move or lift very heavy loads.” Similarly, most (93%) disagreed or strongly disagreed with the statement, “My work requires rapid and continuous physical activity.” For the biomechanical demands, it appears that EHOs are not overly concerned about this issue. For the statement, “I am often required to work for long periods with my head or arms in physically awkward positions,” 96% of participants disagreed or strongly disagreed. A large proportion of respondents (70%), however, agreed or strongly agreed that their work involved a high degree of long sedentary periods at a computer.

Discussion

Overall, most participants reported positively about their current organization’s OHS work arrangements; however, 43% indicated that they are frequently exposed to dangerous or risky situations at their workplace and 35% indicated that they are often required to do tasks that makes them feel like they might be at risk of getting hurt. It was beyond the scope of this study to explore these risks in more depth. It can be argued, however, that exposure to risky situations is commonly associated with the itinerant nature of the EH profession and working in an ever-changing and high-paced environment. EHOs might not know what looms behind the next door they knock on or the next site they visit; therefore, the development of a specific OHS guideline for EHOs is necessary to address different work situations and environments. Local governments in Western Australia are required to provide EHOs with a general OHS induction that covers issues such as how to report an incident, evacuation procedures, first aid, and the organization’s safety policy. There currently is no targeted OHS training or guidelines specific to the work environment for EHOs.

EHOs reported workplace stress as an important workplace issue. Although not statistically significant (p = .216), on average, female EHOs rated workplace stress at a risk level of 3.42, whereas male EHOs rated it at a risk level of 3.08. This observation is in line with other studies that have demonstrated a higher prevalence of workplace-related stress in female workers (Gyllensten & Palmer, 2005; Rivera-Torres et al., 2013), but the causes and factors that influence workplace stress in EHOs was beyond the scope of this study. Systematic observation of the data obtained in this survey, however, indicates that workplace stress is a tangible occupational risk among EHOs.

Our current study shows that most EHOs (69%) indicated that over the past few years their jobs have become more demanding, which has previously been reported as a known cause for workplace-related stress (Akbari et al., 2017). There is also evidence that job demand and resources have significantly affected employee well-being (Adil & Baig, 2018). Our survey revealed that 36% of participants disagreed or strongly disagreed that their work area was adequately staffed. Understaffing, heavy

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Level of Risk (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Chemical agents (e.g., acids, caustics, solvents)</td>
<td>25.3</td>
</tr>
<tr>
<td>Ionizing radiation (e.g., X-rays, gamma rays)</td>
<td>73.3</td>
</tr>
<tr>
<td>Machine safety hazards (e.g., exposed moving parts)</td>
<td>33.3</td>
</tr>
<tr>
<td>Nonionizing radiation (e.g., UV, microwaves, radio frequency, electromagnetic fields)</td>
<td>54.7</td>
</tr>
<tr>
<td>Infectious disease agents (e.g., Mycobacterium tuberculosis bacteria)</td>
<td>28.0</td>
</tr>
<tr>
<td>Bloodborne pathogens (e.g., HIV, hepatitis)</td>
<td>25.3</td>
</tr>
<tr>
<td>Latex allergens (e.g., from gloves)</td>
<td>38.7</td>
</tr>
<tr>
<td>Needlesticks and sharps injuries</td>
<td>17.3</td>
</tr>
<tr>
<td>Temperature extremes</td>
<td>14.7</td>
</tr>
<tr>
<td>Noise levels</td>
<td>21.3</td>
</tr>
<tr>
<td>Poor indoor air quality (e.g., molds, cigarette smoke, vehicle exhaust)</td>
<td>20.0</td>
</tr>
<tr>
<td>Workplace stress</td>
<td>5.3</td>
</tr>
<tr>
<td>Repetitive hand, wrist, arm, or shoulder motions</td>
<td>16.0</td>
</tr>
<tr>
<td>Slips, trips, and falls</td>
<td>10.7</td>
</tr>
<tr>
<td>Prolonged standing</td>
<td>37.3</td>
</tr>
<tr>
<td>Lifting/repositioning heavy objects</td>
<td>37.3</td>
</tr>
<tr>
<td>Violence at work (e.g., assaults, threats)</td>
<td>14.7</td>
</tr>
<tr>
<td>Acts of bioterrorism at work</td>
<td>57.3</td>
</tr>
</tbody>
</table>

1 = no risk, 5 = high risk.
workload, and other working conditions have been found to be the main sources of stress (Bhui et al., 2016). EH services are undervalued in Australian local governments. The absence of advocacy and an evidence-based approach to EH services appear to be a disadvantage in securing additional resources and staff.

Our survey shows that the prevalence of workplace violence among EHOs is frequent and widespread across local governments in Western Australia. The diverse work environments of EHOs make it incredibly challenging to implement effective preventive measures to mitigate the risk of workplace violence. Due to this impracticality, the violence associated with the EHO occupational setting is somewhat normalized as part of the job and it appears that there is limited commitment to address the issue. A large proportion of participants (34%) indicated that they have not been trained by their current employer in how to recognize and deal with potential incidents of workplace violence. Additionally, the responses suggest that in spite of a relatively high prevalence of violence, the level of incident reporting is relatively low. The differences between the number of male and female EHOs in 1) the prevalence of violence experienced and 2) the tendency to report violence in the workplace were not statistically significant. Other studies have shown, however, that exposure to verbal abuse was the most common form of violence (Lown & Setnik, 2018; Sun et al., 2017). Further study among EHOs is necessary to gain a fuller, countrywide understanding of workplace violence in Australia, as well as insight into coping mechanisms adopted by EHOs.

Improperly discarded sharps (e.g., needles, syringes) are a risk to the community and EHOs are tasked with the collection and disposal of these items when sharps are reported in public places. While there are procedures for safe retrieval and disposal of sharps, EHOs who participated in the survey reported a high risk perception of sharps. Data are unavailable on the prevalence of workplace injury from sharps in the EH pro-
Potential exposure to infectious agents has been described among police officers, who can be exposed to infectious agents such as hepatitis viruses and HIV in their role as first responders (Jessop et al., 2014). Equally, as frontline public health professionals, EHOs could be exposed to infectious agents when they responded to various public health-related emergencies in their communities.

The recent and ongoing COVID-19 pandemic is one example of how EHOs can be exposed to infectious disease. While much has been said about the risk of COVID-19 to frontline healthcare workers (Karlsson & Fraenkel, 2020; Nguyen et al., 2020; Shaukat et al., 2020, Sheraton et al., 2020; Shreffler et al., 2020), nothing has been reported about EHOs who have continued to implement EH standards during the pandemic. The pandemic has been challenging for EHOs who must continue to provide successful EH services in potentially high-risk environments and, at the same time, maintain personal responsibilities for their families, colleagues, and themselves.

In Western Australia, EHOs were required to strengthen the level of EH services and maintain a high level of oversight to manage the new and changed health risks associated directly with COVID-19 and the introduction of the government restrictions on businesses and communities. In Queensland, for example, the Public Health Act was amended to include certain offenses for failing to comply with directions designed to contain the spread of COVID-19 (Queensland Government, 2020). EHOs in local governments were given special powers to ensure compliance with public health direction related to particular industries including food businesses and personal appearance services. Our survey was conducted in August 2019 prior to COVID-19, so the potential impact of COVID-19 as a psychological and physical risk to EHOs was not assessed.

Differences in how male and female EHOs perceived different OHS risks were not statistically significant. A study with a larger sample group is necessary to determine if there is a significant difference between male and female EHOs toward potential OHS risks. Studies have shown that women tend to have a higher risk perception and commitment to safety than men do (De Sio et al., 2017; Finucane et al., 2000; Harris et al., 2006; Li et al., 2018; Susanto et al., 2018). In comparison, acceptance and normalization of occupational risks by male workers is well established (Stergiou-Kita et al., 2015). The concept of masculinities has been proved to be an influencing factor of how workplace risks are perceived by men (Johnston & McIvor, 2004). To prove their worth, male workers are known to not report workplace complaints (Breslin et al., 2007) and accept risk as an inevitable part of their work (Knudsen & Gron, 2010).

**Limitations**

As this study is based on a self-administered questionnaire, we were not able to clarify issues that might crop up in the minds of the participants. This study did not examine the causes and impacts of OHS hazards. As with any survey, there is always the element of self-reporting bias. Two types of self-reporting bias could have occurred in this survey. The first, social desirability bias, might have occurred because 50% of participants held a supervisory position, which could have generated bias in their responses on management of OHS and supervisor support of employees (Althubaiti, 2016). The second, recall bias, relates to participants being asked to report on events or situations that took place within the last 12 months (Althubaiti, 2016).

**Conclusion**

This study provides useful preliminary information in understanding OHS issues in the EH profession. EHOs perceived themselves as being at risk of exposure to a range of workplace hazards, with the ones of most concern being workplace stress; workplace violence; sharps injury; and slips, trips, and falls. Job demands, work–life balance, and biomechanical demands were also identified by most participants as being important risks. While this study has its limitations, these findings can be useful in the development of OHS policy and implementation in EH practices and can be used as the basis for a much larger in-depth study to explore some of the issues identified here. Further research using a relevant study design (e.g., focus groups, face-to-face interviews) is necessary to explore potential barriers and perceptions affecting OHS management among EHOs.

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References


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Did You Know?

National Public Health Week (NPHW) is April 5–11. This year’s theme is “Building Bridges to Better Health.” During this week, the American Public Health Association (APHA) brings together communities across the U.S. to recognize the contributions of public health and highlight issues that are important to improving our nation’s health. For over 25 years, APHA has served as the organizer of NPHW, developing a national campaign to educate the public, policy makers, and practitioners about issues related to each year’s theme. APHA creates new materials each year that can be used during and after the observance to raise awareness about public health and prevention. Learn more at www.nphw.org.
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NOW AVAILABLE IN SPANISH!
The Coronavirus Aid, Relief, and Economic Security Act of 2020 authorized $2 trillion to battle COVID-19 and its economic impacts. Within the law, the Coronavirus Relief Fund (CRF) authorized $150 billion earmarked for state and local governments. Departments of environmental health might be well-suited to utilize a portion of this fund in very strategic ways, perhaps in ways not previously considered.

The $150 billion earmarked for state and local governments was rapidly injected into a whirlwind of distribution formulae and disparate request processes, all with extremely limited visibility. Said another way, it can be a challenge to determine the status of the fund in many regions.

At its foundation, the practical need for massive appropriations is apparent and urgent, especially to those in the service of public health—an intensely local matter. But too, Congress intended the fund to accommodate many varied necessities.

As the last calendar year closed and the original December 30, 2020, deadline loomed large, Congress extended the program through December 31, 2021. The president signed the omnibus bill (H.R. 133) into law on December 27, 2020. Notably, Congress did not increase the fund. Most agree that there are substantial unspent or unreported funds, at least in certain regions.

Important facts to know:
1. The U.S. Department of the Treasury disbursed funds directly to states, counties, and cities with populations >500,000, as well as to certain tribal governments.
2. Regionally, states and counties were encouraged to “pass down” funds to municipalities (e.g., those with populations <500,000) within their boundaries.
3. The funds may be used to reimburse for expenditures related to the public health emergency and not budgeted for prior to March 27, 2020.

Congress made spending rules vague on purpose. The U.S. Department of Treasury has published guidance for the CRF program in the January 15, 2021, Federal Register (see sidebar). We can appreciate, though, that the intent of Congress was to enable states, cities, and counties to execute against regional priorities.

Let’s add that the intent of Congress is undermined if the funds are never spent. Unspent funds do not aid in COVID-19 response. Unspent funds to not stimulate the economy. Environmental health departments could still utilize these funds if applied to the pandemic response. Beyond the more obvious direct public health needs, other projects can fit, too. For example, closing (or downsizing) your customer counter by moving plan review, applications, consulting, and payments to the internet reduces virus exposure and risk. Enabling inspectors to do more remotely (e.g., through virtual inspections) eliminates contact. Often overlooked, department payroll (including overtime) for environmental health...
employees substantially involved in these and other COVID-19 response projects is also reimbursable by the fund.

What we know today:
• It is challenging to determine the remaining funds available and the local processes to access it. You must contact the grant, budget, or finance office of your jurisdiction and ask.
• The CRF can pay for software licenses and implementation and configuration services, as well as the payroll and overtime for involved department staff. The software licenses can extend for 12 months (i.e., beyond the deadline), but services (e.g., configuration, data conversion, report writing) should be completed prior to the December 31, 2021, deadline. If services are not completed, you can expect only a partial or proportional reimbursement.
• Some jurisdictions told us that they balance and reallocate expenses to the fund, where the rules allow it, near the end of the reporting period. For example, an environmental health inspector might be assigned to coronavirus education or enforcement, thus making their salary and overtime eligible. That example uses the CRF to free up traditional budgets.

Therefore, I advise environmental health directors and their IT leaders to plan with intent to access all the resources available. Through your local inquiries, identify the status of the CRF in your state, county, or city. Health districts can also be funded. Finally, isolate the processes and approvals that would be needed. If the path is clear, revisit your backlog of projects and find those that meet the definitions above. You could potentially have a way to fund some projects in whole or part.

Remember that projects involving payroll and overtime, as well as most professional services, have a diminishing horizon. That is, the number of pay periods or work products that can be delivered by December 31, 2021, is impacted by the start date of your project. So, delays can diminish the potential.

We also note that President Biden, just prior to the inauguration, committed to a follow-on relief and stimulus package, which promises to include more funding for cities and counties. As of press time, the Biden Administration is still meeting with lawmakers, cabinet secretaries, and industry leaders to gain support for a $1.9 trillion stimulus package to be voted on in mid-March 2021. If the CRF is not accessible to you at this time, there could be a new program available in the future. We suggest maintaining a list of those project priorities and keeping them “shovel-ready.”

Acknowledgement: Additional research for this column was conducted by Jason Christensen.

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**Additional Resources**

- Eligible Units of Local Government: https://home.treasury.gov/system/files/136/Eligible-Units.pdf
Environmental health practitioners play a critical role in the prevention, identification, and mitigation of Legionnaires’ disease outbreaks (Kunz & Cooley, 2016). Over the last 20 years, Legionnaires’ disease outbreaks have increased significantly and the Centers for Disease Control and Prevention (CDC) continues to learn about the disease and how to prevent it (Association of State and Territorial Health Officials, 2019; CDC, 2019). For example, CDC investigations show almost all (9 in 10) Legionnaires’ disease outbreaks were caused by problems preventable with more effective building water management. Water management programs have become an important industry standard and are now required in healthcare facilities nationwide (Centers for Medicare & Medicaid Services, 2018; Veterans Health Administration, 2014).

Updated Guidance on Preventing Legionella in Water Systems and Devices
ASHRAE recently released expanded and updated guidelines (Guideline 12-2020) to help prevent Legionnaires’ disease (ASHRAE, 2020). These guidelines support water management programs and significantly expand previous guidance.

The ASHRAE Guideline 12-2020:
• provides design, operation, and control parameters for various devices and systems, such as decorative fountains, hot tubs, cooling towers, and potable water systems;
• includes considerations for when Legionella testing is appropriate;
• reviews recent and evolving Legionella testing methods; and
• suggests response activities according to routine Legionella testing results.

New Toolkit for Controlling Legionella in Common Sources of Exposure From the Centers for Disease Control and Prevention
CDC created a series of six easy-to-use content modules to summarize the updated guidance. This toolkit aims to help environmental health practitioners, building owners and operators, and facility engineers:
• evaluate hazardous conditions quickly,
• implement Legionella control measures,
• strengthen water management programs, and
• support environmental assessments during public health investigations.

The toolkit’s six content modules (Figure 1) summarize Guideline 12-2020 updates across common sources of Legionella exposure: potable water systems, cooling towers, hot tubs, decorative fountains, and other devices. Each content module includes essential information from Guideline 12-2020 regarding the design, operation, maintenance, and controls specific to the corresponding source of exposure. Module recommendations are anchored to four key factors that affect the ability of Legionella to grow in water: sediment and biofilm, temperature, water age, and disinfectant residuals. The importance of these four factors is highlighted in a quick-reference table of Legionella control measures for each respective device or system.
ADVANCEMENT OF THE PRACTICE

One additional module describes considerations if Legionella testing is conducted for routine purposes, such as water management program validation. The testing module contains practical information such as values for performance indicators and a multifactorial approach to understanding test results.

Updated Legionella Environmental Assessment Form for Building Water Systems From the Centers for Disease Control and Prevention

CDC has also updated the Legionella Environmental Assessment Form (LEAF) based on field experience during outbreak responses and to better align with Guideline 12-2020. Public health officials can use LEAF to gain a thorough understanding of a facility’s water systems and assist facility management with using environmental control measures to minimize the risk of Legionnaires’ disease. It can also be used along with epidemiologic information to determine whether to conduct Legionella environmental sampling and to develop a sampling plan.

A key revision to LEAF includes an expanded cooling tower appendix refined over the course of multiple CDC-led field investigations. During an outbreak involving cooling towers, rapid identification and environmental assessment are essential to limit the number of people exposed. The updated LEAF supports CDC procedures developed in 2019 for identifying cooling towers during an outbreak investigation (Figure 2).

By sharing knowledge and developing easy-to-use resources, CDC hopes to empower local communities to prevent outbreaks of Legionnaires’ disease. Explore CDC’s free Legionella resources at www.cdc.gov/legionella/health-depts/environmental-inv-resources.html.

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LD is caused by inhalation of aerosols that contain Legionella bacteria.

Nearly 1 in 10 cases is fatal (Shah et al., 2019).

The Centers for Disease Control and Protection (CDC) reported 9,933 cases in 2018—an increase of almost 900% since 2000 (CDC, 2019).

Of all waterborne outbreaks reported through CDC’s National Outbreak Reporting System in 2017, 61% implicated Legionella bacteria (CDC, 2018).

(Table 1). One additional module describes considerations if Legionella testing is conducted for routine purposes, such as water management program validation. The testing module contains practical information such as values for performance indicators and a multifactorial approach to understanding test results.
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For more information or to download nomination forms, please visit www.nsf.org or www.neha.org or contact Stan Hazan at NSF at (734) 769-5105 or hazan@nsf.org.
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April 8–May 6, 2021: 2021 California Conference of Directors of Environmental Health (CCDEH) Training Series (Virtual), CCDEH and the California Environmental Health Association, www.ccdeh.org

**Iowa**

**Missouri**

**Nevada**
May 4–5, 2021: NvEHA/NFSTF Joint Virtual Conference: Evolutions in Environmental Health, Nevada Environmental Health Association (NvEHA) and the Nevada Food Safety Task Force (NFSTF), www.nveha.org

**Utah**

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

Certified Professional–Food Safety Manual (3rd Edition)
National Environmental Health Association (2014)

The Certified Professional–Food Safety (CP-FS) credential is well respected throughout the environmental health and food safety field. This manual has been developed by experts from across the various food safety disciplines to help candidates prepare for the National Environmental Health Association’s (NEHA) CP-FS exam. This book contains science-based, in-depth information about causes and prevention of foodborne illness, HACCP plans and active managerial control, cleaning and sanitizing, conducting facility plan reviews, pest control, risk-based inspections, sampling food for laboratory analysis, food defense, responding to food emergencies and foodborne illness outbreaks, and legal aspects of food safety.

358 pages / Spiral-bound paperback
Member: $179 / Nonmember: $209

Principles of Food Sanitation (6th Edition)

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

437 pages / Hardback
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National Environmental Health Association (2014)

The Food Safety Modernization Act has recast the food safety landscape, including the role of the food safety professional. To position this field for the future, NEHA is proud to offer the Certified in Comprehensive Food Safety (CCFS) credential. CCFS is a mid-level credential for food safety professionals that demonstrates expertise in how to ensure food is safe for consumers throughout the manufacturing and processing environment. It can be utilized by anyone wanting to continue a growth path in the food safety sector, whether in a regulatory/oversight role or in a food safety management or compliance position within the private sector. This manual has been carefully developed to help prepare candidates for the CCFS credential exam and deals with the information required to perform effectively as a CCFS.

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Modern Food Microbiology (7th Edition)
James M. Jay, Martin J. Loessner, and David A. Golden (2005)

This text explores the fundamental elements affecting the presence, activity, and control of microorganisms in food. It includes an overview of microorganisms in food and what allows them to grow; specific microorganisms in fresh, fermented, and processed meats, poultry, seafood, dairy products, fruits, vegetables, and other products; methods for finding and measuring microorganisms and their products in foods; methods for preserving foods; food safety and quality controls; and foodborne diseases. Other section topics include biosensors, biocontrol, bottled water, Enterobacter sakazakii, food sanitizers, milk, probiotics, proteobacteria, quorum sensing, and sigma factors. Study reference for NEHA’s Certified Professional–Food Safety credential exam.

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**APRIL 20 & 21**

**Tuesday, April 20**  
Opening Keynote  
Food Safety  
Infectious & Vectorborne Diseases  
Uniformed Services  
Workforce & Leadership  

**Wednesday, April 21**  
Environmental Justice & Children's EH  
Food Safety  
General Environmental Health  
Workforce & Leadership

**JUNE 1 & 2**

**Tuesday, June 1**  
Opening Panel  
Climate & Health  
Emergency Preparedness & Response  
Healthy Communities  
Workforce & Leadership

**Wednesday, June 2**  
Climate & Health  
Emergency Preparedness & Response  
Healthy Communities  
Water Quality

**JULY 14 & 15**

**Wednesday, July 14**  
Data & Technology  
Food Safety  
General Environmental Health  
Water Quality

**Thursday, July 15**  
Closing Session  
Climate & Health  
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General Environmental Health  
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They are about helping people to carry out their assignments successfully. Only when we achieve a high level of cooperation between management and their staff will we become truly successful. Environmental health, occupational health and safety, and public health are not jobs or vocations—they are a calling to help people avoid and overcome disease and injury, and to protect our planet,” stated Dr. Koren.

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. The second volume explains the advanced principles that supervisors need to understand the art of communications, how to resolve communications problems, and the supervisor/manager role in teaching, counseling, and managing employee performance, health, and safety. The set is an excellent resource for students interested in learning management skills prior to entering the workforce.

The updated set offers a practical set of methods, tools, and techniques, all illustrated and easy to understand, for achieving leadership qualities. It provides concise and essential discussion material for each topic. The set also includes thorough updates and many new case problems with answers provided. Finally, the set introduces self-testing questions for different situations and practical exercises that utilize an individual’s own work experience for answers.

Each volume is eligible for up to 20 hours of self-reported continuing education contact hours to go toward a NEHA credential. The set is coauthored with Professor Alma Mary Anderson and was published in February 2021 by CRC Press.

Dr. Herman Koren, MPH, HSD, DLAAS, REHS, long-time member of the National Environmental Health Association (NEHA), has coauthored a new two-volume set of books: Management and Supervisory Practices for Environmental Professionals. Now in its fourth edition, the two-volume set provides up-to-date information for newly promoted or management-aspiring professionals in the fields of environmental health, occupational health and safety, water and wastewater treatment, and public health.

“Supervision and management positions are not about power. They are about helping people to carry out their assignments successfully. Only when we achieve a high level of cooperation between management and their staff will we become truly successful. Environmental health, occupational health and safety, and public health are not jobs or vocations—they are a calling to help people avoid and overcome disease and injury, and to protect our planet,” stated Dr. Koren.

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Dr. Koren has 65 years of practical experience in the environmental and public health field. Over his career, he has been an environmental health practitioner, professor, researcher, consultant, and mentor. He is also the author of 22 books. Dr. Koren currently is a professor emeritus of health and safety at Indiana State University. He is also a member of the NEHA History Project Task Force and is lending his research and writing expertise to help write the living history of environmental health and NEHA. In 2005, Dr. Koren received the Walter S. Mangold Award, NEHA’s highest honor. He was recognition as a Diplomate Laureate of the American Academy of Sanitarians (AAS) in 2012—one of just 11 people to hold this recognition. He was also the recipient of the Davis Calvin Wagner Sanitarian Award from AAS in 2018.

The American Academy of Sanitarians (AAS) is pleased to announce the election of Dr. Francis Charles Hart, PhD, CIH, CSP, RS, as its eleventh Diplomate Laureate. Dr. Hart began his career as a sanitarian with the Summit County Health Department in Cuyahoga Falls, Ohio. He went on to serve as health commissioner in Ashtabula County and had a long and successful career as environmental health and safety director and adjunct faculty at Ohio University, Case Western Reserve University, and Kent State University. Dr. Hart also served on numerous professional advisory boards and as a private consultant. He was recognized as a Diplomate in AAS in 1994.

Formed in 1966, AAS is an organization that elevates the standards, improves the practice, advances the professional proficiency, and promotes the highest levels of ethical conduct among professional sanitarians in every field of environmental health. Certification by AAS is open to individuals who have attained high professional stature through leadership and accomplishment in the field of environmental health and meet the criteria for selection as a Diplomate.

AAS created the certification of a Diplomate Laureate in 1999 to recognize Diplomates who have demonstrated exceptional professional growth, accomplishment, and leadership in the sanitarian profession. The Laureate must demonstrate longevity in the profession, in addition to meeting six additional criteria that include extraordinary accomplishments in the field of environmental health and the professional practice as a sanitarian.

People on the Move is designed to keep NEHA members informed about what their peers in environmental health are up to. If you or someone you know has received a promotion, changed careers, or earned a special recognition in the profession, please notify Kristen Ruby-Cisneros at kruby@neha.org. It is NEHA’s pleasure to announce the achievements and new directions of our members. This feature will run only when we have material to print—so be sure to send in your announcements!
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The Dr. Bailus Walker, Jr. Diversity and Inclusion Awareness Award honors an individual or group who has made significant achievements in the development or enhancement of a more culturally diverse, inclusive, and competent environment.

Application deadline is April 15, 2021.

To access the online application, visit www.neha.org/about-neha/awards/dr-bailus-walker-jr-diversity-and-inclusion-awareness-award.
Earth Day Twitter Chat
Climate change is one of the greatest threats to global health we currently face. It harms health by decreasing the quality of the air we breathe, increasing our exposure to more frequent and intense extreme weather events, increasing extremes of precipitation including flooding and drought, expanding the geographic distribution and number of disease-carrying vectors, and exacerbating health inequities. Around the world, these impacts increase the risk of chronic and infectious diseases, harm mental health and well-being, threaten the safety and security of communities, trigger food insecurity, and place a disproportionate burden on our most vulnerable populations. These populations include children, people of color, older adults, people with disabilities, and people living in low-income and poorly resourced communities.

The Earth Day Network’s theme for Earth Day 2021 is “Restore Our Earth” and focuses on local communities that are disproportionately affected by climate change. The National Environmental Health Association (NEHA) recognizes the role of environmental health in addressing racism as an environmental health issue (https://www.neha.org/NEHA-Racism-Position-Statement) and is committed to addressing justice, equity, diversity, and inclusion.

In promotion of Earth Day, NEHA will host a Climate Justice Twitter Chat on April 22, 2021. This event will initiate conversations about how climate impacts health and address the reality of communities being disproportionately affected by climate change. To join the conversation, visit @nehaorg on Twitter or search the #EarthDayChat hashtag.

NEHA Staff Profiles
As part of tradition, NEHA features new staff members in the Journal around the time of their 1-year anniversary. These profiles give you an opportunity to get to know the NEHA staff better and to learn more about the great programs and activities going on in your association. This month we are pleased to introduce you to two NEHA staff members. Contact information for all NEHA staff can be found on page 38.

Doug Farquhar
I am an attorney with 30 years of experience working with policy makers on environmental health issues. I direct Government Affairs at NEHA, providing guidance on federal, state, and local governmental policies to our members and funders. I also work with policy makers, sharing policies that have been adopted by the NEHA Board of Directors. I joined NEHA in April 2020 but have been involved with NEHA for many years. I have presented on environmental health policy at many NEHA Annual Educational Conference (AEC) & Exhibitions, including those held in Anchorage, Alaska; Atlanta, Georgia; Atlantic City, New Jersey; and Albuquerque, New Mexico—to just name the cities beginning with A. The NEHA past presidents asked about developing a government affairs program at the 2008 AEC in Tucson, Arizona.

I received my law degree from the University of Denver (DU) and undergraduate degree from the University of Texas in Austin. I am an adjunct professor in the DU Graduate School of Environmental Policy and Management and an affiliate professor at the University of Washington School of Public Health.

I received the NEHA Sabbatical in 2010, spending 3 weeks in the UK. Staying at the Mad Hatter Inn, I got to visit the many boroughs of London and meet their environmental health directors. I also golfed St. Andrews. If you ever want to read my report, I’ll be glad to share that with you.

Prior to coming to NEHA, I directed the environmental health program for the National Conference of State Legislatures. I also worked in the Texas House of Representatives and for Colorado Congressman Daniel Schaefer in Washington, DC.

I’ve climbed every 14er (i.e., a mountain peak over 14,000 ft) in Colorado, Mt. Rainier in Washington, and many peaks in California where I climbed with staff from the San Diego Environmental Health Department. My wife and I are empty nesters. Our daughter lives in Fort Collins, Colorado, preparing for graduate school and our son does laboratory wastewater work for Full Sail Brewing Company in Hood River, Oregon.

Jaclyn Miller
I joined NEHA as editor/copywriter in the Entrepreneurial Zone department in April 2020, right as pandemic office closures were taking place, with the goal of giving NEHA a distinguishable, unifying voice while creating and editing content for course resources, marketing materials, and social media. I have a strategic communications degree from Ohio State. Prior to my role at NEHA, I worked as a freelance content creator for various clients, including The DoSeum (a STEM-focused children’s museum in San Antonio, Texas), FITT Magazine, and Salesforce. In my early career, I worked as a music journalist for Fashion Meets Music, a magazine out of Columbus, Ohio, for which I interviewed and profiled artists including Awolnation, Betty Who, Borns, O.A.R., and more.

I have discovered through my content management journey that I feel most fulfilled when communicating the story and voice of an organization that both aligns with my personal values and serves the common good—one that I can be proud to promote. NEHA is, indeed, such an organization. During my first year in this position, I have really enjoyed creating and editing material that has a clear purpose and application, working with enormously talented and passionate individuals, and being a part of a team that is genuinely
dedicated to making a lasting, positive impact on the environmental health community. I hope to continue evolving with NEHA by discovering creative, impactful ways to expand our reach.

Having lived in several different cities—Charlotte, North Carolina; Youngstown and Columbus, Ohio; Austin, Texas; and now, Denver, Colorado—I have always felt the unshakable urge to explore and experience. Since moving here in October 2019, Colorado has kept my adventurous spirit well-fed. I love just about anything outdoors (hiking, rollerblading, swimming, nature photography), and as a self-proclaimed “music consumer,” I have never turned down a concert or live music event. In fact, when COVID-19 is finally behind us, I’m fairly certain that is the first place you’ll find me.

you can connect with an employee to assist you whether they are in the office or not.

Execution: We strive to provide our members what they need when they need it. We were challenged by COVID-19 to produce training materials and remote learning in Spanish. It is what our Puerto Rican colleagues needed, and as I type these words, those products are almost ready for prime time. We have streamlined and modernized our accounting systems and share our audited financial statements so that membership can trust that the resources they and other sponsors entrust to us are professionally and ethically managed.

This train of thought now brings me full circle to Istanbul.

One sunny day we purchased a sightseeing boat tour that brought us from the Eminonu Pier in Kadıköy to Anadolu Kavağı, a small fishing village at the northern edge of the Bosphorus. We slowly and methodically hiked up the steep incline to ruins at the top of the hill that provided a panoramic view of the Baltic and surrounding area. I was mesmerized. History. Politics. Religion. Global commerce. The focal points of humanity seemed to amalgamate before my eyes, united by a simple waterway blessed by deep waters. The ties that bind.

The way our organization lives by its values bind us beyond a credentialing arrangement, a membership benefit, or mission statement. What we do and how we conduct ourselves in honoring you and our profession reveal our true corporate self. The forces that would deliberately or incidentally serve to cleave us from our values are abundant and often seductively present themselves masquerading as opportunity, a new partnership, or access to influence.

The image of the many homes constructed along the Bosphorus directly on the shores of the strait reveal an inordinate amount of trust the occupants have in their instincts and knowledge of the tides, storms, and other natural events that might otherwise undermine their foundations. That trust must have been built over centuries of experience and observation. We aim to build the same trust with you as you observe our values in action.

We aim to be the professional warmth of the sun during the coldest of winter days.
Expiring frequent flyer miles and adventurous family members represent a dodgy confluence of emotion and motivation, particularly around the holiday season. To harness the potential of the moment, we depleted what seemed like a working lifetime of accumulated airline miles and in December 2012, the Dyjack family departed for the historic capital of the Ottoman Empire, Istanbul. Time and space do not permit me to gush about architecture, history, food, and of course, the coffee. While the eye candy was mesmerizing, what I remember most is the Bosphorus.

The Bosphorus is a 19-mile strait that passes through Istanbul from the Black Sea on its journey to the Sea of Marmara, forming part of the traditional boundary between Europe and Asia. It is historically considered where East meets West, and represents a major commercial artery connecting the residents of the shores of the Black Sea with the rest of the world. The waterway is a critically important fishery and supports an abundant tourism industry. It is literally the main artery of the region bringing resources and investment from around the planet. Its economic and cultural value to the region would be difficult to overestimate.

Memories of that once in a lifetime family holiday recently flooded the portion of my mind that drives self-reflection. Our association is slowly and methodically working through a strategic planning process, and we are now considering our values statements. These represent the core principles and philosophical ideals that will serve to guide our decisions and behaviors much as the Bosphorus serves as the aquatic network that binds a region together. As I completed the online poll with my recommendations for values statements, I recognized that mine are only one set out of a couple dozen that will be considered by the NEHA Board of Directors, which means they might not make the short list for final consideration. Having said that, as executive director, you might find it useful to understand the values I hold close as a member of our organization’s leadership team.

**Servant Leadership:** I feel we should serve the common good of the profession, starting with our employees and members, and radiating outward to our affiliates and the profession writ large. You might have observed this leadership in 2020 when we made our entire inventory of online continuing professional education free during the early stages of the pandemic, irrespective of membership status. Thousands of people took tens of thousands of our courses. We subsequently offered the Digital Defense conference in August 2020, again at no cost, that provided up to 12 hours of continuing professional education to over 2,400 people throughout the world.

**Thought Leadership:** Our aim is to establish a richer and more meaningful relationship with the profession through our intellectual products and contributions to science. We have submitted or published 11 scientific journal articles since 2019, which represents a dramatic increase over prior years. Much of that effort was focused on you, the environmental health workforce. We believe we possess a deep understanding of your needs and challenges, and are using that knowledge to advance advocacy for the profession.

**Care:** We care about the well-being and success of our employees. Their safety, health, and success have guided our decision making as we pivot into the future. In illustration, we have provided each employee a stipend to underwrite the cost of their home wireless system and they have also been provided a one-time financial allocation to purchase furnishings to make their home office suitable for their individual set of circumstances. Additionally, each employee receives an annual continuing professional education investment that is used at their discretion.

**Innovation:** We strive to connect new ideas to today’s problems. In that spirit, we nimbly toggled from face-to-face training in 2019 to an entirely online format in 2020. Our formal catalog of Food and Drug Administration training went remote. We provided—and continue to provide—numerous online trainings and just-in-time programs, including a new program of web-based updates on government affairs. Our credentialing program is rapidly moving to a paperless application and management system. We no longer have land phone lines in our Denver office, which means

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**We aim to build the same trust with you.**

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**Apricity**

David Dyack, DrPH, CIH

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Thank you to all who’ve tirelessly pursued public health and safety since COVID began, upholding NEHA’s mission “To advance the environmental health professional for the purpose of providing a healthful environment for all.” Our country needs more people like you.

All of us at Ozark River Manufacturing Co. send our endless gratitude.
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