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# Environmental Health

## ABOUT THE COVER



This issue's featured article, "Lung Cancer Worry and Home Screening for Radon and Secondhand Smoke in Renters," explores the relationships between

demographic factors, lung cancer worry, and completion of home screening for radon and secondhand smoke among renters. The study found that renters who had at least one smoker in the home and those with a lower education level were more likely to report lung cancer worry. Renters pose a particular challenge because they may feel powerless to control decisions that influence air quality beyond their own space. As such, policies designed to protect air quality in rental properties is essential.

See page 8.

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### Official Publication



**Journal of Environmental Health**  
(ISSN 0022-0892)

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Published monthly (except bimonthly in January/February and July/August) by the National Environmental Health Association, 720 S. Colorado Blvd., Suite 1000-N, Denver, CO 80246-1926. Phone: (303) 756-9090; Fax: (303) 691-9490; Internet: [www.neha.org](http://www.neha.org). E-mail: [kruby@neha.org](mailto:kruby@neha.org). Volume 79, Number 6. Yearly subscription rates in U.S.: \$150 (electronic), \$160 (print), and \$185 (electronic and print). Yearly international subscription rates: \$150 (electronic), \$200 (print), and \$225 (electronic and print). Single copies: \$15, if available. Reprint and advertising rates available at [www.neha.org/JEH](http://www.neha.org/JEH). CPM Sales Agreement Number 40045946.

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All technical manuscripts submitted for publication are subject to peer review. Contact the managing editor for Instructions for Authors, or visit [www.neha.org/JEH](http://www.neha.org/JEH).

To submit a manuscript, visit <http://jeh.msubmit.net>. Direct all questions to Kristen Ruby-Cisneros, managing editor, [kruby@neha.org](mailto:kruby@neha.org).

Periodicals postage paid at Denver, Colorado, and additional mailing offices. POSTMASTER: Send address changes to *Journal of Environmental Health*, 720 S. Colorado Blvd., Suite 1000-N, Denver, CO 80246-1926.



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## ► PRESIDENT'S MESSAGE



David E. Riggs,  
MS, REHS/RS

As I put the finishing touches on last month's column discussing the future of the environmental health profession and professional, I had the feeling that what the professional brings to the practice of environmental health is only half of the equation. The other half of the equation is the role and responsibilities of seasoned practitioners and supervisors, as well as agencies and organizations, in recruiting, developing, and retaining talented entry and midlevel environmental health personnel.

The environmental health workforce is gray-ing with a significant number of baby boomers retiring at an astonishing rate, especially in the areas of technical, field, and midlevel management. The recruitment of talented and skilled professionals is of the greatest importance to employers in local, state, and federal agencies, as well as industry. Even as the environmental health workforce is retiring, the pool of qualified entry-level environmental health professionals is insufficient to meet the needs for public, nonprofit, and industry employers. It is our responsibility to properly recruit and retain personnel with the talent and skills to ensure organizational success.

Talent and skills are becoming the newest and highest priorities employers consider in hiring entry-level and midmanagement professionals. For environmental health professionals, technical knowledge is a given. Today's intricate and dynamic workplace demands that employers strongly consider the potential employee's character and indicators of future performance during recruitment. The successful organization is constantly searching for the right skills and temperament. The search for

## Search and Employ

*The recruitment of talented and skilled professionals is of the greatest importance.*

the right employee with the appropriate technical knowledge, skills, talent, and character is now more important than ever.

Although the recruitment of talented and creative employees is an important start in developing a successful and viable environmental health organization, it is only the first step. Skilled and talented environmental health practitioners will increasingly gravitate toward employers that create a workplace that promotes creativity, innovation, education, and professional and personal advancement. The best talent in our profession will be attracted to organizations that provide work experiences rather than jobs. The successful employer will provide challenges that are rewarding and meaningful. New employees want to be engaged and appreciated.

There are three generations in the labor market right now: baby boomers, Generation X, and millennials. In addition, a fourth generation is due to come into the mainstream workforce in 6 to 10 years. This diversity is

changing the relationship between employers and employees.

The workforce will become one in which challenge, opportunity, and empowerment set the parameters in careers that will attract the best and brightest. Employees will no longer be tied to a particular employer. The loyalties of millennials and Generation X are not to employers, but rather to the leaders who can offer work environments proportional to their career goals. What further complicates the picture is the reality that environmental health (in fact, all of government) is in competition for these talented individuals. It also means it is time for environmental health to offer compensation levels that are commensurate with the challenges we offer to our environmental health professionals.

Now to the point of this message. The supply of talented, skilled, knowledgeable, and competent environmental health practitioners is limited. In response, the successful employer not only must hire talented, capable, and competent environmental health practitioners with technical backgrounds, but also provide an employment environment that encourages the development of professional capabilities.

Professional capability development is not a new term, however, the application to environmental health is a fascinating and exciting prospect. As it becomes more and more difficult to attract experienced people, changes in how to develop and retain environmental health professionals will be implemented. This change will require workforce leaders to better recognize and promote the skills and knowledge needed to be successful in

our profession. The organization that develops and implements systems for promoting individual and professional growth, as well as rewards experience and responsibility, will find its retention rates higher and turnover rates lower. Even more important, the organization will find its employees more satisfied with the workplace.

I can see all of our agencies and companies recruiting the most talented and competent

personnel. Once we recruit the best individuals, it becomes our responsibility to develop workplace experiences that promote professional growth. Our workforce, in general, and millennials and Generation X, specifically, value meaningful and rewarding work environments. A successful organization invests in the development of an innovative and creative work environment.

In the end, these are principles NEHA can use to take the lead in developing programs and systems for environmental health practitioners and organizations to apply to promote competency and skill sets now and for the future. 🐘

David E. Riggs

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## Lung Cancer Worry and Home Screening for Radon and Secondhand Smoke in Renters

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**Abstract** Lung cancer is largely preventable by eliminating tobacco smoke and radon exposure. This exploratory study assessed the relationships of demographic factors, including having one or more smokers living in the household, and a) lung cancer worry and b) completion of home screening for radon and secondhand smoke (SHS) among renters. A convenience sample of renters ( $N = 47$ ) received free test kits for radon and SHS as part of a larger study. Demographic factors, lung cancer worry, and completion of home testing were assessed at baseline. The sample was mostly Caucasian (68%), female (62%), and educated beyond high school (70%). The average age was 43 years ( $SD = 15$ ), and roughly half lived with at least one smoker (49%). Gender, race/ethnicity, education, and whether they had smokers in the home accounted for 35% of the variability in lung cancer worry,  $F(4, 42) = 5.6, p = .001$ . Lung cancer worry was associated with lower level of education,  $b = 0.77$ ;  $SE(b) = 0.32$ , and having at least one smoker living in the home,  $b = 0.71$ ;  $SE(b) = 0.31$ . Renters tested their homes for radon and SHS whether they had smokers in the home or not. Constructing and delivering educational messages that target low-educated populations may promote radon testing and smoke-free homes.

### Introduction

Lung cancer is the leading cause of cancer death in the U.S. (Henley et al., 2014), and is largely preventable by eliminating smoking, exposure to secondhand smoke (SHS), and radon. While tobacco use is a well-known risk for developing lung cancer, an estimated 25% of lung cancer cases globally occur in nonsmokers and result in approximately 300,000 deaths annually (Sun, Schiller, & Gazdar, 2007). Radon exposure is the second leading cause of lung cancer among smokers and the leading cause among nonsmokers (Neri, Stewart, & Angell, 2013). In the U.S.,

approximately 15,000–22,000 lung cancer deaths each year are related to radon exposure. There are synergistic effects between tobacco smoke and radon; exposure to both increases the risk of developing lung cancer (National Research Council, 1999).

Few people are aware of the combined risks; therefore, strategies are needed to promote healthy air free of radon and SHS. Radon results from the decay of uranium, naturally found in soil and rock. Radon cannot be detected by human senses (Neri et al., 2013). The U.S. Environmental Protection Agency (U.S. EPA) recommends that

radon levels  $\geq 4.0$  picocuries per liter (pCi/L) warrant mitigation (Sethi, El-Ghamry, & Kloecker, 2012), a process used to rid buildings of detectable levels of radon. The U.S. Surgeon General and U.S. EPA estimate that 1 in 15 U.S. residences exceed 4.0 pCi/L and recommend that every residence be tested for radon (Neri et al., 2013).

Discovering evidence of radon and/or SHS in the home can act as a threat, potentially prompting the individual to worry about outcomes and stimulating action (Gladstone & Parker, 2003; McBride et al., 2008). The teachable moment model can be used to understand worry and motivation to test for radon or SHS in the home. McBride and coauthors (2003) found that a cueing event, such as disease diagnosis or abnormal test results, can create a teachable moment for smoking cessation, depending on the extent to which it increases perceptions of personal risk and poor outcomes (McBride, Emmons, & Lipkus, 2003). This might also be the case if an individual discovers elevated radon and/or SHS in the home, thereby increasing motivation to mitigate or adopt a smoke-free home policy.

While smoking is a known cause of lung cancer that may prompt worry, lack of knowledge is a primary reason for not testing for radon (Sandman, Weinstein, & Klotz, 1987). Individuals might believe that there is not a radon problem in the home. Further, consumers might not know where or how to get radon test kits or how to use them once purchased (Kennedy, Probart, & Dorman, 1991).

The home is a major source of SHS exposure for many nonsmokers, especially for children in households with less-educated parents or headed by a single parent (U.S. Department of Health and Human Services,

2007; Zhang, Martinez-Donate, Kuo, Jones, & Palmersheim, 2012). Home exposure to SHS may impact multiunit housing renters particularly, as SHS can come from units other than their own, and there is no control over decision making about smoking. Similarly, renters might feel they have little influence over whether their landlords would test for radon or mitigate if radon levels were high.

The purpose of this exploratory study was to assess the relationships of demographic and personal factors, including having one or more smokers living in the household, and a) lung cancer worry and b) completion of home screening for radon and SHS in a sample of renters. It was hypothesized that renters with smokers in the home would be more worried about lung cancer, but less likely to test their homes for radon and SHS than renters without smokers in the home.

## Methods

### Design and Sample

This exploratory study was based on a purposive sample of 47 renters who completed the baseline (preintervention) survey for a larger randomized controlled trial to test an intervention for reducing exposure to radon and SHS in the home. Renters were recruited in the waiting areas of a family medicine clinic and pharmacy located in a central Kentucky academic medical center between January and May 2013. Quota sampling was used to select a sample of renters, half with smokers in the home and half without; participants could either be smokers or nonsmokers themselves, were at least 18 years old, and currently living in rental housing. Electronic surveys to assess sociodemographic factors and lung cancer worry were administered via iPads. The study was approved by the medical center's institutional review board.

All renters were provided free test kits for radon and air nicotine, an indicator for SHS, and were asked to test their homes for 6 days but no longer than one week (Begley, Bratslet, & Hahn, 2013). Recruiters demonstrated how to use each kit. Participants were instructed to place the test kits on the lowest level of their home in a commonly used living area and hang them on a stationary item 4 feet from the floor, 4 feet away from exterior doors and windows, and 12 inches away from interior walls. Online videos demonstrated

how to deploy and return each test kit ([www.youtube.com/user/ukfreshrest](http://www.youtube.com/user/ukfreshrest)). Participants were paid \$20 after testing their home and returning the kits for both radon and SHS.

## Measures

### Sociodemographic/Personal Characteristics

Participants were asked to report their age in years and whether they identified as male, female, or transgender. Race and ethnicity were assessed with two items; given the small number of participants in each minority racial/ethnic category, the combined variable was categorized as White, non-Hispanic versus other race/ethnicity. To determine smoking status, participants were asked, "Do you currently smoke cigarettes, even just once in a while?" and "When was the last time you smoked a cigarette?" Those who responded yes to the first question and either today, 1–7 days ago, or 8–29 days ago to the second question were classified as current smokers.

Highest level of education was assessed using an 8-category ordinal item ranging from ever attended school/only kindergarten to postgraduate (after high school) education. Participants were categorized into two groups prior to analysis: those with at most a high school diploma versus those with any postgraduate education. Marital status was categorized as partnered (including married and living together) versus unpartnered.

### Smoker(s) in the Home

Participants were asked, "Do you or any other members of your household smoke cigarettes, cigars, or pipes?" that had a yes/no response. Those with one or more smoker living in the home were included in the smoker(s) in the home group, with the remaining participants being categorized in the no smoker(s) in the home group.

### Lung Cancer Worry

Lung cancer worry was measured using a 4-item ordinal scale (Lerman et al., 1991). Participants were first asked, "How much do you currently worry about getting lung cancer some day?" Answers ranged from not at all (0) to almost all of the time (5). Next, they were asked three questions: "How much do worries about lung cancer impact your mood?"; "How much do worries about lung cancer impact your daily activities?";

and "When you worry about lung cancer, how difficult is it to control these worries?" Answers ranged from not at all (0) to a lot (4). Responses to each question were rescaled to create a value ranging from 0 to 1. Total lung cancer worry scores were calculated as a sum of the four rescaled responses ranging from 0–4 (Cronbach's  $\alpha = .91$ ).

### Home Testing Status

Participants were classified as yes for testing if they completed at least one of the two test kits for radon and SHS.

## Data Analysis

Study variables were summarized using descriptive analysis including means and standard deviations or frequency distributions. Bivariate analysis tested for associations of sociodemographic/personal characteristics and the outcomes of lung cancer worry and home testing status using Pearson's product moment correlations, two-sample *t*-tests, or chi-square tests. Linear and logistic regressions were used to assess predictors of lung cancer worry and home testing status, respectively. Variance inflation factors assessed whether multicollinearity was present. Analyses were conducted using SAS version 9.3; an alpha level of .05 was used.

## Results

The average age of participants was 42.5 ( $SD = 14.7$ ; Table 1), ranging from 21–84 years. The majority of participants were female (62%), White, non-Hispanic (68%), nonsmokers (64%), educated beyond high school (70%), did not have a partner (62%), and completed at least one of the home test kits (57%). Of those in the minority racial/ethnic category, 10 were Black or African American. The remaining five were multiracial/multiethnic. Of those who completed at least one test kit ( $n = 27$ ), 26 completed both tests and the remaining one participant completed radon only.

Race/ethnicity, smoking status, education, and household smoking group were significantly associated with lung cancer worry (Table 1). Of a possible total of 4, renters identifying as a minority race/ethnicity had significantly higher lung cancer worry scores compared with those identifying as White, non-Hispanic ( $M = 1.6, 0.8$ , respectively;  $p = .017$ ), while smokers had higher scores than

TABLE 1

**Descriptive Summary and Bivariate Associations of Sociodemographic Variables, Lung Cancer Worry, and Home Testing Status (N = 47)**

Variable	Mean (SD) or n (%)	Lung Cancer Worry			Home Testing Status		
		Mean (SD)	Test Statistic	p-Value*	% Yes	Test Statistic	p-Value*
Age	42.5 (14.7)	–	r = .15	.31	–	t = 1.43	.16
Gender							
Male	18 (38.3%)	1.2 (1.2)	t = 0.69	.49	44.4	χ <sup>2</sup> = 2.02	.15
Female	29 (61.7%)	1.0 (1.1)			65.5		
Race/ethnicity							
White, non-Hispanic	32 (68.1%)	0.8 (1.0)	t = 2.48	.017	59.4	χ <sup>2</sup> = 0.15	.70
Other	15 (31.9%)	1.6 (1.2)			53.3		
Smoking status							
Smoker	17 (36.2%)	1.6 (1.3)	t = 2.69	.010	52.9	χ <sup>2</sup> = 0.22	.64
Nonsmoker	30 (63.8%)	0.7 (0.9)			60.0		
Education							
≤High school	14 (29.8%)	1.8 (1.3)	t = 2.56	.020	50.0	χ <sup>2</sup> = 0.45	.50
>High school	33 (70.2%)	0.8 (0.9)			60.6		
Partnered status							
Partnered	18 (38.3%)	0.9 (1.1)	t = 0.59	.56	50.0	χ <sup>2</sup> = 0.66	.42
Nonpartnered	29 (61.7%)	1.1 (1.1)			62.1		
Home smoking group							
Smoker(s) in the home	23 (48.9%)	1.6 (1.2)	t = 3.68	<.001	52.2	χ <sup>2</sup> = 0.51	.47
No smoker(s) in the home	24 (51.1%)	0.5 (0.8)			62.5		
Home testing							
At least one test returned	27 (57.4%)	1.1 (1.1)	t < 0.1	>.9	–	–	–
Did not test	20 (42.6%)	1.1 (1.2)					

\*p < .05 denotes significance.

nonsmokers (M = 1.6, 0.7, respectively; p = .010). The mean lung cancer worry score among renters with postsecondary education was 0.8 compared with 1.8 among those with at most a high school education (p = .020). The average lung cancer worry score was 1.61 for those with at least one smoker in the home, compared with 0.53 for those without any household smokers (p < .001; Figure 1). None of the sociodemographic/personal variables in this study was associated with home testing status. Lung cancer worry was not associated with testing status: both those who did or did not return at least one test kit had mean worry scores of 1.1 (p > .9).

The overall linear regression model to assess factors associated with lung cancer worry was significant, F(4, 42) = 5.6, p = .001, R<sup>2</sup> = .35

(Table 2). With the goal of having at least 10 observations per predictor (Babyak, 2004), the variables included as predictors were gender, race/ethnicity, education, and home smoking status. Age and partnered status were not included, as these were the factors most weakly associated with home smoking status based on the significance of test statistics listed in Table 1; smoking status was not included because it was strongly associated with home smoking group (χ<sup>2</sup> = 21.8; p < .0001) and more weakly associated with the outcome. Significant predictors of lung cancer worry were postsecondary education (b = -0.72; SE(b) = 0.32) and having at least one smoker living in the home (b = 0.71; SE(b) = 0.31). Participants with postsecondary education had lung cancer worry scores that were 0.72 points lower than those

with less education. Those who had one or more smokers in their household scored 0.71 points higher on lung cancer worry than those without one or more smokers in the home. All variance inflation factors for this model were smaller than 1.3, indicating multicollinearity did not distort regression parameters.

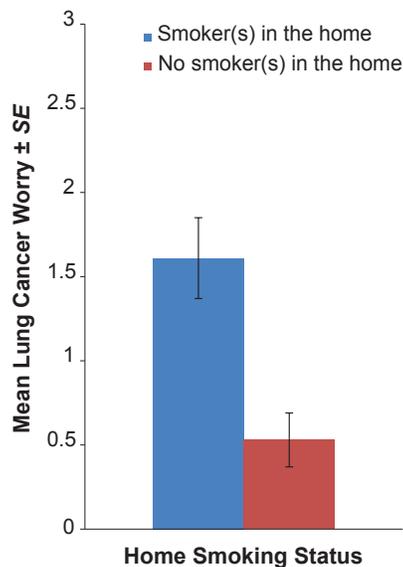
We used the same four predictors as in the linear regression to assess predictors of testing status with logistic regression. The logistic model was not significant overall (χ<sup>2</sup> = 2.9, p = .57). Gender, race/ethnicity, education, and home smoking status were not predictive of likelihood to test for radon and/or SHS.

**Discussion**

As hypothesized, renters with one or more smokers in the home were more worried about

FIGURE 1

**Lung Cancer Worry by Home Smoking Status**



Lung cancer worry measured by 4-item scale with potential range of 0–4; higher scores indicate greater worry.

lung cancer than those without smokers in the home. Our finding is consistent with McCaul and coauthors (1998), who found that those at high risk for developing cancer in their lifetimes report more worry. Perhaps renters with smokers in the home see themselves at risk for developing lung cancer. There is little research, however, relating SHS exposure and lung cancer worry. Studies with smokers show that their perceived risk of developing lung cancer is often lower due to a feeling of invulnerability (Ayanian & Cleary, 1999), even when well-informed about health risks related to smoking (Leventhal & Cameron, 1987). Risk perception is important because it has been shown to influence protective actions such as cancer screening or quitting smoking (McCaul, Branstetter, O'Donnell, Jacobson, & Quinlan, 1998; National Cancer Institute, 1999; Weinstein, 1988). Environmental health professionals could target renters with smokers living in the home to offer lung cancer risk reduction activities such as radon awareness, testing, and mitigation.

Those with lower education levels reported feeling more worried about lung cancer than

TABLE 2

**Linear Regression Assessing Sociodemographic Predictors of Lung Cancer Worry (N = 47)**

Regressor	Estimated <i>b</i> (SE)	Standardized Estimated <i>b</i>	<i>p</i> -Value*
Male	0.13 (0.30)	0.06	.66
White, non-Hispanic	-0.45 (0.32)	-0.19	.16
Post-secondary education	-0.72 (0.32)	-0.30	.031
Smoker(s) in the home	0.71 (0.31)	0.32	.027

\**p* < .05 denotes significance.

those with any postsecondary education. Lung cancer worry is an important construct, as it may be associated with whether or not individuals take action to reduce lung cancer risk. Moderate levels of cancer worry facilitated adherence to breast cancer screening (Diefenbach, Miller, & Daly, 1999). Given the association between educational level and lung cancer worry documented in our study, constructing and delivering educational messages that target low-literacy populations could promote radon testing and smoke-free homes.

Contrary to the hypothesis, those with one or more smokers in the home were as likely to test for radon and SHS compared to those without smokers in the home. Similarly, gender, race/ethnicity, smoking status, and education were not associated with home testing. Free resources and being paid to test might have motivated participants to test their homes. Regardless, it is promising that nearly 6 of 10 renters tested for radon and SHS. It is encouraging that those exposed to tobacco smoke and most at risk for developing lung cancer might be likely to test their homes for radon. Environmental health professionals need to combine health education messages with lung cancer risk reduction activities to promote radon reduction and smoke-free homes.

There is little prior research relating smoking status and radon testing; however, one study indicated smokers were less likely to demonstrate protective radon behaviors (Hampson, Andrews, Barckley, Lichtenstein, & Lee, 2006). As air nicotine test kits are restricted to researchers and not commercially available, there is no known research on smoking status and testing

the home for air nicotine. Increasing renters' knowledge about risk and their rights related to living in a smoke- and radon-free home needs to be part of any environmental health strategy. This study is exploratory; therefore, more research is needed to determine the best ways to motivate renters to test their homes, communicate with their landlords, and take steps to reduce environmental exposures related to lung cancer (Hahn et al., 2014).

Given the clear relationship of exposure to tobacco smoke and radon with lung cancer, it is important for healthcare providers to encourage all clients (especially those with smokers living in the home) to test their homes for radon. Educational protocols that promote radon testing, including information on how to obtain the kits, are needed to guide all client encounters. This information may be particularly timely during delivery of tobacco treatment services and/or lung cancer screening. The Prescription for Radon program is one example of an educational protocol targeted at healthcare providers. The program, within the Bridging Research Efforts and Advocacy Toward Healthy Environments (BREATHE) team at the University of Kentucky College of Nursing, provides prescription pads (for radon testing) and other educational materials for clients and providers. Environmental health and communication professionals can use audience segmentation tools to tailor messages for groups that might be especially receptive (e.g., low socioeconomic groups and those with smokers in the home).

A lack of understanding about how to test can be a barrier to testing; therefore, health-

care providers need to educate clients not only about why it is important to test, but also on the specifics of how to do it. Clients who have not yet tested need to be reminded at periodic intervals, because “not getting around to it” has been reported as a common reason for not testing. The synergistic risks for lung cancer from tobacco smoke and radon exposure need to be emphasized with clients who have a history of smoking or living with smokers (Kennedy et al., 1991).

Renters pose a particular challenge because they may feel powerless to control decisions beyond their own space. Renters living in multiunit housing facilities, for example, might choose to be smoke-free within their own home, but do not have the ability to control what others do around them. State laws vary related to home exposure to radon and SHS. For example, Kentucky requires disclosure of radon testing at the point of property sale, but does not require actual radon testing. Requiring radon testing at the point of sale would inform buyers of their risk for radon exposure. Policies requiring landlords to adopt smoke-free buildings and test for radon could be one solution. Such policies would greatly reduce lung cancer risk among high-risk populations. More research is needed on renters and their exposure to radon and tobacco smoke, as well as environ-

mental health interventions to reduce risk of lung cancer in rental properties.

The primary limitation of this exploratory study was the sample size. Still, these findings provide preliminary evidence to suggest that lung cancer worry among renters might be closely tied to both whether there are smokers living in the home and level of education. On the other hand, willingness to test for radon and SHS might be unrelated to demographic or personal characteristics, including whether there is one or more smokers living in the household. Renters form an important at-risk segment of the population because they have less control over their indoor air environments than do those who own their homes.

### Conclusion

We found that renters who had at least one smoker in the home and those with a lower education level were more likely to report lung cancer worry. Lung cancer worry can serve as a motivator for renters to test their homes for radon and to take action to reduce lung cancer risk. These findings suggest that people who live with one or more smokers or who have at most a high school degree might be most motivated to take action to reduce their risk of lung cancer. Environmental health professionals need to combine health education

messages that promote radon reduction and smoke-free homes. More research is needed to identify effective interventions to motivate both renters and landlords to test for radon and also to take action to eliminate exposure to SHS (Hahn et al., 2014). Renters do not have the decision-making power to achieve a radon- and smoke-free environment on their own; therefore, implementing policies that require landlords to test and fix their rental homes for radon and SHS are essential. 🏠

**Acknowledgements:** This project was funded by the National Institute of Environmental Health Sciences (NIEHS) and the National Institute of General Medical Sciences (NIGMS). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIEHS, NIGMS, or the National Institutes of Health. This project was supported, in part, by the University of Kentucky College of Nursing Undergraduate Research Internship Program.

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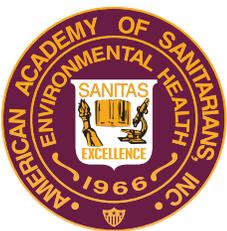
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# DAVIS CALVIN WAGNER SANITARIAN AWARD



**The American Academy of Sanitarians (AAS) announces the annual Davis Calvin Wagner Award. The award will be presented by AAS during the National Environmental Health Association's (NEHA) 2017 Annual Educational Conference & Exhibition. The award consists of an individual plaque and a perpetual plaque that is displayed in NEHA's office lobby.**

Nominations for this award are open to all AAS diplomates who:

1. Exhibit resourcefulness and dedication in promoting the improvement of the public's health through the application of environmental and public health practices.
2. Demonstrate professionalism, administrative and technical skill, and competence in applying such skills to raise the level of environmental health.
3. Continue to improve through involvement in continuing education type programs to keep abreast of new developments in environmental and public health.
4. Are of such excellence to merit AAS recognition.

**NOMINATIONS MUST BE RECEIVED BY APRIL 15, 2017.**

**Nomination packages should be sent electronically to [shep1578@gmail.com](mailto:shep1578@gmail.com). If desired, three hard copies of the nomination document may be submitted to**

American Academy of Sanitarians  
c/o Craig A. Shepherd  
1271 Statesville Road  
Watertown, TN 37184

For more information about the award nomination, eligibility, evaluation process, and previous recipients of the award, please visit [sanitarians.org/awards](http://sanitarians.org/awards).

# The Effect of Inspection Announcement on the Outcome of Food Service Establishment Sanitary Health Evaluations

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**Abstract** This study evaluated whether a difference existed between one-hour and one-day notice on inspection announcements versus unannounced inspections on health inspection ratings of food establishments. Three hundred food establishments were randomly assigned into three sections of no announcement, one-hour announcement, or one-day announcement. Certified food inspectors performed routine inspections of these establishments for foodborne illness risk factors. Inspection results were analyzed using chi-square analysis. A significant interaction was found: those who had no notice were more likely to have an unsatisfactory outcome (4%) than establishments that had either one-hour or one-day notice (0%). One-hour notice did not result in a significant difference in outcome when compared with no notification. One-day notice did result in a significant difference in outcome when compared with no notification. This result suggests that one-hour notification is not a significant amount of time to impact the outcome of an inspection, but is sufficient to allow management to logistically prepare for an inspection and still maintain the objective of the inspection process.

## Introduction

Foodborne illness in the U.S. is a major cause of personal distress, preventable death, and avoidable economic burden (U.S. Department of Health and Human Services [HHS], 2013). Food service establishments are sources of foodborne illnesses and food handlers contribute to foodborne illness outbreaks (Guzewich & Ross, 1999; Olsen, MacKinon, Goulding, Bean, & Slutsker, 2000). More than 74 billion meals are served at 970,000 commercial food establishments in the U.S. each year and restaurant industry sales on a typical day in 2012 totaled \$1.7 billion. Restaurant industry sales in 2016 were estimated at \$782.7 billion, which equals 4%

of the gross domestic product in the U.S. and a total daily sales of \$2.1 billion. There are over one million restaurants with 90% having fewer than 50 employees and over 70% being single-unit operations (National Restaurant Association, 2016).

Of a mean 550 foodborne disease outbreaks reported to the Centers for Disease Control and Prevention each year from 1993 through 1997, over 40% were attributed to commercial food establishments (Olsen et al., 2000). Meade and coauthors (1999) estimated that foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the U.S. each year. It has been estimated that 38.4 million

foodborne illnesses are caused by unspecified agents, resulting in 71,878 hospitalizations and 1,686 deaths (Scallan, Griffin, et al., 2011). Moreover, it has been reported that 31 major pathogens caused 55,961 hospitalizations and 1,351 deaths each year in the U.S. (Scallan, Hoekstra, et al., 2011).

For many victims, foodborne illness results only in discomfort or lost time from the job. For highly susceptible populations such as preschool age children, older adults in healthcare facilities, and those with impaired immune systems, however, foodborne illness is more serious and may be life-threatening. The World Health Organization (2002) identifies food safety as the assurance that food does not cause harm to human health and well-being when consumed in the usual manner. In this regard, food safety is of paramount concern in the 21st century (Patron, 2004). Poor food safety practices have been identified as a reason for increased foodborne disease outbreaks in schools, colleges, and universities in the U.S. (Daniels et al., 2002).

Preventing restaurant-associated foodborne disease outbreaks, therefore, is an important task. This measure to enhance food safety is the responsibility of public health departments. Restaurants in the U.S. are regularly inspected by local, county, or state health department personnel. The annual costs of foodborne illness in terms of pain and suffering, reduced productivity, and medical costs are estimated to be \$10–\$83 billion (Guzewich & Ross, 1999). While technological advances such as pasteurization and proper canning have all but eliminated some disease, new causes of foodborne illness have been identified (Meade et al., 1999). According to HHS (2013), there are

five major risk factors related to employee behaviors and preparation practices in retail and food service establishments that contribute to foodborne illness: 1) improper food holding temperatures; 2) inadequate cooking, such as undercooking raw shell eggs; 3) contaminated equipment; 4) food from unsafe sources; and 5) poor personal hygiene.

Routine unannounced restaurant inspections performed by local or state environmental health specialists have traditionally served as a primary regulatory strategy to prevent restaurant-associated foodborne illnesses (Reske, Jenkins, Fernandez, VanAmber, & Hedberg, 2007). By so doing, they monitor and enforce compliance with applicable legislation (Newbold, McKeary, Hart, & Hall, 2008). These inspections have reduced the risk of foodborne outbreaks (Irwin, Ballard, Grendon, & Kobayashi, 1989; Luby, Jones, & Horan, 1993). Restaurant inspection results were found to predict the likelihood of small foodborne-illness outbreaks in Seattle-King County (Irwin et al., 1989). In addition, lower inspection scores were one of several factors significantly associated with the occurrence of foodborne incidents investigated in Los Angeles County (Buchholz, Run, Kool, Fielding, & Mascola, 2002). Results of a Miami-Dade County assessment of routine inspections, however, did not predict foodborne outbreaks (Cruz, Katz, & Suarez, 2001).

Routine inspection of restaurants to prevent foodborne disease is mandated by food sanitation codes throughout the U.S. (Bryan, 1978) and is recommended by the Model Standards for Community Health Practice of the U.S. Public Health Service (HHS, 2013). Controlling foodborne illness in the U.S. consists of regulatory requirements for the food industry, some level of consumer education, and state or local health regulatory activities. At the municipal level, regulatory activities are aimed largely at retail food premises (restaurants, food stores, etc.).

Little scientific evidence exists to support the effect of various inspection announcements on sanitary inspection evaluations. The available studies provide mixed results or intermingled changes to inspection frequency with other regulatory changes (Bader, Blonder, Henriksen, & Strong, 1978; Corber, Barton, Nair, & Dulberg, 1984; Kaplan, 1978;

Mathias, Sizto, Hazlewood, & Cocksedge, 1995). Some studies suggest that once-a-year inspections were insufficient to maintain sanitary conditions (Bader et al., 1978; Kaplan, 1978). Increased frequency of inspection (up to 4 times per year) resulted in improved sanitation (Allwood, Lee, & Borden-Glass, 1999). A randomized study in Ottawa–Carleton, Ontario, found that increasing the frequency of inspections did not lead to improved sanitary conditions (Corber et al., 1984). Kassa (2001) found that failure to meet regulatory standards is assumed to increase the risk of foodborne disease and that foodborne outbreak is commonly associated with facilities with a history of regulatory failure. Kassa and coauthors (2010) found that restaurants with certified food managers received fewer critical food safety violations compared to establishments without certified food managers.

There remains a gap in the literature to show whether inspection announcements effect the overall performance of food service establishments. Food inspectors are faced daily with unwelcoming, angry food establishment owners and managers who many times prefer not to deal with inspections during their busy hours of operation. Sometimes they demand to know why inspectors come at the wrong time and arguments ensue between inspectors who are trying to perform their assigned task of inspecting the food establishment and establishment owners who regard the inspector as an unwanted guest.

Not all times of the day are favorable for inspection in a food establishment from the standpoint of the food establishment owner. At peak time in most food establishments, movement in the kitchen, prep area, service area, and dining area can be impossible and the entire operation can be disorganized. In some cases, the mere sight of a health inspector in a food establishment raises a red flag and suspicion in the minds of the patrons. Routine unannounced inspections are mostly regarded as regulatory in nature compared with announced inspections that are viewed as discussion and education based. Standardized inspections should be both regulatory and educational in nature.

Previous studies have investigated the beneficial effect of implementing an announced restaurant inspection program (Reske et al., 2007) and evaluated the frequency of food service establishment sanitation inspection (Bader

et al., 1978). There remains, however, a need to study the effect of inspection announcements on the overall performance of food service establishments' sanitary evaluation.

The primary purpose of this study was to determine if there is a difference in effect between one-hour and one-day notice on the health inspection ratings of food establishments. The following research questions were proposed: 1) Is there a difference in the satisfactory ratings of food establishments that received no announcement compared with establishments that received one-hour notice announcement? 2) Is there a difference in the performance of food establishments that received no announcement compared with establishments that received a one-day notice?

## Methods

Three hundred food establishments were randomly assigned into three sections: no announcement, one-hour announcement, and one-day announcement. All food establishments were licensed within an urban city in Essex County, New Jersey, and classified as restaurants (183), delicatessens (65), daycare centers (21), residential healthcare facilities, (13) and schools (18). Registered environmental health specialists (REHS), generally referred to as health inspectors, performed full sanitary inspections using food establishment inspection checklists and retail food inspection report forms while conducting inspections in these establishments. The inspectors were trained and standardized in the inspection of food establishments.

The inspection covered areas of foodborne illness risk factors and interventions: management and personnel, preventing contamination from hands, food source, food protected from contamination, potentially hazardous foods, and time and temperature controls. Other areas covered during the inspection were the good retail practices: safe food and water control, protection from contamination, food temperature control, equipment, utensil and linen handling, and condition of general physical facilities.

For the no announcement inspections, the REHS walked into one of the randomly selected food establishments unannounced and performed a full sanitary inspection. For the announced inspections, the REHS called the establishment one hour or one day before

visiting the establishment for a full sanitary inspection. Results of the inspections are recorded as “satisfactory” for establishments that performed exceedingly well or as “conditionally satisfactory” for establishments that performed fairly well with violations to correct, but not enough violations to warrant a closure. An “unsatisfactory” rating was given to establishments that performed poorly and needed extensive correction of violations. All establishments with unsatisfactory ratings were closed by order of the health department and were reopened by the health department only when the establishments called for a re-inspection and demonstrated they had corrected all prior violations.

Establishments were randomly selected into one of three groups, representing the independent variable of no announcement, one-hour announcement, and one-day announcement. The dependent variable was represented by the results of the inspections, which were recorded as satisfactory, conditionally satisfactory, and unsatisfactory. Pearson’s chi-square test was used in analysis of the data because both dependent and independent variables are nominal and met chi-square test assumptions of sample size, simple random sampling, and independence. The test compared frequencies of food establishments’ performance and level of inspection announcement or no announcement. Data analysis was performed using SPSS 17.

**Results**

Table 1 shows a cross tabulation of the outcomes of health inspections by the amount of notice given to the establishment and shows that in the control group (no notification given), 4% of inspections yielded an unsatisfactory outcome, 22% yielded an outcome of conditionally satisfactory, and 74% yielded an outcome of satisfactory.

In the group given a one-hour notification, no inspections yielded an unsatisfactory outcome, 20% yielded an outcome of conditionally satisfactory, and 80% yielded a satisfactory outcome. In the one-day group (24-hour notification given), no inspections yielded unsatisfactory outcome, 7% yielded an outcome of conditionally satisfactory, and 93% yielded an outcome of satisfactory.

Figure 1 shows a clustered bar graph with the differences in the satisfaction outcome frequencies among the three groups. When

**TABLE 1**  
**Cross Tabulation of Inspection Outcome by Notification**

Notification	Outcome			Total
	Unsatisfactory	Conditionally Satisfactory	Satisfactory	
<b>Control</b>				
Count	4	22	74	100
% within notification	4.0%	22.0%	74.0%	100%
% within outcome	100%	44.9%	30.0%	33.3%
% of total	1.3%	7.3%	24.7%	33.3%
<b>One-hour</b>				
Count	0	20	80	100
% within notification	0%	20.0%	80.0%	100%
% within outcome	0%	40.8%	32.4%	33.3%
% of total	0%	6.7%	26.7%	33.3%
<b>One-day</b>				
Count	0	7	93	100
% within notification	0%	7.0%	93.0%	100%
% within outcome	0%	14.3%	37.7%	33.3%
% of total	0%	2.3%	31.0%	33.3%
<b>Total</b>				
Count	4	49	247	300
% within notification	1.3%	16.3%	82.3%	100%
% within outcome	100%	100%	100%	100%
% of total	1.3%	16.3%	82.3%	100%

comparing the frequency of satisfactory, conditionally satisfactory, and unsatisfactory outcomes in establishments with no notice, one-hour notice, and one-day notice, Table 2 shows that a significant interaction was found ( $\chi^2 (4) = 18.41, p < .01$ ). Those who had no notice were more likely to have an unsatisfactory outcome (4%) than establishments that had one-hour or one-day notice (0%).

When comparing the frequency of satisfactory, conditionally satisfactory, and unsatisfactory outcomes in establishments with no notice and one-hour notice, however, no significant interaction was found ( $\chi^2 (2) = 4.33, p > .05$ ). When comparing the frequency of satisfactory, conditionally satisfactory, and unsatisfactory outcomes in establishments with no notice and one-day notice, a significant difference was found ( $\chi^2 (2) = 13.92, p < .05$ ), suggesting that there was a difference in outcomes between no notification

and one-day notification. In addition, when comparing the frequency of satisfactory and conditionally satisfactory outcomes in establishments with no notice, one-hour notice, and one-day notice, a significant interaction was found ( $\chi^2 (1) = 7.24, p < .01$ ).

**Discussion**

Establishment owners and managers were more accommodating toward announced inspections compared with unannounced inspections. Furthermore, 86% of restaurant owners and managers agree that announced inspections lead to better relationships with inspectors. This approach is consistent with prior findings (Reske et al., 2007). All establishments that received a conditionally satisfactory or unsatisfactory rating failed to meet certain regulatory standards, which is consistent with a prior study’s findings (Kassa, 2001). The results show that notification, overall,

FIGURE 1

**Satisfaction Rating Frequency by Notification Type**

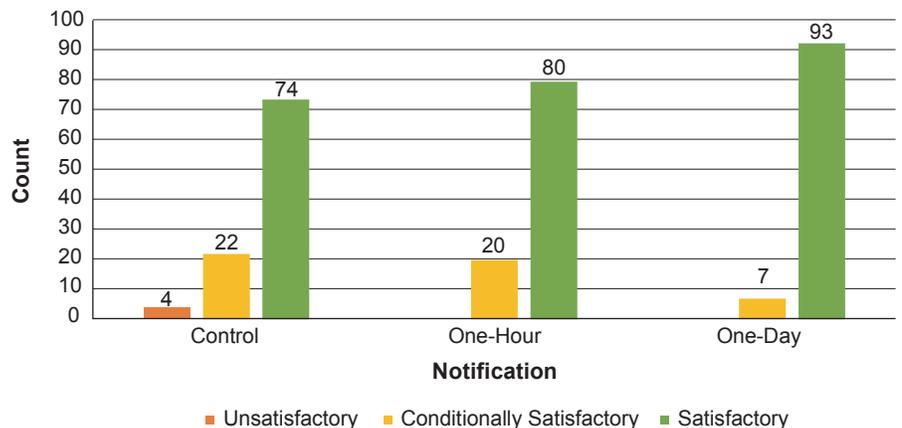


TABLE 2

**Chi-Square Test of All Cases**

	Value	df	Asymptotic Significance (2-Sided)
Pearson's chi-squared test	18.41	4	.001
Likelihood ratio	20.40	4	.000
Linear-by-linear association	14.60	1	.000
N of valid cases	300		

df = degrees of freedom.

can have a significant effect on inspection satisfactory rating outcomes. Overall, the odds of receiving a satisfactory inspection outcome were 2.25 times higher in establishments with any notification than in those with no notification. Establishments that were given 24 hours' notice were 3.32 times more likely to receive a satisfactory inspection rating than establishments that were given only one-hour notice. Those who had no notice were more likely to have an unsatisfactory outcome (4%) than establishments that had any notice (one hour, one day) (0%). This finding is consistent with what Reske and coauthors (2007) reported previously.

In order to determine whether this effect was present in only one-hour notifications,

both one-hour notifications and one-day notifications were compared with the no-notification control. These comparisons showed that one-day notifications yielded a significant effect on outcome ( $\chi^2 (2) = 13.92, p < .05$ ), while one-hour notifications did not ( $\chi^2 (2) = 4.33, p > .05$ ). To further validate this, one-day notification outcomes were compared with one-hour notification outcomes and found there was, indeed, a significant difference between the outcomes in the two groups ( $\chi^2 (1) = 7.24, p < .01$ ). Additionally, this study found that a one-day notification does have a significant effect on the overall outcome and might bias the inspection results.

This study opens an avenue for further studies. A major limitation of this study is

that it was conducted in one locality. Data from other localities need to be evaluated to see if outcomes will differ. The study was cross-sectional and correlational in nature, therefore, causal nature of the association between no announcements compared with one-hour versus one-day announcement cannot be determined. Measurements occurred at a single point in time. Results of reinspections were not reported. A repeat cross-sectional study can be conducted to measure any change in the sample. In addition, a study to ascertain the impact of the type and consistency of enforcement action on compliance could be conducted. There might be confounding factors (extraneous variables) that interfere with actual results of the inspections.

**Conclusion**

Based on these findings, it is recommended that one-hour notification is acceptable to provide establishments with adequate time to prepare staff and assure that they have adequate personnel available to both run the operations of the establishment and to accommodate the needs of the health inspector. This study's findings suggest that one hour is not a significant amount of time to impact the overall outcome, but is sufficient to allow management to logistically prepare for an inspection. 🐼

**Acknowledgments:** The author would like to acknowledge and thank all the registered environmental health specialists who participated in this study. In addition, the author would like to thank Drs. Jason Sudia and Terrence Cahill at the Department of Health Sciences and Health Administration, Seton Hall University, for their time and effort in assisting with statistical methods and reviews.

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## ► SPECIAL REPORT

# Overview of Silica-Related Clusters in the United States: Will Fracking Operations Become the Next Cluster?

M. Thomas Quail, MS, RN, LNC

**Abstract** Silicosis is the oldest known occupational pulmonary disease. It is a progressive disease and any level of exposure to respirable crystalline silica particles or dust has the potential to develop into silicosis. Silicosis is caused by silica particles or dust entering the lungs and damaging healthy lung tissue. The damage restricts the ability to breathe. Exposure to silica increases a worker's risk of developing cancer or tuberculosis. This special report will provide background history of silicosis in the U.S., including the number of workers affected and their common industries. Over the years, these industries have impeded government oversight, resulting in silicosis exposure clusters. The risk of acquiring silicosis is diminished when industry implements safety measures with oversight by governmental agencies. Reputable authorities believe that the current innovative drilling techniques such as fracking will generate future cases of silicosis in the U.S. if safety measures to protect workers are ignored.

## Introduction

In 1936, the U.S. House of Representatives Committee of Labor convened and conducted an inquiry into the massive silicosis epidemic at the Hawk's Nest Dam and Tunnel Hydroelectric Power Project (Rukeyser, 1936). This project was noted as the worst occupational and public health disaster in the history of the U.S. It affected nearly 2,000 workers, many of whom developed acute silicosis, became ill, and died after being exposed to respirable crystalline silica (Cherniack, 1986; Crandall, Parnell, & Spillan, 2009; Goodwyn, 2006a; Greenberg, Waksman, & Curtis, 2007; Harshbarger, 2009; Rampton & Stauber, 2002; Stalnaker, 2006; Thomas & Kelley, 2010; "Victim of Silicosis," 1936).

Silicon dioxide (silica) is a mineral found naturally in most rock beds, constituting approximately 59% of the Earth's crust. It

occurs at varying concentrations in rocks such as granite (25%–40% silica), sandstone (67% silica), or slate (30%–40% silica). Silica major categories are the crystalline or non-crystalline forms, with multiple subforms. The noncrystalline forms include coesite, keatite, and lechatelierite and are less toxic than the crystalline forms. The crystalline forms include cristobalite, quartz, and tridymite (Ahasic & Christiani, 2011; American Public Health Association [APHA], 1995; Castranova & Vallyathan, 2000; Glenn, 2008; Greenberg et al., 2007; Jackson, 2012; Leung, Yu, & Chen, 2012; Muetterties, O'Halloran-Schwartz, & Wang, 2003; National Toxicology Program, 2016; Occupational Safety and Health Administration [OSHA], 2013; Smith, 1992; Stocker, 2006; U.S. National Library of Medicine, 2014; World Health Organization [WHO], 2000).

Crystalline silica is found in almost all construction, manufacturing, maritime, and general industries and their associated occupations (Table 1.) Quartz, the most abundant crystalline form, is the "major component of granite, gypsum, sand, soil, and stone. Quartz is present in lesser amounts in asphalt, brick, cement, concrete, and mortar" (Stocker, 2006). Finer grains of silica are known as "flour," and may be found in specific products such as abrasive cleaners, grouting, metal polish, paper, plastics, sandpaper, and toothpaste (APHA, 1995; Castranova & Vallyathan, 2000; Cherniack, 1986; Ehrenberg, 2012; Greenberg et al., 2007; National Institute for Occupational Safety and Health [NIOSH], 2004a, 2004b; Rampton & Stauber, 2002; Steenland & Ward, 2014; Thomas & Kelley, 2010; U.S. Department of Labor [U.S. DOL], 2012b; Vupputuri et al., 2012; WHO, 2012; Ziskind, Jones, & Weill, 1976).

Respirable crystalline silica or dust can be harmful. To be classified as respirable, silica particles must be <10 µg in diameter. Particles usually are formed when workers chip, cut, drill, grind, or pulverize objects that contain the crystalline silica. When particles are inhaled, they become settled in the bronchioles and alveoli of the lungs. The body's response to these foreign substances is to encapsulate, remove, or destroy them. Normally any damaged lung tissue is repaired; however, during the silica removal process, pulmonary tissue can remain damaged, causing a thickening and scarring (called pulmonary fibrosis). This damage over time eventually restricts the person's ability to breathe (Ahasic & Christiani 2011; Bang, Attfield, Wood, & Syamlal, 2008; Castranova & Vallyathan, 2000; Cherniack, 1986; Greenberg et al., 2007; Jackson, 2012; Leung et al., 2012;

TABLE 1

**Type of Industry/Occupations Where Silica Dust Exposure Occurs (Partial List)**

Industry/Trades	Occupation/Duties
Agriculture	Farmers, farm laborers
Automotive repair	Mechanics, auto-body bonding, fillers, repairs
Construction/demolition	Carpenters, laborers, masons, plumbers, truck drivers, pipe fitters, jack hammering, milling, railroad rehabilitation, bridge/road/highway construction/repair, drywall finishing, roofing, track tie laying
Dentistry	Dental technicians, dental equipment and supplies, dental laboratories
Foundry	Castings, molds
Fracking	Refilling operations of hoppers, sand blenders/movers, transfer belts, vehicle traffic
General industry	Boiler repair, metal preparation, paving, petroleum refining, abrasive/sand blasting, smelting
Hobbyists	Artisans, ceramics, glass blowing, pottery
Manufacturing	Abrasives, concrete, cookware, detergents, enamels, etching, fiberglass, flooring, foundry, glass, jewelry, porcelain, steel, textiles
Maritime	Rust removal, sandblasting, ship building, surface preparation
Masonry	Brick laying, buffing, grinding, lettering, stone cutting, polishing
Mining	Blasting, crushing rock, drilling, mining, quarrying, sand screening, tunneling, vehicle traffic

Muetterties et al., 2003; National Toxicology Program, 2016; NIOSH, 2004a, 2004b, 2014; U.S. DOL & NIOSH, 1996; OSHA, 2013; Pietrykowski & Tobin, 2002; Rampton & Stauber, 2002; Steenland & Ward, 2014; Thomas & Kelley, 2010; U.S. DOL, 2012b; Vupputuri et al., 2012; WHO, 2000, 2012; Ziskind et al., 1976).

In 2013, the Occupational Safety and Health Administration (OSHA) requested a change to the permissible exposure limit (PEL) of respirable crystalline silica. In their report, they proposed to decrease the current (1971) PEL standards because it posed a significant occupational health risk, including cancer (Harding, 2014; Markowitz & Rosner, 1995; National Toxicology Program, 2016; OSHA, 2013; Steenland & Ward, 2014; WHO, 2012).

OSHA (2013) stated, “exposure to respirable crystalline silica is the only known cause of silicosis.” They added that it is “the oldest known occupational lung disease and is still today the cause of significant premature mortality.”

It is estimated that over two million workers in the U.S. are chronically exposed to silica each year. Of these, approximately 3,600–

7,000 workers will be newly diagnosed with silicosis, with 200–300 deaths occurring (Ahasic & Christiani, 2011; Bang et al., 2008; Castranova & Vallyathan, 2000; Greenberg et al., 2007; Harding, 2014; Muetterties et al., 2003; NIOSH, 2004b, 2014; U.S. DOL & NIOSH, 1996; OSHA, 2004, 2013; Rampton & Stauber, 2002; Raymond & Wintermeyer, 2006; Rosenman, Reilly, & Henneberger, 2003; Rosner & Markowitz, 1995; Stalnaker, 2006; Steenland & Ward, 2014; Thomas & Kelley, 2010; Ziskind et al., 1976).

OSHA (2013) stated “silicosis-related mortality and morbidity statistics are likely to be understated. This is due to misclassification of causes of death . . . errors in recording occupation on death certificates, misdiagnosis of disease by healthcare providers,” and because there is no national silicosis disease surveillance system in the U.S. It is estimated that if the newly proposed PEL standards are implemented, 1,700 new cases of silicosis will be avoided, saving approximately 700 lives each year (Glenn, 2008; Harding, 2014; National Toxicology Program, 2016; Steenland & Ward, 2014; Thomas & Kelley, 2010; WHO, 2012).

**Silica History**

Silica-related lung disease has been described as early as Hippocrates (460 B.C.–370 B.C.) using such terms as grinders rot, industrial phthisis, masons disease, miners phthisis, potters consumption, stone cutters consumption, and tunnelitis (Cherniack, 1986; Greenberg et al., 2007; Hoffman, 1922; Muetterties et al., 2003; Rampton & Stauber, 2002; Rosner & Markowitz, 2006; Shapiro, 2005; Stalnaker, 2006).

Prior to its discovery, silicosis was diagnosed as being tuberculosis, pneumonia, or pneumoconiosis by clinicians and public health professionals who suspected that organisms were responsible for a worker’s lung disease (Rosner & Markowitz, 1991). Cherniack (1986) reported that in Britain “the direct association between exposure to siliceous dusts and morbid fibrosis of the lungs was established as early as 1860.” The term silicosis was used as early as 1870 (Ziskind et al., 1976). British physicians “had produced sound and detailed descriptions of [chronic silicosis]” that encouraged the British industry to implement changes in the workplace (Cherniack, 1986).

Practices to decrease silica dust and dust particle exposure, such as dry drilling, were either prohibited or replaced with wet drilling by 1897. Wet drilling is an attempt to diminish the airborne dust by wetting the silica substance being cut, drilled, grinded, or pulverized. This method somewhat protects the worker; however, most industries were reluctant to implement wet drilling because it significantly slowed productivity (Cherniack, 1986; Jordan, 1998; Stalnaker, 2006; Synder, 2010).

In the U.S., meanwhile, workers continued to be diagnosed with silicosis because

- the U.S. declined to follow British practices, primarily due to limited resources to implement, regulate, and enforce these methods;
- clinicians remained firm and persistently blamed organisms as being responsible for the disease;
- industry and their insurers refuted allegations of substandard working conditions; and
- industry and their insurers manipulated scientific literature by suppressing scientific findings to ensure the industry was safe from liability (Cherniack, 1986; Egilman, Bird, & Lee, 2013; Markowitz & Rosner, 1995; Rosner & Markowitz, 1995).

In 1908, Frederick L. Hoffman, a U.S. statistician for the Prudential Insurance Company of America, reported and later published a study in 1918 using statistical analysis that identified silicosis as a distinct condition from other types of lung diseases (Hoffman, 1918; Rosner & Markowitz, 1991). His study blatantly disputed the clinicians view and “gave legitimacy . . . that dust was dangerous to [one’s] health” (Rosner & Markowitz, 1991). After his study, workers in the U.S. experiencing symptoms from crystalline silica or silica dust exposure were now said to have “silicosis” (Greenberg et al., 2007; Muetterties et al., 2003; Shapiro, 2005).

Hoffman then looked at various industries to determine if workers who had been diagnosed with tuberculosis actually had silicosis. During the 1920s, he and others published studies of granite worker illnesses. One study reported that over 90% of Vermont granite workers had contracted silicosis, some of whom had been misdiagnosed as acquiring tuberculosis (Hoffman, 1922; Rosner & Markowitz, 2006; Stocker, 2006). Hoffman later said that it wasn’t until the tragedy at Hawk’s Nest, however, that public awareness became heightened.

By the 1950s, silicosis was generally considered a disease of the past and essentially was forgotten. Shapiro (2005) reported, “articles were written about how silicosis was only a concern to minority workers and workers who were hypersensitive to dust.” The industry even made attempts to hide this problem by blaming unhygienic and primitive conditions as its cause, and often chastised physicians for diagnosing silicosis cases (Egilman et al., 2013; Markowitz & Rosner, 1995; Rosner & Markowitz, 1995; Thomas & Kelley, 2010). Many of these attempts failed because “the federal government had to intervene and regulate [the] industry in order to control the growing problem of silicosis” in the industry (Shapiro, 2005).

## Silicosis Clusters in the U.S.

### West Virginia

The Hawk’s Nest Tunnel Project (1930–1931) was a hydroelectric power plant construction plan of Union Carbide and Carbon Corporation (UCC) to divert 5 miles of rivers in Gauley Bridge, West Virginia. The project required blasting and drilling through Gauley Mountain to construct multiple dams, tunnels, and power stations along the rivers to supply hydroelectric

power to UCC subsidiaries (Ahasic & Christiani, 2011; Cherniack, 1986; Crandall et al., 2009; “Giant Undertaking,” 1930; Goodwyn, 2006a; Greenberg et al., 2007; Harshbarger, 2009; Jordan, 1998; Lucas & Paxton, 1999, 2006; Rampton & Stauber, 2002; Stalnaker, 2006; “Victim of Silicosis,” 1936).

The project employed over 5,000 poor, black, migrant workers, of which more than half worked underground blasting and drilling through almost pure (96%–99.44%) crystalline silica. Crystalline silica had become a priceless commodity and was extensively used in the electro-processing of steel. UCC denied knowledge of its abundance, however, and purposely altered their previously proposed plans to widen sections of the tunnels for no known engineering reason. By the time the project was completed, UCC had mined over 300,000 tons of ore, processed by their own metallurgic plant downstream (Cherniack, 1986; Crandall et al., 2009; Egilman et al., 2013; Goodwyn, 2006a; Greenberg et al., 2007; Jordan, 1998; Kendall, 2012; Muetterties et al., 2003; Rampton & Stauber, 2002; Shapiro, 2005; Spangler, 2008; Stalnaker, 2006; Steenand & Ward, 2014; Stocker, 2006; Thomas & Kelley, 2010; “Victim of Silicosis,” 1936).

UCC engineers supervised the project contractors and set aggressive deadlines that determined the pace of how the excavation proceeded. Men worked under deplorable conditions because UCC implemented dry drilling procedures, required extended underground working hours, and failed to collect dust samples for testing. They purposely ignored the use of appropriate respiratory equipment and did not implement the necessary safety precautions and ventilation requirements (Ahasic & Christiani, 2011; Cherniack, 1986; Jordan, 1998; Kendall, 2012; OSHA, 2013; Rampton & Stauber, 2002; Rosner & Markowitz, 2006; Spangler, 2008; Stalnaker, 2006; Stocker, 2006; Thomas & Kelley, 2010; “Victim of Silicosis,” 1936).

Cherniack (1986) reported that “measures for [silicosis] prevention through ventilation and moisture were in wide use” throughout the mining industry and that workers at Hawk’s Nest were “deprived . . . of [these] protective provisions.” UCC would always “appear” to comply with industry standards, however, when mine inspectors performed their site visits (Cherniack, 1986, 2015; Kendall, 2012; Spangler, 2008; Synder, 2010).

There is a significant degree of conflicting information regarding the exact number of men who became ill and died during this project. The conflicting numbers were due to alleged coercion and misrepresentation by company personnel and the destruction of company, death, and medical records. The project was completed in 18 months with over 75% of the workers becoming ill or having died. UCC physicians diagnosed them with tunnelitis, pneumonia, or tuberculosis; however, it was later determined they had actually died of acute silicosis.

The public first heard of the Hawk’s Nest tragedy when silicosis lawsuits began to surface against UCC by sick workers or their surviving family members. UCC requested the help of their insurance company, who eagerly complied because they had known years earlier that workers would acquire silicosis over time. The congressional inquiry into the Hawk’s Nest tragedy clearly identified that corporate greed and profits were placed before worker safety. This disaster ultimately led to the creation of new occupational safety standards and regulations to reduce the amount of silica exposure to workers (Centers for Disease Control and Prevention [CDC], 2005; Cherniack, 1986; Crandall et al., 2009; Egilman et al., 2013; Goodwyn, 2006a, 2006b; Greenberg et al., 2007; Harshbarger, 2009; Kendall, 2012; Markowitz & Rosner, 1995; Muetterties et al., 2003; Pietrykowski & Tobin, 2002; Rampton & Stauber, 2002; Rosner & Markowitz, 1995; Shapiro, 2005; Spangler, 2008; Stalnaker, 2006; Stocker, 2006; Thomas & Kelley, 2010; “Victim of Silicosis,” 1936; West Virginia Department of Commerce, 1930; Ziskind et al., 1976).

### Louisiana

In the late 1960s, Louisiana sandblasters and painters who worked in the shipyard industry, painting and refitting ships and steel structures, began complaining of chest pain and difficult or labored breathing (dyspnea). Thomas and Kelley (2010) reported sandblasters would often “sandblast . . . residue in the poorly ventilated inner walls of . . . ship bottoms.”

After two workers died from silicosis, Rosner and Markowitz (2006) reported, “Tulane University . . . began a series of epidemiological studies which documented widespread silicosis among shipyard workers” (Bobear,

Hanemann, & Beven, 1962; Goodier, Boudreau, Coletta, & Lucas, 1974; Rosner & Markowitz, 1995, 2006). One of the studies identified 103 workers, 83 of whom demonstrated clinical evidence of progressive silicosis and 28 died (Bailey et al., 1974). Rosner and Markowitz (2006) stated that shortly thereafter, “the Occupational Safety and Health Act of 1970 became law [which] created OSHA and NIOSH.” NIOSH was established to develop scientifically sound standards for occupational hazards and OSHA’s mandate was to enforce safe and healthy work practices. NIOSH then began releasing hundreds of new workplace standards for hazards considered immediately dangerous to a worker’s life and health, in an effort to reform specific industries.

### **Texas**

In the 1970s, the demand in petroleum and petroleum-made products generated fuel shortages. Thousands of jobs in the petroleum industry were created. Migrant workers, mostly Mexican, would sandblast and recondition abandoned oil equipment, pipelines, and storage tanks from oil fields that had previously discontinued their operation (CDC, 1990; Raymond & Wintermeyer, 2006; Rosner & Markowitz, 1995, 2006; Shapiro, 2005; Thomas & Kelley, 2010).

In 1974, Boeing was contracted by NIOSH to look at the abrasive industry and concluded the abrasive industry had no interest in workers’ safety, citing poor machine maintenance and improper fit of workers’ face masks and respirators. Boeing felt the equipment manufacturer should be held accountable equally for a worker’s health and recommended the manufacturer design safer equipment (Blair, 1974; Markowitz & Rosner, 1995; Rosner & Markowitz, 1995).

NIOSH subsequently proposed new regulations to limit a sandblaster’s exposure to silica by controlling the silica concentrations and prohibiting the use of silica during abrasive blasting operations (Markowitz & Rosner, 1995; Rosner & Markowitz, 1995). Industry leaders, recognizing there would be a cost incurred by them for new abrasives and equipment, again placed profits over workers’ health and safety and mobilized together to successfully lobby against the impending regulations.

Then in 1988, 10 workers from Texas became ill and were diagnosed with silico-

sis. The local and county health departments began an inquiry and confirmed abnormal chest radiographs in 9 of the 10 workers, most of whom were under 30 years of age. Three workers subsequently died, while an additional 102 workers demonstrated symptoms of disease progression.

The inquiry determined that none of the affected workers had been fit-tested for respirators and had only worn a disposable type respirator during sandblasting operations. This cluster led to new legislation in Texas mandating that health professionals report a diagnosis of silicosis to state health officials (Abraham & Wiesenfeld, 1997; CDC, 1990; NIOSH, 2004b; Raymond & Wintermeyer, 2006; Rosner & Markowitz, 2006; Shapiro, 2005; Texas Department of State Health Services, 2014; Wiesenfeld & Abraham, 1995).

### **Mississippi**

Thomas & Kelley (2010) reported that “in 2002 the state of Mississippi began to show an increase in silicosis litigation claims,” even though previous years had shown a decline. Shapiro (2005) reported that this “resurgence” was a “result of greedy plaintiffs’ attorneys using tactics developed in asbestos litigation to earn large settlements from deep-pocketed silica manufacturers and their suppliers. Goodwyn (2006a) reported that instead of the industry screening potential workers at risk, the “lawyers and screening companies began advertising to the general public . . . of prospective litigants, which inflated . . . the pool.”

Thousands of false silicosis claims were filed. Due to this influx, claims were transferred to the federal court system for trial under multidistrict litigation. Federal Judge Janis Jack, a former nurse, began questioning the validity of the cases and ordered a review of the plaintiffs’ medical histories and medical records. She began deposing the plaintiffs’ physicians to justify and prove their allegations were accurate (Goodwyn, 2006a; “Judge Janis Jack Made History,” 2005; Thomas & Kelley, 2010). Jack ruled the claims were fraudulent, worthless, and had been just “manufactured for money.” Many plaintiffs’ attorneys withdrew their claims after her ruling.

This alleged cluster led to the establishment of specific medical criteria for silicosis claims. Medical criteria vary from state to state; however, they may require

- having a physical examination by a board-certified physician;
- obtaining a detailed medical history confirming substantial occupational exposure to silica;
- obtaining specific diagnostic testing that confirms the diagnosis;
- demonstrating acute silicosis, silicotic nodules, or progressive massive fibrosis;
- demonstrating impairment;
- filing claims in the state of residence; and
- ensuring that a credible medical testimony exists.

The establishment of medical criteria permits for only creditable cases be filed and litigated and excludes potential fraudulent cases (Behrens & Cruz-Alvarez, 2006; Behrens & Goldberg, 2005; Glenn, 2008; Janek & Nelson, 2005; Thomas and Kelley, 2010).

### **Nevada**

In 2004, the U.S. Department of Energy (U.S. DOE) announced the establishment of a silicosis screening program for workers who performed drilling operations at Yucca Mountain. This program was established because two former workers were diagnosed with silicosis (“Workers at Nevada Waste Site,” 2004; “Yucca Mountain Project,” 2004).

Yucca Mountain was a U.S. DOE-contracted drilling operation (1992–2003) to build a radioactive waste storage site to bury spent nuclear fuel material. The operation consisted of drilling a 5-mile tunnel through volcanic material and silica. U.S. DOE reported approximately 1,200–1,500 workers, plus an unknown number of visitors, might have been exposed to silica (Stalnaker, 2006; Tetreault & Rogers, 2004; “Workers at Nevada Waste Site,” 2004; “Yucca Mountain Project,” 2004). Tetreault and Rogers (2004) reported there was no oversight of this operation because OSHA had previously “relinquished its authority to police activities at U.S. DOE sites.”

Struglinski (2004) reported that an inquiry resulted; during testimony, an industrial hygienist confirmed her “supervisor made her change silica level measurements [to] . . . within applicable limits so the company would not have to provide workers with respirators.” She stated, “some of the dust contained material 100-times more dangerous than asbestos” and U.S. DOE “did not enforce or require safety precautions during the tunnel boring and digging.”

The inquiry further revealed the contractor used dry drilling practices to hasten the completion of the facility; did not inform workers that silica was present at the work site; and issued dust masks with limited protection, instead of the required fit-tested respirators (Stalnaker, 2006; Struglinski, 2004; Tetreault & Rogers, 2004; “Workers at Nevada Waste Site,” 2004; “Yucca Mountain Project,” 2004).

Struglinski (2004) stated, “this was a massive, corrupt, fraudulent scheme to save money on labor costs, budget, and schedules.” The contractors “placed a higher priority on the site characterization deadlines than they did on human safety and health, [and] deliberately [deceived] their workforce about the hazards, so as to impose harm upon workers and visitors [in order] to save time and money.”

### Fracking: The Future Cluster?

The increased demand for gas and oil consumption in the U.S., in conjunction with a shift to decrease foreign oil imports, has initiated new methods of natural gas and oil procurement. Hydraulic fracturing (fracking) is a method used to extract accumulated deposits of these resources from the ground by fracturing the layers of shale during the drilling process (Ehrenberg, 2012; Mitka, 2012; NIOSH, 2014; U.S. DOL, 2012b). When the drilling reaches the layers of shale, a mixture of water, sand, and chemicals are pumped at extremely high pressures through the layers, releasing the natural gas and oil deposits back into the well.

The mixture is composed of water (~89%–90%); sand (~9%–10%); and hundreds of hazardous chemicals (~1%). Some of the chemicals include acids, aromatic hydrocarbons, alcohols, amides, and formaldehydes. A typical well site will use between two to eight million gallons of water and chemicals, and over 2,000 tons of sand (Mash, Minnaar, & Mash, 2014; Michigan Occupational Safety & Health

Administration, 2012–2013; Mitka, 2012; National Toxicology Program, 2016; New York State Department of Environmental Conservation, 2009; NIOSH, 2014; U.S. DOL, 2012b).

In 2012, OSHA and NIOSH issued a hazard alert to employers and workers in the drilling industry because of the health risks associated with the massive amount of exposure to silica from fracking operations (U.S. DOL, 2012a). In it they reported that of the 116 air samples collected, 31%–79% showed that silica exposures were greater than OSHA and NIOSH acceptable exposure limits, placing workers in an unhealthy environment. The hazard alert reminded employers and workers about wearing the appropriate respirators, monitoring dust levels, and decreasing a worker’s time of exposure by improving the existing controls and workplace practices. They also recommended using alternative material instead of silica (Michigan Occupational Safety & Health Administration, 2012–2013; Steenland & Ward, 2014; U.S. DOL, 2012b).

In January 2015, 22 states had reported ongoing fracking operations with over 82,000 wells in operation (Hirji & Song, 2015; Ridlington & Rumpler, 2013). It is anticipated over the next several years that thousands to hundreds of thousands of new and existing well sites will use the fracking method of extraction (Finkel & Law, 2011; Mash et al., 2014). Some states that had previously allowed fracking operations are now placing a local or statewide ban until more health data are available (Krupp, 2014; “Texas Town’s Fracking Ban,” 2014; “Vermont First State to Ban Fracking,” 2012; Weinhold, 2012).

### Conclusion

Silicosis has been recognized throughout history as a lung disease mostly seen in construction, manufacturing, maritime, and general industry settings. It wasn’t until Hoffman’s report in 1908 and published study in 1918

that silicosis was considered a distinct medical condition. Thomas and Kelley (2010) reported that silicosis has been mishandled throughout the history of the U.S. and that industry continues to deny the hazards associated with silica exposure. Fit-test respirators have been recommended since 1974; however, industry leaders continue to demonstrate a flagrant disregard toward workers’ health and safety by not supplying respirators or mandating their use. Silicosis will continue to occur as long as industries fail to comply and to completely implement health and safety standards. As recent studies have confirmed, crystalline silica causes lung cancer (WHO, 2012).

Fracking operations have already begun in the U.S. and are expanding throughout the country even though some states have made attempts to limit or prohibit fracking operations altogether. OSHA and NIOSH have already identified unacceptable air samples at fracking operations that indicate fracking has the potential for future clusters of silicosis cases to emerge. The industry must ensure that proper precautions, safety measures, and oversight are implemented and enforced.

If this issue is not addressed, it is only a matter of time before we will see the associated and direct health effects to the workforce from fracking operations, resulting in another silicosis cluster. Silicosis is avoidable. As we have seen throughout history, though, it likely will never be completely eradicated. Silicosis clusters will continue unless the industries involved proactively mitigate a worker’s exposure to silica and silica dust by decreasing a worker’s risk and by providing workers with appropriate respiratory equipment, education, medical monitoring, and screening. 🐼

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## ▶ BUILDING CAPACITY



Darryl Booth, MBA

## Building Capacity Through Public Health Headlines

**Editor's Note:** A need exists within environmental health agencies to increase their capacity to perform in an environment of diminishing resources. With limited resources and increasing demands, we need to seek new approaches to the business of environmental health.

Acutely aware of these challenges, NEHA has initiated a partnership with Accela called *Building Capacity*. *Building Capacity* is a joint effort to educate, reinforce, and build upon successes within the profession, using technology to improve efficiency and extend the impact of environmental health agencies.

The *Journal* is pleased to publish this bimonthly column from Accela that will provide readers with insight into the *Building Capacity* initiative, as well as be a conduit for fostering the capacity building of environmental health agencies across the country.

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

Darryl Booth is senior vice president and general manager of environmental health at Accela and has been monitoring regulatory and data tracking needs of agencies across the U.S. for almost 20 years. He serves as technical advisor to NEHA's informatics and technology section.

Substantial or trivial, the spotlight of public attention turns occasionally to public and environmental health issues. During these slivers of time—just flashes of focus—the best of our profession educate, advise, and oftentimes calm policy makers and community members.

The word “Zika” did not exist for most North Americans prior to 2015. As public health officials warned the public to its earliest detection, interest in Zika exploded (Figure 1).

While you and your staff are on the front lines, let me assure you that regular folks, like my parents (and perhaps your parents), learned of the disease, its transmission, and

preventative measures from Centers for Disease Control and Prevention (CDC) interviews and through commercial news outlets reporting on the specific activities of Florida's state and local health departments.

So, how do environmental health professionals get extra value out of these teachable moments—moments when you are asked the question? What follows is our association's grassroots wisdom.

### Establish a Public Presence

If you aren't controlling the story, you are the story. Take a moment right now to consider if you know how to quickly get a new message

up on your agency's Web site. Who holds the reins to your agency's social media accounts? How do you get information to the public via local news? What are its deadlines? Who will send a camera crew for a brief interview?

I will discuss later in more detail how important it is to collaborate with community partners, but I want to emphasize here how particularly beneficial a strong relationship with local media can be.

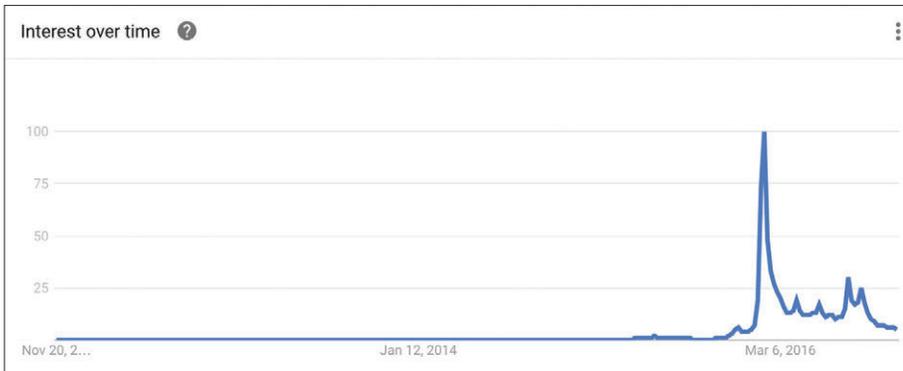
“Brands pay millions of dollars to advertise on television in order to stay in the public's consciousness. Local news stations gladly give us this gift for free to feed the public's hunger for reassurance that Zika won't kill them or that the local water is safe to drink,” says JoAnn Xiong-Mercado, an environmental health specialist at Marion County Public Health's Department of Food and Consumer Safety. “We can't go door-to-door cleaning out gutters to destroy mosquito breeding habitats, but we can empower the public to clean their own gutters.”

Local news outlets allow you to reach a broader audience and build awareness for your department, and when the next event happens, reporters in your area will know who to call—the person with the friendly smile, the professional attire, and the credible quote. Note that this relationship does require some upkeep. Reporters should not only know who to call but also should feel confident that they'll get a timely response.

Keeping a strong public presence also requires some prep work, such as preparing and practicing responses to various issues and events, including marketing plans for social media, your Web site, news outlets, etc. You don't have to reinvent the wheel and waste resources developing these items from

FIGURE 1

**Google Trends: Keyword “Zika” (U.S. Only)**



Source: [www.google.com/trends/explore?geo=US&q=zika](http://www.google.com/trends/explore?geo=US&q=zika).

FIGURE 2

**Sample Media List**



**MEDIA/CONTACT LIST**

Organization	Medium	Name	Title	Address	Phone	Email	Time of day to contact	Notes
Local newspaper 1	Newspaper							
Local newspaper 2	Newspaper							
Local news station 1	News Station							
Local news station 2	News Station							
Local news station 3	News Station							
Rotary District Newsletter	Newsletter							
YOUR agency social media contact	Social Media							
YOUR agency newsletter	Newsletter							
YOUR agency website administrator	Website							
Local nonprofit 1	Nonprofit							
Local nonprofit 2	Nonprofit							

Visit [www.linkedin.com/groups/6945520](http://www.linkedin.com/groups/6945520) to download your own media/contact list template, as well as find other links and resources for communication and planning.

scratch. For example, CDC released a communications planning guide for state and local jurisdictions to leverage during a Zika response ([www.cdc.gov/zika/pdfs/zika-com-communications-planning-guide-for-states.pdf](http://www.cdc.gov/zika/pdfs/zika-com-communications-planning-guide-for-states.pdf)). The guide, and there are many others like it, includes communication activities for differ-

ent scenarios and printable materials that you can share with your community.

**Promote Other Health Programs**

Even if you are not currently the site of a headline-worthy health issue, you will inevitably get some public attention. This

spotlight is a good thing. Take advantage of someone calling your office seeking reassurance to pivot the conversation around helpful information and your department’s services.

“National headlines provide a foot in the door of busy people’s attention span,” says Peter Cooley, an environmental health specialist at Coos County Health and Wellness. “Zika virus? Yes, maybe rounding up old tires and disposing of them properly is a worthy goal. And while we’re at it, let’s talk about prenatal vitamins. Foodborne illness citation at your restaurant? Why yes, washing your hands is still a good idea. And while we’re at it, let’s talk about your supply chain.”

While recently visiting the popular Florida Health Zika Web site, I noted a banner that read, “1 out of 3 kids is considered overweight or obese.” See what was done here?

These moments are not just a chance to engage directly with the public. Bringing your services to more community members can help you better argue for a program’s existence or expansion, which leads me to the next suggestion.

**Request Resources**

According to the National Association of County and City Health Officials’s 2015 Forces of Change survey ([www.naccho-profilestudy.org/forces-of-change](http://www.naccho-profilestudy.org/forces-of-change)), over 51,700 health department jobs have been lost since the 2008 recession. Though the economy has been improving, along with public agency budgets, 27% of health department directors surveyed indicated that they expected budget cuts to continue. Even if your financial situation is on the upward slope, you are almost guaranteed to be operating with less than what you were used to or needed.

“Environmental health has become a victim of its own success and exists in a world where there is not the political will to properly fund programs unless there is some type of crisis,” says David Troutman, director of environmental health at Cabarrus Health Alliance. “Safe drinking water, food safety, and emerging diseases like Zika have the potential to affect everyone. As these issues hit the headlines, it is important at the local level that we seize these opportunities to promote and improve the delivery of environmental public health services to communities.”

Kimberley Moe, an environmental health practitioner at Fargo Cass Public Health, echoed

this sentiment, “As environmental health agencies, it should be our main goal to not only educate the public but also our legislature.”

No council or board member, mayor, senator, or governor wants to be implicated in the next Flint, Michigan, disaster, or govern over the site of a Zika infection. Despite other competing priorities and departments clamoring for funding, public health is enjoying a unique moment at the front of the conversation. I encourage health departments and community members to leverage this moment, along with their collective political power, to seek and advocate for additional resources to invest back in programs and other strategic capacity-building activities. I acknowledge that industry hasn't been sitting idly on their hands. As of this writing, it's well-known that federal Zika funding has been slow to arrive. If the funding problem was easy to solve, it already would have been by now, which delivers us to my final insight.

**Establish Community Partnerships**

You don't have to do it alone. Even during calmer times, a successful organization looks beyond its borders to solicit and offer support. In seeking the resources I mentioned above, can you band together with your neighbors to speak directly to legislators as a unified,

nonpolitical entity? And amongst yourselves, what collateral, tools, people, and experiences can be shared to operate more efficiently?

I also encourage you to look beyond the typical environmental health network when seeking creative efficiency hacks. Coordinate with local community activists, nonprofits, event organizers, schools, and other departments. One city hosts annual back-to-school health fairs where children come to get their lead levels tested, are brought up-to-date on immunizations, and receive school supplies for the year. Another city partnered with a local animal shelter to run a vaccine day for people and pets.

Finally, I would be remiss if I didn't dedicate at least one section of this column to technology and innovation. Do you sense patterns in your data but don't know how to dig deeper? Are there issues with your processes that you aren't quite sure how to solve? Consider teaming up with a university or startup on a research project, or embrace open data to leverage the skills of community members and companies to help make new sense of your business. Seattle-King County Health Department worked with Stanford University to study inspection score deviations, resulting in more standardized and reliable inspections (and unintentionally, happier inspectors). You can read more about that study at <https://goo.gl/XvcWQh>.

<https://goo.gl/XvcWQh>. Chicago, that bastion of innovation, is testing an analytical model to enhance its beach water quality inspection process to provide timely health advisories using a model built by a team of volunteer “citizen data scientists.” You can read more about endeavor at <https://goo.gl/1lZ2LD>.

**Join the Conversation**

How are you or your organization creating opportunities from headlines? Share your stories or opinions, download free marketing/communication and media list templates (Figure 2), and access links to additional resources at the Building Capacity LinkedIn page at [www.linkedin.com/groups/6945520](http://www.linkedin.com/groups/6945520).

*Acknowledgement:* Nearly every recommendation that surfaced in this article is credited to NEHA members through foundational NEHA Annual Educational Conference & Exhibition presentations, award submissions, and scholarship applications—an ongoing testament to the acumen of the professionals among us. Thank you.

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 AEHAP Coordinator  
 E-mail: [info@aehap.org](mailto:info@aehap.org)  
 Phone: 206-522-5272

For additional information and research submission guidelines, please visit [www.aehap.org](http://www.aehap.org). AEHAP gratefully acknowledges the volunteer efforts of AEHAP members who serve on the advisory committee for this competition.



# Share your success and shine a light on **innovation**

For the past two years, our Building Capacity column in the *Journal* has featured fresh ideas and the work of innovative thought leaders.

Looking ahead to our 2017 column series, we invite you and other industry experts to help us shine a light on innovative technology implementations and best practices for building capacity.

Think you have a success story to share? We are looking for:

- Leadership profiles
- Practical case studies, or
- General environmental health topics (productivity, administration, etc.)

Visit us at [www.accela.com/buildingcapacity](http://www.accela.com/buildingcapacity) to read our past columns and submit ideas for future ones.



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Erik W. Coleman, MPH

## CDC Takes Action to Improve the Reporting of Environmental Assessment Data During Foodborne Illness Outbreak Investigations

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

In these columns, EHSB and guest authors share insights and information about environmental health programs, trends, issues, and resources. The conclusions in this article are those of the author(s) and do not necessarily represent the views of CDC.

Erik Coleman is a health scientist in informatics with EHSB.

When a foodborne illness outbreak is detected, food safety officials work quickly to collect as much information as possible to determine the cause and prevent more people from getting sick (Centers for Disease Control and Prevention, 2016). Environmental assessments are an essential component of foodborne illness outbreak investigations. Typically conducted by food safety officials (e.g., environmental health specialists), environmental assessments help determine how and why the environment contributed to the introduction or transmission of agents that cause illness. Critical data from these assessments help prevent and reduce future outbreaks and improve food safety in the U.S.

The National Outbreak Reporting System (NORS) is a Centers for Disease Control and Prevention (CDC) surveillance system that collects foodborne illness outbreak data (e.g., date and location of the outbreak, number of people who became ill, and illness symptoms) from state, local, and territorial food safety programs. NORS collects, however,

limited environmental assessment data. To address this gap in foodborne illness outbreak data collection, CDC launched in 2014 a companion surveillance system to NORS, the National Environmental Assessment Reporting System (NEARS) (Figure 1).

NEARS is a surveillance system that collects environmental assessment data as part of foodborne illness outbreak investigations. Since NEARS launched, CDC has worked to

- promote the importance of conducting environmental assessments during foodborne illness outbreak investigations,
- increase the amount of environmental assessment data reported from food safety programs, and
- improve the quality of environmental assessment data collected and reported.

To promote NEARS, CDC staff presents at meetings where food safety officials discuss and address food safety concerns, such as the National Association of County and City Health Officials' annual conference, the Association of Public Health Laboratories'

PulseNet and OutbreakNet regional meetings, and the Food and Drug Administration's regional retail food protection seminars.

Additionally, to improve competency on conducting environmental assessments and reporting data to NEARS, CDC conducted in-person NEARS training for over 180 California and Southern Nevada Health District food safety officials who conduct foodborne illness outbreak investigations. Most food safety officials indicated a high level of overall satisfaction after the training. They went on to report the following as the most useful portions of the training:

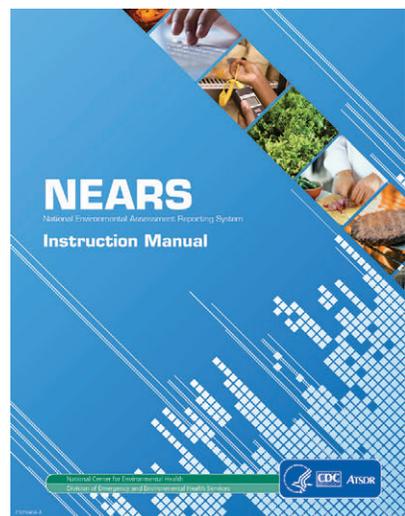
- completion of the training prerequisite, CDC's free and interactive e-Learning on Environmental Assessment of Foodborne Illness Outbreaks ([www.cdc.gov/nceh/ehs/elearn/ea\\_fio/index.htm](http://www.cdc.gov/nceh/ehs/elearn/ea_fio/index.htm));
- detailed review of the NEARS data reporting instrument; and
- live demonstration of the NEARS web-based platform.

In addition to formal NEARS presentations and trainings, CDC has streamlined and improved its NEARS Web site content ([www.cdc.gov/nceh/ehs/nears](http://www.cdc.gov/nceh/ehs/nears)), developed NEARS fact sheets ([www.cdc.gov/nceh/ehs/docs/factsheets/nears-factsheet.pdf](http://www.cdc.gov/nceh/ehs/docs/factsheets/nears-factsheet.pdf)), distributed NEARS 2014 summary reports ([www.cdc.gov/nceh/ehs/nears/docs/2014-summary-report.pdf](http://www.cdc.gov/nceh/ehs/nears/docs/2014-summary-report.pdf)), and disseminated electronic promotional messages to thousands of food safety officials via environmental health listservs and social media outlets (e.g., Twitter and LinkedIn).

CDC's successful marketing and promotional activities have increased the number of state and local food safety programs registered to report environmental assessment

FIGURE 1

### National Environmental Assessment Reporting System: Instruction Manual

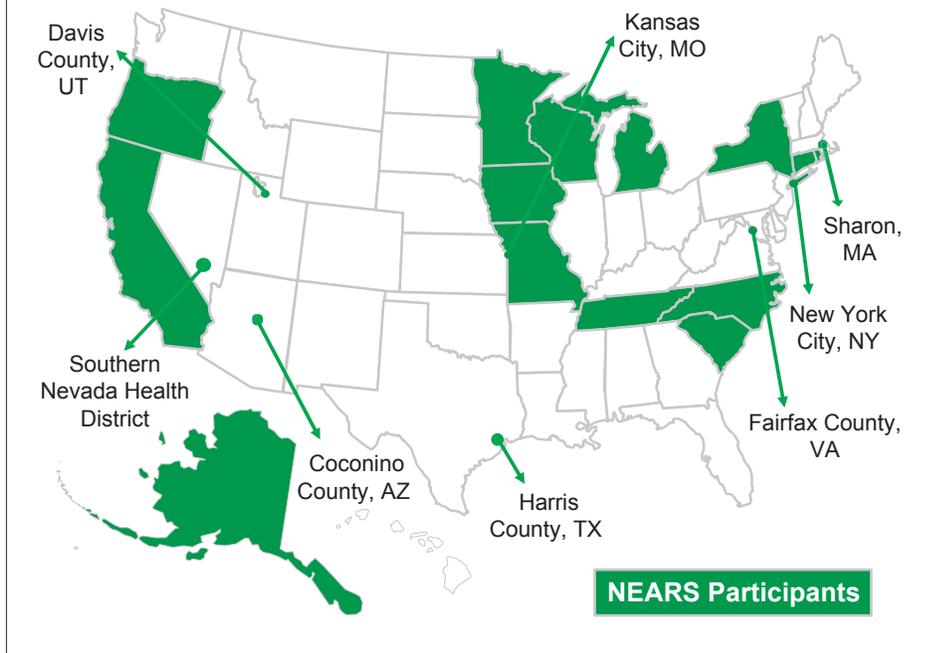


data to NEARS. In 2014, 11 state and local food safety programs were registered. In 2015, that number increased to 16. To date, 21 food safety programs are registered (Figure 2). A current listing of NEARS participants can be found at [www.cdc.gov/nceh/ehs/nears/participants.htm](http://www.cdc.gov/nceh/ehs/nears/participants.htm). A minimum of 100 outbreaks have been reported into the system since its launch. Prior to the NEARS launch, these data were not reported on a national level. More frequent reporting of environmental data helps to improve the quality of foodborne illness outbreak data collected by CDC and provides opportunities to link outbreaks across NORS and NEARS.

In 2014, CDC formed an intra-agency NORS-NEARS workgroup to aid foodborne illness outbreak response and prevention to improve reporting and analysis of foodborne illness outbreak data. This group is also exploring ways to ensure that the burden of reporting overlapping foodborne illness outbreak

FIGURE 2

### National Environmental Assessment Reporting System (NEARS) Participants



data in both NORS and NEARS is minimized. Based on an analysis of 2014 outbreak data reported to NORS and NEARS, the workgroup learned that 87% (97 of 111) of foodborne illness outbreaks reported to NEARS were also reported to NORS. These dually-reported data provide additional context about the series of foodborne illness outbreak events. For example, these data will allow us to monitor and evaluate timeliness and outbreak response by comparing the date of initial exposure (reported to NORS) to the date the establishment was identified for an environmental assessment (reported to NEARS).

As CDC continues its work to improve food safety, understanding how and why foodborne illness outbreaks occur will be pivotal in its reduction and prevention. To achieve this goal, CDC encourages food

safety programs to improve competency on conducting environmental assessments and report these data to NEARS. 🐷

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#### Reference

Centers for Disease Control and Prevention. (2016). *Investigating outbreaks: Using data to link foodborne disease outbreaks to a contaminated source*. Retrieved from <http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/index.html>

## Did You Know?

Students can now apply for a 2017 summer internship at health departments across the country as part of the National Environmental Public Health Internship Program funded by the Centers for Disease Control and Prevention. Learn more at [www.neha.org/professional-development/students/internships](http://www.neha.org/professional-development/students/internships).

## CAREER OPPORTUNITIES

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 Milwaukee, WI  
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 Rochester, NY  
 San Antonio, TX  
 San Diego, CA  
 San Francisco, CA  
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 Sioux City, IA  
 Sioux Falls, SD  
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 Yuma, AZ

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If you are interested in an opportunity near you, please send your resume to: ATTN Bill Flynn at [LST.RAS.RESUMES@UL.COM](mailto:LST.RAS.RESUMES@UL.COM) or visit our Web site at [www.evercleanservices.com](http://www.evercleanservices.com).

## Did You Know?

The U.S. Environmental Protection Agency has designated January as National Radon Action Month. Learn more about the national effort to take action against radon at [www.epa.gov/radon](http://www.epa.gov/radon).



## JEH Needs Peer Reviewers

**The Journal of Environmental Health is currently in search of new peer reviewers.**

If interested, please send your résumé and cover letter to Kristen Ruby-Cisneros, managing editor of the *JEH*, at [kruby@neha.org](mailto:kruby@neha.org), and contact her with any questions.

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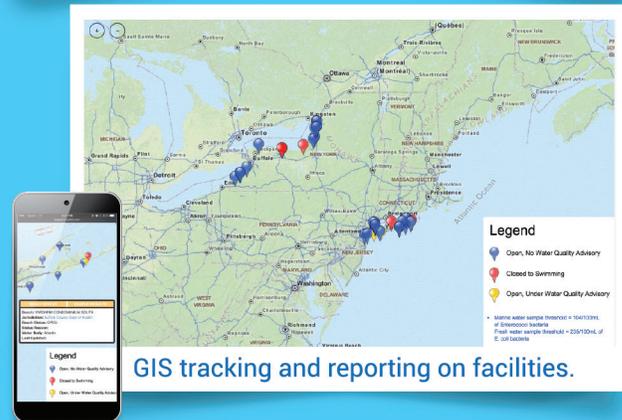
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# EH CALENDAR

## UPCOMING NEHA CONFERENCES

January 18–19, 2017: **EH<sub>2</sub>O Recreational Waters Virtual Conference**. For more information, visit [www.neha.org/eh2o-recreational-water-virtual-conference](http://www.neha.org/eh2o-recreational-water-virtual-conference).

July 10–13, 2017: **NEHA 2017 Annual Educational Conference & Exhibition**, Grand Rapids, MI. For more information, visit [www.neha.org/aec](http://www.neha.org/aec).

## NEHA AFFILIATE AND REGIONAL LISTINGS

### California

April 10–13, 2017: **66th Annual Education Symposium**, hosted by the California Environmental Health Association's Citrus Chapter, Garden Grove, CA. For more information, visit [www.ceha.org](http://www.ceha.org).

### Kentucky

February 15–17, 2017: **Annual Conference**, hosted by the Kentucky Environmental Health Association, Lexington, KY. For more information, visit [www.kyeha.org](http://www.kyeha.org).

### Michigan

March 15–16, 2017: **Annual Education Conference**, hosted by the Michigan Environmental Health Association, Big Rapids, MI. For more information, visit [www.meha.net/AEC](http://www.meha.net/AEC).

### Minnesota

January 27, 2017: **Winter Conference**, hosted by the Minnesota Environmental Health Association, St. Paul, MN. For more information, visit [www.mehaonline.org](http://www.mehaonline.org).

### Utah

April 26–28, 2017: **Spring Conference**, hosted by the Utah Environmental Health Association, Bryce Canyon, UT. For more information, visit [www.ueha.org/events.html](http://www.ueha.org/events.html).

### Washington

May 1–3, 2017: **Annual Education Conference**, hosted by the Washington State Environmental Health Association, Wenatchee, WA. For more information, visit [www.wseha.org](http://www.wseha.org).

## TOPICAL LISTINGS

### Food Safety

January 25–27, 2017: **Consumer Food Safety Education Conference**, hosted by the Partnership for Food Safety Education, Washington, DC. For more information, visit <http://cfsec2017.fightbac.org>.

### Public Health

April 11–12, 2017: **Iowa Governor's Conference on Public Health**, Des Moines, IA. For more information, visit [www.ieha.net/IGCPH](http://www.ieha.net/IGCPH). 🐷

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# STUDENTS Don't Miss This Opportunity!

Applications for the 2017 National Environmental Health Association/American Academy of Sanitarians/American Public University (NEHA/AAS/APU) Scholarship Program are now available.

The purpose of the NEHA/AAS/APU Scholarship program is to encourage early commitment by students to a career in environmental health, as well as stimulate past and present graduates to pursue postgraduate studies in environmental health sciences. The ultimate goal of the program is to introduce adequately trained professionals into the environmental health workforce. Last year, \$5,000 was awarded to four students who demonstrated the highest levels of achievement in their respective environmental public health degree programs.

## VISIT

[www.neha.org/professional-development/students/scholarship](http://www.neha.org/professional-development/students/scholarship)  
to download scholarship application and qualification information.

**Deadline: March 15, 2017**

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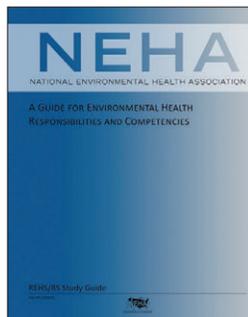
# RESOURCE CORNER

Resource Corner highlights different resources that NEHA has available to meet your education and training needs. These timely 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!



## REHS/RS Study Guide, 4th Edition

National Environmental Health Association (2014)



The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is NEHA's premier credential. This study guide provides a tool for individuals to prepare for the REHS/RS exam and has been revised and updated to reflect changes and advancements in technologies and theories in the environmental health and protection field. The study guide covers the following topic

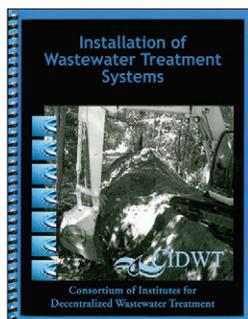
areas: general environmental health; statutes and regulations; food protection; potable water; wastewater; solid and hazardous waste; zoonoses, vectors, pests, and poisonous plants; radiation protection; occupational safety and health; air quality; environmental noise; housing sanitation; institutions and licensed establishments; swimming pools and recreational facilities; and disaster sanitation.

308 pages / Paperback

Member: \$149 / Nonmember: \$179

## Installation of Wastewater Treatment Systems

Consortium of Institutes for Decentralized Wastewater Treatment (2009)



This manual is the definitive source for information on installing decentralized wastewater treatment systems. Developed by a team of experts, this manual provides installers with training materials geared specifically to address installation—one of the many vital aspects of programs for managing decentralized wastewater treatment systems. Installers, regulators, and designers of onsite wastewater

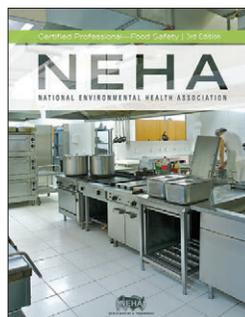
treatment systems will gain a better understanding of the activities related to proper installation and startup to maximize system efficiency, longevity, and performance. This manual is a recommended study reference for NEHA's Certified Installer of Onsite Wastewater Treatment Systems credential exam.

454 pages / Spiral-bound paperback

Member: \$68 / Nonmember: \$79

## 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 NEHA's 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

## Healthy & Safe Homes: Research, Practice, & Policy

Edited by Rebecca L. Morley, MSPP, Angela D. Mickalide, PhD, CHES, and Karin A. Mack, PhD (2011)



This book marks an exciting advance in the effort to ensure that people across all socioeconomic levels have access to healthy and affordable housing. It provides practical tools and information to make the connection between health and housing conditions relatable to everyone. The book brings together perspectives from noted scientists, public health experts, housing advocates, and policy leaders to fully explain the problem of substandard housing

that plagues our nation and offers holistic, strategic, and long-term solutions to fix it. The many experts who have contributed to this book lay out smart approaches to help achieve the goal of making healthy housing accessible to all. Expanding access to healthy and affordable housing is a first step to creating a country of healthier people. Study reference for NEHA's Healthy Homes Specialist credential exam.

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## 2017 Joe Beck Educational Contribution Award

This award was established to recognize NEHA members, teams, or organizations for an outstanding educational contribution within the field of environmental health.

Named in honor of the late Professor Joe Beck, this award provides a pathway for the sharing of creative methods and tools to educate one another and the public about environmental health principles and practices. Don't miss this opportunity to submit a nomination to highlight the great work of your colleagues!

**Nomination deadline is March 15, 2017.**

To access the online application, visit  
[www.neha.org/joe-beck-educational-contribution-award](http://www.neha.org/joe-beck-educational-contribution-award).



# JEH QUIZ

## FEATURED ARTICLE QUIZ #4

### Lung Cancer Worry and Home Screening for Radon and Secondhand Smoke in Renters

Available to those holding an individual NEHA membership only, the *JEH* Quiz, offered six times per calendar year through the *Journal of Environmental Health*, is an easily accessible means to accumulate continuing-education (CE) credits toward maintaining your NEHA credentials.

1. Read the featured article carefully.
  2. Select the correct answer to each *JEH* Quiz question.
  3. a) Complete the online quiz found at [www.neha.org/publications/journal-environmental-health](http://www.neha.org/publications/journal-environmental-health),  
b) Fax the quiz to (303) 691-9490, or  
c) Mail the completed quiz to  
*JEH* Quiz, NEHA  
720 S. Colorado Blvd., Suite 1000-N  
Denver, CO 80246.
- Be sure to include your name and membership number!
4. One CE credit will be applied to your account with an effective date of January 1, 2017 (first day of issue).
  5. Check your continuing education account online at [www.neha.org](http://www.neha.org).
  6. You're on your way to earning CE hours!

#### Quiz Registration

Name \_\_\_\_\_

NEHA Member No. \_\_\_\_\_

E-mail \_\_\_\_\_

#### JEH Quiz #2 Answers October 2016

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

→ Quiz deadline: April 1, 2017

1. Radon exposure is the \_\_\_ cause of lung cancer annually among nonsmokers.
  - a. leading
  - b. second leading
  - c. third leading
  - d. fourth leading
2. Approximately \_\_\_ lung cancer deaths each year in the U.S. are related to radon exposure.
  - a. 5,000–9,000
  - b. 10,000–14,000
  - c. 15,000–22,000
  - d. 25,000–32,000
3. The U.S. Environmental Protection Agency (U.S. EPA) recommends that radon levels greater than \_\_\_ warrant mitigation.
  - a. 3 picocuries per liter (pCi/L)
  - b. 4 pCi/L
  - c. 5 pCi/L
  - d. 6 pCi/L
4. The U.S. Surgeon General and U.S. EPA estimate that \_\_\_ in \_\_\_ U.S. residences exceed the recommended radon level.
  - a. 1; 5
  - b. 1; 10
  - c. 1; 15
  - d. 1; 20
5. The purpose of this study was to assess the relationships of demographic and personal factors and lung cancer worry and completion of home screening for radon and secondhand smoke (SHS) in renters.
  - a. True.
  - b. False.
6. Of the study participants, \_\_\_ completed at least one of the home test kits.
  - a. 57%
  - b. 62%
  - c. 68%
  - d. 70%
7. Of those participants who completed at least one test kit, \_\_\_ completed both tests.
  - a. 26%
  - b. 57%
  - c. 84%
  - d. 96%
8. Race/ethnicity, smoking status, education, and household smoking group were \_\_\_ associated with lung cancer worry.
  - a. not significantly
  - b. significantly
9. The mean lung cancer worry score among renters with postsecondary education was \_\_\_ the mean lung cancer worry score among renters with at most a high school education.
  - a. less than
  - b. equal to
  - c. greater than
10. The average lung cancer worry score among renters with at least one smoker in the home was \_\_\_ the average lung cancer worry score among renters without any household smokers.
  - a. less than
  - b. equal to
  - c. greater than
11. Participants with one or more smokers in the home were more likely to test for radon and SHS compared to those without smokers in the home.
  - a. True.
  - b. False.
12. Gender, race/ethnicity, education, and home smoking status were \_\_\_ of the likelihood to test for radon and SHS.
  - a. not predictive
  - b. predictive

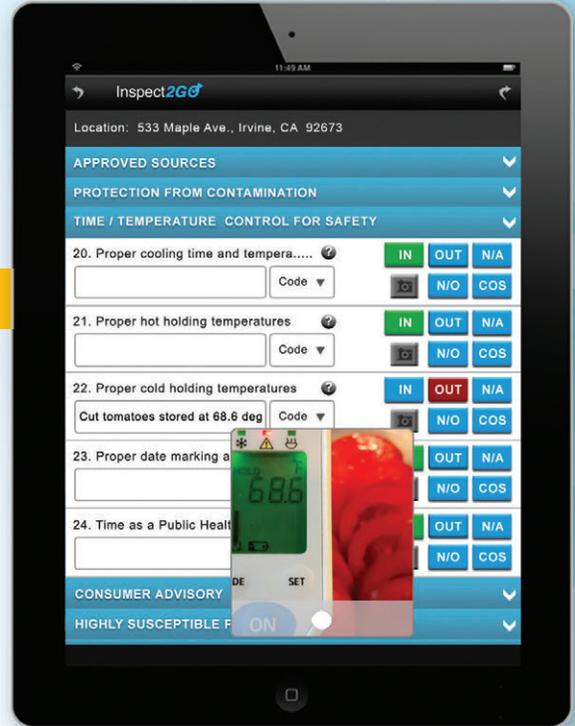
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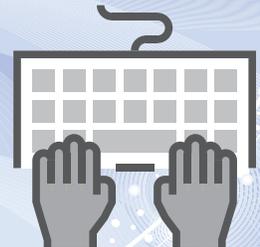
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## NEHA NEWS

### Students Encouraged to Apply for Environmental Health Internships

NEHA is accepting applications for the National Environmental Public Health Internship Program (NEPHIP). NEHA will accept over 20 environmental health interns for summer 2017, sponsored by the Centers for Disease Control and Prevention. Students from National Environmental Health Science and Protection Accreditation Council-accredited undergraduate and graduate programs are eligible to apply for a 10-week internship at local, state, or tribal environmental health departments across the country. NEHA will award students a stipend of \$4,000 (\$400/week) for completing the internship. An additional stipend is available to cover the relocation costs for the internship.

Students interested in NEPHIP should apply at [www.neha.org/internships](http://www.neha.org/internships) by **February 13**. Interns who participated in NEPHIP last summer were involved in a wide range of activities such as studying contamination levels of surface water and groundwater, building on tracking initiatives by presenting pesticide exposures and illness information, and completing asset mapping related to sustainable environments in communities. To learn more about past student internship experiences, visit [www.neha.org/professional-development/students/internship/2015-student-success-stories](http://www.neha.org/professional-development/students/internship/2015-student-success-stories).

### 2017 HUD Secretary's Awards for Healthy Homes

The U.S. Department of Housing and Urban Development (HUD), in partnership with NEHA, announce the third annual Secretary's Awards for Healthy Homes. These awards will recognize excellence in healthy housing innovation and achievement in three categories: public housing/multifamily supported housing; policy and research innovation; and cross program coordination among health, environment, and housing. The activities or policies nominated must show measurable benefits in the health of residents and be available to low- and/or moderate-income families. Applications will be open January 27 on NEHA's and HUD's Web sites and are due no later than **March 15, 11:59:59 p.m. PST**. Previous award winners are ineligible to apply. The awards will be presented at NEHA's 2017 Annual Educational Conference & Exhibition ([www.neha.org/aec](http://www.neha.org/aec)), July 10–13, in Grand Rapids, Michigan.

### 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 45.



#### Faye Koeltzow

I joined NEHA in January 2016 as its business analyst. My overarching role is to take a fresh and innovative look at every business decision while also serving as the board of director's liaison, guiding the team coordinating NEHA's Annual Educational Conference & Exhibition, supervising various departments—credentialing, membership, education, human resources, and

sales—as well as leading various initiatives to assure that sound business practices are followed.

I earned a bachelor of science degree in secondary education with a minor in health from Idaho State University. I was born and raised in Golden, Colorado, enjoying the wonderful outdoor recreation that Colorado affords. I worked 28 years for Colorado Parks and Wildlife, 10 of which I served as the volunteer and education program manager. My proudest achievement was working with staff and volunteers to design, implement, and grow a strong volunteer program, doubling volunteer hours over a 5-year period to more than 200,000 hours. After leaving state government in April 2015, I changed gears a bit and served as a patient navigator with Colorado HealthOP, a member-directed insurance company.

Every organization needs a reevaluation period from time to time and with many needed changes taking place at NEHA, every day brings new challenges and excitement. Riding the proverbial waves with our amazing staff, members, affiliates, and various partners to move NEHA in relevant new directions is very rewarding. I look forward to interacting with many of you along the way. Thank you for your support of NEHA!



#### Sandra Whitehead

I began my journey to NEHA long before I was hired last January to lead the Program and Partnership Development team. I have been a member since 2008 and was a technical adviser for several years. I came to environmental health by way of land use planning, having been a local planner before spending seven years at the Florida Department of Health's central office where it was my job to create trainings

and projects in partnership with the 67 county health departments. I was privileged to create the Health and the Built Environment program in the Division of Environmental Health.

I am one half of the Washington, DC, office, and the thing I love most about my job is that no two days are ever the same. I represent NEHA at meetings with national partners and am working to create a diverse funding stream to support trainings and programs for our members. It has been gratifying to go to

# NEHA NEWS

meetings and have colleagues tell me how happy they are that NEHA is “finally at the table.”

As a seventh-generation Floridian, moving to Washington, DC, was a huge change, but an exciting one. I love going to museums, walking my dog near the Anacostia River, and gardening. I am an avid reader and a coffee fanatic. While DC is quite different than north Florida, my husband and I are enjoying a four-season year, picking apples in the mountains, and the advantages of big city life. We have three grown children, the youngest of whom lives with us and goes to college here. Our older children visit quite often and we are anticipating the marriage of our oldest son in March.

The most exciting project my team is working on is a needs assessment of the environmental public health workforce called

Understanding the Needs, Challenges, Opportunities, Vision, and Emerging Roles in Environmental Health (UNCOVER EH). As a first step, we are gathering information on how environmental health services are allocated to different agencies for each state. The second step is to send a survey to as many environmental health professionals at the state and local health department level to get your feedback on emerging issues and needs. This kind of assessment has not been done before and we will use the information gathered to improve our offerings and resources for you. I am excited to work with and for you, our members. Please feel free to reach out to me if you want to serve on a program committee, have feedback on programs or resources we can create to assist in your everyday work, or want to find out more about UNCOVER EH. 🐼

## SUPPORT THE NEHA ENDOWMENT FOUNDATION

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

Individuals who have contributed to the foundation are listed below by club category. These listings are based on what people have actually donated to the foundation—not what they have pledged. Names will be published under the appropriate category for one year; additional contributions will move individuals to a different category in the following year(s). For each of the categories, there are a number of ways NEHA recognizes and thanks contributors to the foundation. If you are interested in contributing to the Endowment Foundation, please call NEHA at 303.756.9090. You can also donate online at [www.neha.org/donate](http://www.neha.org/donate).

*Thank you.*

### DELEGATE CLUB (\$25–\$99)

*Name in the Journal for one year and endowment pin.*

**Richard W. Mitzelfelt**  
Edgewood, NM

### HONORARY MEMBERS CLUB

(\$100–\$499)

*Letter from the NEHA president, name in the Journal for one year, and endowment pin.*

**Tim Hatch, MPA, REHS**  
Montgomery, AL

**Adam E. London, RS, MPA**  
Grand Rapids, MI

**Larry Ramdin, REHS, CP-FS, HHS**  
Salem, MA

**Ned Therien, MPH**  
Olympia, WA

### 21st CENTURY CLUB

(\$500–\$999)

*Name submitted in drawing for a free one-year NEHA membership, name in the Journal for one year, and endowment pin.*

**Bob Custard, REHS, CP-FS**  
Lovettsville, VA

**David T. Dyjack, DrPH, CIH**  
Denver, CO

**Bette J. Packer**  
Ham Lake, MN

**Peter M. Schmitt**  
Shakopee, MN

**LCDR James Speckhart, MS**  
Silver Spring, MD

### SUSTAINING MEMBERS CLUB

(\$1,000–\$2,499)

*Name submitted in drawing for a free two-year NEHA membership, name in the Journal for one year, and endowment pin.*

**James J. Balsamo, Jr., MS, MPH, MHA, RS, CP-FS**  
Metairie, LA

**Gavin F. Burdge**  
Lemoyne, PA

**George A. Morris, RS**  
Dousman, WI

### AFFILIATES CLUB

(\$2,500–\$4,999)

*Name submitted in drawing for a free AEC registration, name in the Journal for one year, and endowment pin.*

**Vince Radke, MPH, REHS, CP-FS, DAAS, CPH**  
Atlanta, GA

### EXECUTIVE CLUB AND ABOVE

(\$5,000–\$100,000)

*Special invitation to the AEC President's Reception, name in the Journal for one year, and endowment pin.*

**DirecTalk**

*continued from page 50*

makers, and federal policymakers to incorporate health into all areas of governance.

Now then, check out the areas Dr. DeSalvo would like the country to focus its national health system integration efforts on:

- economic development,
- education,
- transportation,
- food,
- environment,
- housing, and
- safe neighborhoods.

Much of the priority attention noted above is directly threaded to our spheres of influence. Of course they are. I wonder out loud, “Public health seems to be a part of environmental health, and not the other way around.”

While size does not make a profession, effective and consistent performance, coupled with character-based trust, does. I don’t take one iota of solace in our numerical superiority. In fact, I’m alarmed that we have not socialized this dominance and achieved greater professional cohesion and impact as a by-product.



*A taste of Texas. Photo courtesy of David Dyjack.*

An association funded by The Kresge Foundation to inquire about childhood environmental health services interviewed me this morning. The key question centered on what services environmental health programs should be providing to ensure the health of children ages 0–8 years. I challenged the interviewer and suggested he was asking the wrong question. The National Academy of Medicine recently released a report that describes the environ-

mental health profession as foundational to the nation’s health. In that spirit, I suggested to the interviewer that the real question was not about specific services, but rather whether the services of a registered environmental health specialist were present in any given community. The basket of individual services will necessarily change with the times, while the presence of a qualified environmental health workforce will ensure that the vision of Public Health 3.0 is attained.

Irrespective of the challenges at hand, we are an essential player in the health of the nation. It is true in Texas. It is true during emergencies. It is true in the uniformed services. It is true in the civilian world.

Please know that your association is going to connect the dots and tirelessly advocate for you as the general consensus is that you are a strategic national asset. Thank you, Texas, for bringing the vision into laser sharp focus. 🐾

*Dave*  
 ddyjack@neha.org  
 Twitter: @DTDyjack

## 2017 Walter F. Snyder Award

### Call for Nominations Nomination deadline is April 28, 2017.

Given in honor of NSF International’s co-founder and first executive director, the *Walter F. Snyder Award* recognizes outstanding leadership in public health and environmental health protection. The annual award is presented jointly by NSF International and the National Environmental Health Association.



Nominations for the 2017 *Walter F. Snyder Award* are being accepted for environmental health professionals achieving peer recognition for:

- outstanding accomplishments in environmental and public health protection,
  - notable contributions to protection of environment and quality of life,
- demonstrated capacity to work with all interests in solving environmental health challenges,
- participation in development and use of voluntary consensus standards for public health and safety, and
- leadership in securing action on behalf of environmental and public health goals.



Past recipients of the *Walter F. Snyder Award* include:

2016 – Steve Tackitt	2007 - Wilfried Kreisel	1997 - J. Roy Hickman	1988 - Mark D. Hollis	1979 - John G. Todd
2015 – Ron Grimes	2006 - Arthur L. Banks	1996 - Robert M. Brown	1987 - George A. Kupfer	1978 - Larry J. Gordon
2014 – Priscilla Oliver	2005 - John B. Conway	1995 - Leonard F. Rice	1986 - Albert H. Brunwasser	1977 - Charles C. Johnson, Jr.
2013 - Vincent J. Radke	2004 - Peter D. Thornton	1994 - Nelson E. Fabian	1985 - William G. Walter	1975 - Charles L. Senn
2012 - Harry E. Grenawitzke	2002 - Gayle J. Smith	1993 - Amer El-Ahraf	1984 - William Nix Anderson	1974 - James J. Jump
2011 - Gary P. Noonan	2001 - Robert W. Powitz	1992 - Robert Galvan	1983 - John R. Bagby, Jr.	1973 - William A. Broadway
2010 - James Balsamo, Jr.	2000 - Friedrich K. Kaerferstein	1991 - Trenton G. Davis	1982 - Emil T. Chanlett	1972 - Ralph C. Pickard
2009 - Terrance B. Gratton	1999 - Khalil H. Mancy	1990 - Harvey F. Collins	1981 - Charles H. Gillham	1971 - Callis A. Atkins
2008 - CAPT. Craig A. Shepherd	1998 - Chris J. Wiant	1989 - Boyd T. Marsh	1980 - Ray B. Watts	

The 2017 Walter F. Snyder Award will be presented during NEHA’s 81<sup>st</sup> Annual Educational Conference (AEC) & Exhibition to be held in Grand Rapids, MI July 10-13, 2017.

For more information or to download nomination forms, please visit [www.nsf.org](http://www.nsf.org) or [www.neha.org](http://www.neha.org) or contact Stan Hazan at NSF at 734-769-5105 or [hazan@nsf.org](mailto:hazan@nsf.org).





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David Dyjack, DrPH, CIH

## Size Does Not Make a Profession

Texas is a large state and Austin is a cool town by almost any standard. Enjoy a bite at Stiles Switch BBQ. Catch the famously elusive Radiohead, who recently headlined at the Austin City Limits Music Festival. Attend the Texas Environmental Health Association's educational conference that took place in October. It was not, however, "Karma Police" that blew my mind. It was the speaker from the state health department who inadvertently rocked my world.

The words flowed from the representative's mouth as if he was unaware of their profound importance. Roughly 90 of Texas's local health departments are almost, or entirely, comprised of environmental health professionals. While I don't have the exact data to support my contention, I believe a large segment of the national government public health workforce is similar. You might retort, "So what?" Let's unpack this starburst.

First, the consensus among my peers is that nurses make up the single largest segment of the professional public health workforce. To the best of my knowledge, there is scant evidence to support this hypothesis. Available information from the Robert Wood Johnson Foundation suggests there are roughly 40,000 public health nurses. Contrast that with the number of environmental health scientists employed in the U.S. In 2010, the Bureau of Labor Statistics estimated there are 17,540 environmental health workers in federal government, 37,970 in state government, and 32,930 in local government. These numbers bring the sum to around 88,000. Even accounting for rounding errors and confounders, there appears to be

*Public health seems to be a part of environmental health, and not the other way around.*

roughly two environmental health professionals for every public health nurse.

Empirically, we are the largest profession in the public health universe (excluding administrators and clerical support). We are also a community axis and access resource. Check out the below list of sectors that were on a Federal Emergency Management Agency planning phone call during the recent Baton Rouge flooding response:

- communications,
- energy,
- academic institutions,
- finance/insurance,
- grocers and convenience stores,
- hospital/medical/pharmacy,
- lodging and restaurants,
- logistics/transportation,
- manufacturing,
- retail,
- tourism, and
- umbrella organizations.

What is the one profession that has the greatest insight into most, if not all, of these sectors? Environmental health.

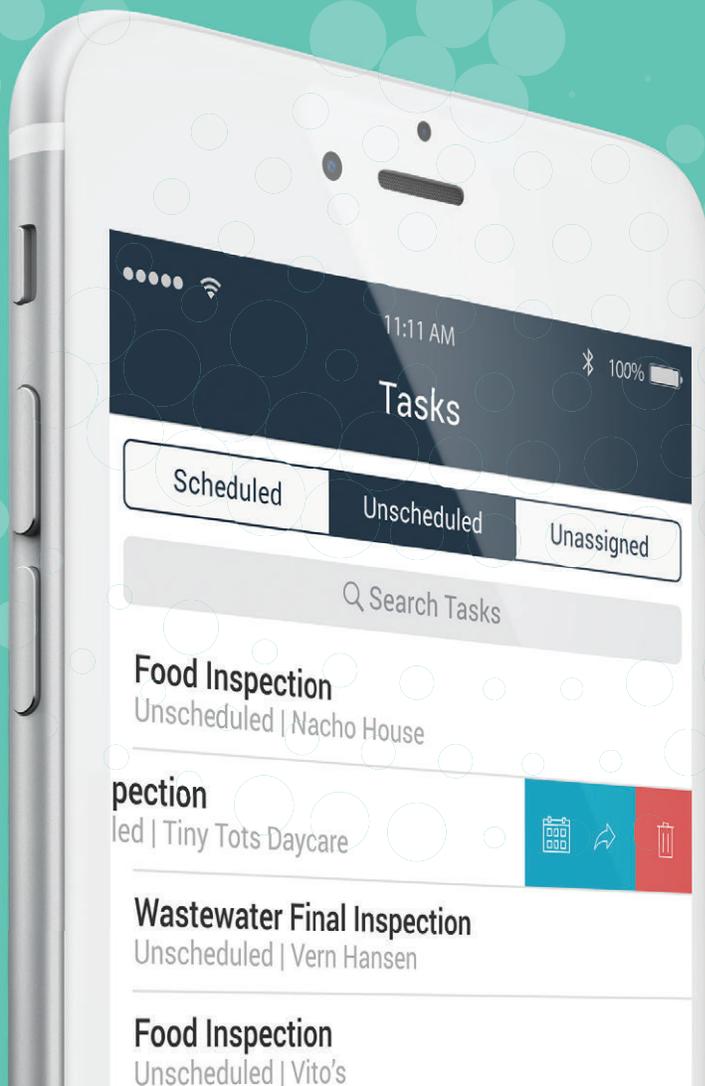
Shortly before I started work at NEHA, I was the director of programs at the National Association of County and City Health Officials (NACCHO). The executive director at the time was a friend with the leadership of the U.S. Army Public Health Command. Their leadership and key subject matters experts came en masse to NACCHO's offices to explore potential areas of collaboration because many military bases are adjacent to civilian communities and a substantial percentage of military dependents live in those communities. As the Department of Defense team introduced themselves, it was evident that the largest fraction of the contingent were sanitarians or industrial hygienists. I was stunned. While chronic disease and wellness issues were given significant attention, and deservedly so, the lion's share of the dialogue centered on infectious and vectorborne disease, clean food and water, and chemical/biological exposures. The military is, in large measure, a reflection of society at large, and environmental health figures as a prominent player in protecting and promoting public health.

Fast forward to the current conversation saturating the ether—Public Health 3.0. The current Acting Assistant Secretary for Health Dr. Karen DeSalvo spearheads this effort. Dr. DeSalvo is an effective and compelling leader, one I greatly admire. Public Health 3.0 is intended to be a major upgrade in public health practice that emphasizes cross-sectorial environmental, policy, and systems-level actions. A kindred spirit to Health in All Policies, Public Health 3.0 represents a challenge to business and community leaders, state law-

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# From Perchloroethylene Dry Cleaning to Professional Wet Cleaning: Making the Health and Business Case for Reducing Toxics

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**Abstract** Increased regulatory oversight over the use of perchloroethylene (perc) in dry cleaning establishments due to health and environmental risks have prompted many dry cleaning facilities to seek substitutes. Among the most benign alternatives is professional wet cleaning. Yet, is wet cleaning viable from a business perspective? Using data from five dry cleaners that recently transitioned from perc to professional wet cleaning, this analysis reviews changes associated with cleaning performance, natural resource use, operations, labor, and associated costs. The financial assessment found that the average payback period related to the capital investments averaged 2.5 years and the average return on investment was 3.6 (using a discount rate of 5%). Higher financial returns were observed when cleaners kept their capital investments below \$50,000. The performance evaluation found that garments cleaned with the wet cleaning technology came out as well as or better than with perc, especially as the cleaner became more familiar with the wet cleaning process. This analysis affirms the business case for wet cleaning, adding to the body of evidence that professional wet cleaning is not only environmentally preferable, but that it is also technically and financially feasible.

## Introduction

For over a hundred years, the dry cleaning industry has been reliant on the use of hazardous solvents. Despite its name, dry cleaning involves the use of liquid solvents to remove stains from fabrics. Since the 1950s, perchloroethylene (perc, also known as tetrachloroethylene) has been the dominant dry cleaning solvent in the U.S. (Doherty, 2000). In 2006, the U.S. Environmental Protection Agency (U.S. EPA) estimated that 28,000 dry cleaning operations across the U.S. still use perc—an estimate that remains current on their Web site today (U.S. EPA, 2016a)

Given the widespread use of perc, as well as fugitive and environmental emissions, there is considerable potential for human exposure among both workers and the general population. Perc contamination of groundwater and soil has become as widespread as the dry cleaning industry itself. In 2001, a report estimated that 75% of dry cleaning properties were contaminated primarily with perc, along with other dry cleaning solvents that have historically been used (Schmidt, DeZeeuw, Henning, & Trippler, 2001). Perc can be released into the environment during routine dry cleaning operations due to improper use, poor housekeeping prac-

tices, lack of maintenance and resulting malfunctioning equipment, and spills, as well as improper storage and disposal.

Over 30 years ago, evidence emerged regarding higher mortality rates from cancer among dry cleaning workers (Blair et al., 1990). In 2012, U.S. EPA classified perc as “likely to be a human carcinogen by all routes of exposure” and in 2014, the International Agency for Research on Cancer maintained its classification of perc as a “probable carcinogen” (U.S. EPA, 2016b; World Health Organization [WHO], 2014).

Studies most consistently demonstrate elevated risks of bladder cancer with perc exposure, although elevated risks of non-Hodgkin lymphoma, kidney cancer, and multiple myeloma have also been observed (Guyton et al., 2014; WHO, 2014). Perc also causes liver, kidney, and central nervous system damage with long-term exposure, as well as neurological effects including vision disturbances and decreased reaction time with short-term exposure (Guyton et al., 2014). While workers are at greatest risk of exposure and associated health effects, several studies have documented health outcomes in the general population associated with ambient exposure to perc from residences that were collocated in the same building as dry cleaners (Ma, Lessner, Schreiber, & Carpenter, 2009; Schreiber et al., 2002).

These recognized public health and environmental risks have resulted in increased regulatory oversight and have prompted many dry cleaning firms to seek substitutes. In 2006, the U.S. EPA strengthened the air toxics requirements for dry cleaners using perc (U.S. EPA, 2006). The rule includes a phase out of perc used at dry cleaners located in residential buildings by 2020, along with

TABLE 1

## Facility Demographics and Wet Cleaning Capital Investments

Facility Name	Silver Hanger	Ace	King & Queen	AB	KMK
Square footage	1,300	2,300	1,700	1,600	2,000
Full-time employees	7	4.5	3	3	6
Year of intervention	2008	2010	2011	2012	2012
Washer	\$13,327	\$14,114	\$41,045 <sup>a</sup>	\$7,218	\$13,920
Dryer	\$4,964	\$5,428	\$7,367	\$16,498	\$5,671
Tensioning equipment	\$33,589 <sup>b,c</sup>	\$14,439 <sup>b,d</sup>	\$14,734 <sup>b,d</sup>	\$9,796 <sup>b</sup>	\$18,560 <sup>c</sup>
Total	\$51,880	\$33,981	\$63,146	\$33,512	\$38,151

<sup>a</sup>All-in-one machine.  
<sup>b</sup>Pants topper.  
<sup>c</sup>Form finisher.  
<sup>d</sup>Press.  
*Note.* Costs reflect 2014 dollars.

requirements that will reduce perc emissions at other dry cleaning facilities.

Some states, including Massachusetts, will ban perc dry cleaning operations in facilities in 2020 that are also colocated in a building with additional susceptible populations, such as licensed day care centers and health-care facilities, among others (Massachusetts Department of Environmental Protection, n.d.). California has issued more stringent regulations that will ban the use of perc in dry cleaning in 2023 (California Environmental Protection Agency, 2007). While drop-in replacement solvents for perc are available, such as n-propyl bromide or other alternatives requiring new equipment such as petroleum hydrocarbons, evidence reveals a broad range of additional health and safety concerns associated with these substitutes (Toxics Use Reduction Institute [TURI], 2012).

One alternative process that has eliminated the use of toxic solvents is professional wet cleaning. Professional wet cleaning is a water-based process to clean delicate textiles (wool, silk, rayon, natural and man-made fibers) that uses computer-controlled washers and dryers along with biodegradable detergents and specialized finishing equipment to prevent fabric shrinkage and damage (American Association of Textile Chemists and Colorists, 2007). While this alternative is not new, the technology has evolved in the past 5–10 years, resulting in significantly improved performance (TURI, 2012).

To facilitate the growth of the professional wet cleaning industry in Massachusetts, the Massachusetts Toxics Use Reduction Institute (TURI) established a dedicated Professional Wet Cleaning Grant program in 2008. The program incentivized the transition of dry cleaners to professional wet cleaning by providing technical assistance and equipment purchase offsets. During 2008–2014, grants totaling \$140,000 were awarded to nine cleaners and TURI collected financial, performance, operational resource, and natural resource use data from a comparable set of five grantees—first while still using perc, and then after the transition to wet cleaning. This evaluation assessed the financial and technical feasibility of professional wet cleaning based on the Massachusetts experience of transitioning these five cleaners. Challenges confronting a broader shift in the industry towards the use of wet cleaning were also reviewed.

## Methods

Each of the five shops was a small business enterprise having fewer than 10 full-time equivalent employees. The five shops allowed TURI to disclose their names: AB, Ace, KMK, King & Queen, and Silver Hangers.

TURI required each of the five cleaners to collect data for one year when the shop still operated using perc and one year when the shop operated as a dedicated professional wet cleaner. A “dedicated professional wet cleaner” was defined as having only wet cleaning equip-

ment (washer, dryer, tensioning equipment) in the shop, and sending only incidental items (fewer than approximately one to five items per month that a shop was not comfortable cleaning in water at that time) elsewhere for processing using another method.

Standardized data collection sheets were used based on similar published evaluations (Sinsheimer, Grout, Namkoong, & Gottlieb, 2007). These published evaluations tracked similar dry cleaning facility demographics, performance measures, natural resource use, and financial expenditures impacted by the change in cleaning technology, which were incorporated into data collection instruments used in this analysis. Cost measures used in the financial assessment included

- capital investment costs associated with new wet cleaning equipment and costs associated with both perc cleaning and wet cleaning;
- cleaning performance;
- labor (both labor productivity and cleaning efficiency);
- cleaning operation costs including supplies (e.g., detergents, spotting agents, and in the case of perc, solvents), machine maintenance, as well as regulatory costs; and
- resource usage (e.g., energy, water, and sewer costs).

Each of the above measures was collected on a monthly basis and averaged. Labor hours were converted into costs using the U.S. Bureau of Labor Statistics (U.S. BLS) wage data for laundry and dry cleaning workers (U.S. BLS, 2014).

Shops completed the data sheet using cost information from similar standardized sources, including supply and equipment invoices, utility bills, and disposal invoices, among others. All shops did not track performance data, however, so the information collected for those metrics was based on averages recalled by the cleaners. Instructional letters were provided with the data collection sheets on how to collect the data, and any units of measurement (e.g., 100 ft<sup>3</sup> versus gallons of water) that were inconsistent between cleaners were converted whenever possible to ensure consistency among shops. At the shops where there was some language barrier, TURI staff provided assistance in guiding the cleaners through the data collection sheets and helped pull data from utility bills.

An initial cost analysis was performed to compare the cost of the investment in

TABLE 2

**Performance/Quality (Average Number of Items or Money if Noted per Month)**

	Silver Hanger		Ace		King & Queen		AB		KMK	
	Perc	Wet	Perc	Wet	Perc	Wet	Perc	Wet	Perc	Wet
Send-outs	5	5	0	25	0	0	3	0	0	0.58
Redos	0	3	4	4	1	0	0	0	4,033 <sup>a</sup>	62
Claims	\$1,348	\$0	0	0	0.5	0	0	0	2	0.67

<sup>a</sup>KMK cleaners interpreted a redo as any garment that was not cleaned to their satisfaction just out of the washer that had to be spotted and sent back through. Only internal comparisons (i.e., KMK's perc versus wet cleaning experience) are appropriate.

Perc = perchloroethylene.

Note. Costs reflect 2014 dollars.

TABLE 3

**Natural Resources Usage (Change in Cost and Amount Per Month From Perchloroethylene to Wet)**

	Silver Hanger	Ace	King & Queen	AB	KMK
Electricity (\$)	-\$108	-\$43	\$20	-\$252	-\$591
Electricity (kWh)	-20%	-15%	0%	-29%	-38%
Natural gas (\$)	-\$305	\$119	-\$160	-\$119	\$110
Natural gas (therms)	-14%	0%	-5%	21%	-1%
Water (\$)	-\$1	\$5	\$1	-\$58	-\$602
Water (gallons)	-3%	25%	15%	-52%	-53%
Total natural resource cost	-\$414	\$81	-\$86	-\$429	-\$1,083

Note. Costs reflect 2014 dollars.

equipment among shops, which occurred in different years. As a result, investment costs in capital equipment were all adjusted to 2014 dollars. Similarly, to compare the costs and benefits of the dry cleaning transition among the shops, data were adjusted to 2014 dollars and then modified to better reflect the potential price increase in the resources required to operate in future years (U.S. BLS, 2015). A 2% annual increase was selected as the average increase in resource prices. Wages were retrieved from the May 2014 U.S. BLS Occupational Employee Survey for Laundry and Dry-Cleaning Workers. Those wages were also increased to reflect benefits provided by employers.

Commonly used financial measures were also calculated to establish the overall value of the investment. Measures included were the payback period (the time it takes for a project to pay for itself), return on investment (ROI; financial gains recovered for every dollar invested), internal rate of return (IRR; the interest rate where the investment costs equal the benefits), and net present value (NPV; the relative value of today's investment to business over the selected time period). Each was calculated using standard equations over the average life of the wet cleaning equipment (15 years) using a discount rate of 5% to account for the time-value of the dollar (Carande-Kulis, Biddle, & Sotnikov, 2009).

**Results**

As shown in Table 1, the five shops included in this analysis transitioned to wet cleaning during 2008–2012 and varied in size from 1,300–2,300 square feet. The number of full-time equivalent employees ranged from three to seven, and did not necessarily correlate to the physical size of the facility.

**Capital Costs**

Capital costs (Table 1) included washer and dryer equipment as well as tensioning equipment, which is equipment used during the finishing process to prevent shrinkage. A form finisher and a pants toppler are the tensioning equipment considered essential to wet cleaning, and are used to reshape garments during drying. Capital investments varied from \$33,981–\$63,145 (adjusted to 2014 dollars). This range can be attributed to variations in equipment needed by specific facilities, as well as the sophistication of the equipment purchased. The facility with the highest capital costs, King & Queen, purchased an all-in-one machine that performs both the washing and drying. Facilities (i.e., Silver Hangers) that desired higher-end finishing equipment invested more capital in that part of the process.

**Performance and Quality**

Each shop estimated their number of send-outs, redos, and claims at their facility as a perc user and as a wet cleaner as a measure of performance and quality (Table 2). Send-outs reflect the frequency of items sent to another shop for processing per month. Of the five cleaners, three experienced similar send-out frequencies for both perc and wet cleaning (Silver Hanger, King & Queen, and KMK). AB decreased their send-outs from three to zero. Ace experienced a significant increase in send-outs the first year. This frequency, however, was reduced in subsequent years as familiarity with the wet cleaning process increased. Redos are defined as the number of items that are not satisfactorily cleaned in the complete cleaning process and must be recleaned. Two cleaners reported similar redo frequencies (Ace and AB). Two cleaners reported a decrease in redos associated with wet cleaning compared with use of perc (King & Queen and KMK). Silver Hanger increased their redos from zero to three per month.

TABLE 4

**Operations (Labor and Productivity)**

	Silver Hanger		Ace		King & Queen		AB		KMK	
	Perc	Wet	Perc	Wet	Perc	Wet	Perc	Wet	Perc	Wet
Load size (lbs)	30	50	50	50	45	50	45	20	50 lbs/hr	85 lbs/hr
Cycle time (min/load)	40	20	45	20	55	30	55	16	60	60
DEP ERP paperwork (average hrs/yr)	2	0	2	0	5	0	2	0	10	0
Spotting time (average hrs/day)	0.5	0.5	0.75	0.33	2	0.75	2	0.5	4	1
Finishing time (average hrs/day)	8	8	6	5	7	7	6	7	3.5	0.75
Training time (hrs/employee)	5	5	6	2	—	—	2	2	1–2 wks	3–4 wks
Annual labor costs	\$34,557	\$34,531	\$27,474	\$21,639	\$36,559	\$31,425	\$32,491	\$30,438	\$31,322	\$8,915

DEP = Department of Environmental Protection; ERP = Environmental Results Program; Perc = perchloroethylene.

Note. Costs reflect 2014 wages.

TABLE 5

**Changes in Operational Costs per Month (From Perchloroethylene to Wet)**

	Silver Hanger	Ace	King & Queen	AB	KMK
Maintenance	\$0	-\$117	-\$93	-\$47	-\$206
Filters	-\$32	\$0	\$0	-\$66	-\$34
Solvent	-\$168	-\$99	-\$166	-\$113	-\$621
Detergent	\$823	\$117	\$225	\$0	\$1,048
Spotting agents	\$46	-\$18	\$16	-\$74	-\$67
HW disposal	-\$214	-\$41	-\$40	-\$95	-\$681
Regulatory fees	-\$23	-\$23	-\$22	-\$30	-\$124
Total	\$432	-\$181	-\$80	-\$425	-\$683

HW = hazardous waste.

Note. Costs reflect 2014 dollars.

Claims are the number of items that the customer is not satisfied with and submits and receives reimbursement from the cleaner. Silver Hanger reported their claims in dollars, which dropped from over \$1,350 per month to zero. The remaining facilities essentially remained consistent at or close to zero claims without providing changes in dollars.

**Natural Resource Use**

The natural resources vital to the garment cleaning industry include electricity, natural gas (as a fuel for the boiler), and water (Table

3). Utility rates can change over time, though, so the best comparison is between usage amounts; however, both the changes in usage and costs (adjusted to 2014 dollars) are shown in the overall financial analysis (Table 3). Cleaners demonstrated a decrease in electricity use of 15%–38%, except for King & Queen where there was no change in electricity use. King & Queen was the only cleaner that invested in an all-in-one machine, which is more energy intensive than a separate washer and dryer. Natural gas use remained steady, or decreased 1%–14% at four of the five facilities.

The fifth facility, AB demonstrated an increase of 21% in their use of natural gas.

Water usage at three of the facilities decreased 3%–53% and rose 15%–25% at the other two facilities. It is known that not every facility will experience water use decline if they switch to professional wet cleaning. Each of the five facilities in this study did eliminate the use of a water-cooled solvent distiller, which should have reduced their overall water usage. It is unclear why water use increased at Ace and King & Queen, though it might be explained by less efficient washers than those at the other three facilities.

**Operational Costs**

Labor costs associated with regulatory reporting, cleaning tasks, and training are outlined in Table 4. In Massachusetts, each facility using perc was required to report to the Massachusetts Department of Environmental Protection under the Environmental Results Program. Compliance required labor time ranging between 2–10 hours (range reflects the size of the facility), which was eliminated after becoming a wet cleaner. Spotting time—the time spent cleaning specific stains with specialized treatment agents—was greatly reduced at all but one shop, where there was no difference. Finishing time remained fairly consistent with the exception of one facility (KMK) where there was a substantial time savings when moving to wet cleaning. Training time decreased at Ace

TABLE 6

## Financial Assessment

	Silver Hanger	Ace	King & Queen	AB	KMK	Average
Payback period (yrs)	3.2	4.7	8.2	2.7	0.9	2.5
NPV	\$136,016	\$48,715	\$20,612	\$111,073	\$474,303	\$158,142
IRR	32%	21%	9%	38%	116%	41%
ROI/ROI discounted	4.3/2.6	2.6/1.4	1.0/0.3	5.3/3.3	18.8/12.4	5.7/3.6

NPV = net present value over 15 years; IRR = internal rate of return; ROI = return on investment.

Note. Costs reflect 2014 dollars; Discount rate = 5%.

and remained the same at AB, the only two cleaners that submitted this information.

Additional operational costs at the facilities included maintenance, filters, solvent, detergent, spotting agents, hazardous waste disposal, and regulatory fees (Table 5). By switching from perc to wet cleaning, the costs for filters, solvent, hazardous waste disposal, and regulatory fees were eliminated for each facility. Maintenance costs remained at zero or were reduced when using wet cleaning equipment. The costs for detergents increased at each facility. Though some detergent is used in the solvent machines, more is used in a wet cleaning system. Spotting agent costs decreased for three of the facilities. Increases for two facilities can be attributed to the start-up costs of purchasing a new inventory of water-based spotting agents appropriate for the wet cleaning process.

### Financial Assessment

Across the five cleaners, the payback period for the initial wet cleaning equipment investment averaged 2.5 years and ranged from less than 1 year up to about 8 years (Table 6). Looking forward 15 years, considering the average life span of wet-cleaning equipment, the NPV of the costs and benefits associated with an investment in wet cleaning technology averaged \$158,142 (range of \$20,612–\$474,303)—all positive values indicating sound financial investments. Considering the 15-year wet cleaning equipment life span, there was an average ROI of \$3.60 for every \$1.00 invested considering a discount rate of 5%. The highest ROI saw KMK Cleaners receiving \$12.40 for each \$1.00 invested, while the lowest ROI still provided 33 cents for each \$1.00. The lower value experienced

by King & Queen was driven by their high initial investment costs (far higher than the other four cleaners). The IRR calculations demonstrate that on average, an investment in wet cleaning would be considered a good business decision if the cost of capital is less than 41%. The IRR, considering 15 years, ranged 9%–116% among the five cleaners.

### Discussion

The results of this analysis demonstrate that there is a strong financial case for operating a dedicated wet cleaning shop on a scale of these five shops in the northeast. These results demonstrate the potential for large savings in operating costs, resource use, labor, and productivity. The financial assessment reveals a strong ROI, NPV, and IRR when cleaners kept their upfront capital expenditures below \$50,000.

In this analysis, only one cleaner, King & Queen, did not demonstrate a strong financial return. This lack of financial return was due primarily to their decision to purchase an all-in-one machine, which is far more expensive than a separate washer and dryer. In addition to the financial benefits, the majority of wet cleaners in this analysis demonstrated similar or better performance with wet cleaning compared with using perc. These findings are consistent with other financial and technical analyses of wet cleaning transitions in California (Biddle, 2013; Sinsheimer et al., 2007). Facilities progressively tracked the majority of data used in this analysis, and used archived invoices for supplies and energy bills. Thus, the findings in this analysis are unlikely to be explained by recall bias.

Beyond the technical and financial benefits, wet cleaning technology allows business

owners to create a safer and healthier work environment for themselves, their staff, and their communities. Adoption of wet cleaning corresponds to the highest form of protection and disease prevention based on the well-accepted hierarchy of industrial hygiene controls (Occupational Safety and Health Administration, 2016). This toxics use reduction intervention is a form of primary prevention—minimizing the use of and therefore exposure to toxics through process redesign and substitution of safer alternatives.

As described in the introduction, perc exposure is associated with several disease outcomes, including cancer (Guyton et al., 2014; WHO, 2014), and use in dry cleaning is the source of significant environmental contamination throughout the U.S. (Schmidt et al., 2001). Substitution of perc with wet cleaning among facilities in this analysis eliminated the use of perc and the generation of associated hazardous waste from operations. While this analysis focused on the financial and technical feasibility of transitioning from perc to wet cleaning, the value to human health and the environment by eliminating the solvent and the resulting waste needs to be underscored.

There was some variability in the data collected from the five cleaners. As with any service sector, this evaluation observed variability in quality of service based on human-controlled components. This variability is not unique to wet cleaning, however, as methods and practices of cleaners vary from shop to shop no matter what cleaning medium is being used. This variability also leads to inconsistencies in labor time and productivity.

The most efficient and effective system, based on cleaning performance and financial rewards, would incorporate effective equipment, adequate training, and efficient workflow. This combination is a feasible scenario to achieve, as demonstrated by one cleaner in this assessment, KMK, which achieved the greatest natural savings, the greatest labor productivity, and the highest ROI.

There still exists variability in the data based on data collection methods used by each cleaner. For example, KMK considered a redo differently than the other cleaners, therefore making that data set difficult to compare with other cleaners. This performance/quality metric was not monetized, however, so it had no effect on the overall

financial assessment. Also, Silver Hanger reported their costs rather than item numbers for claims, also making this data set difficult to compare with other cleaners.

## Conclusion

This analysis affirms the business case for wet cleaning, adding to the body of existing evidence that professional wet cleaning is technically and financially feasible, and environmentally preferable. When the TURI Wet Cleaning program began in 2008, there were

no dedicated wet cleaners operating in the state to our knowledge. Today, Massachusetts has more than a dozen dedicated wet cleaners in operation.

Garment cleaners considering a switch to professional wet cleaning can use the information and data presented here and elsewhere (Sinsheimer et al., 2007) to make informed decisions about equipment purchasing and staff training to maximize their ROI. Each of the cleaners included in this study, as well as others across the state, are resources for those

evaluating their options when moving away from perc. As more cleaners move toward professional wet cleaning, both in Massachusetts and in other states, the garment cleaning sector and the communities they support will reap the benefits. 🐼

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