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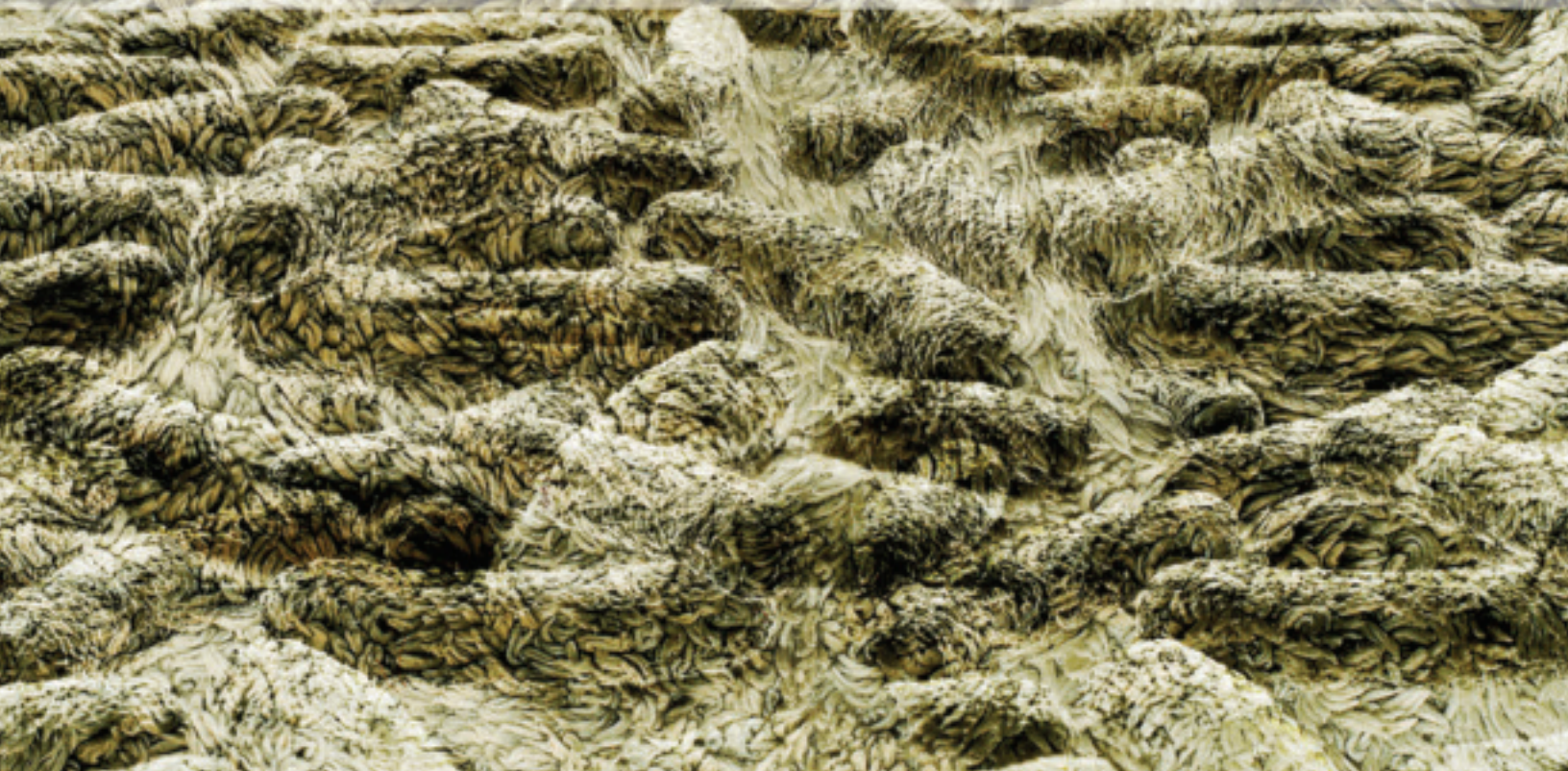
Volume 74, No. 9 May 2012

WATER INTRUSION RESTORATION

Best Practices to Reduce Bacterial Amplification in Carpet



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ABOUT THE COVER

Carpet is well known for its ability to accumulate dust, organic material, and microorganisms. In our cover feature this month, "Bacterial Amplification and In-Place Carpet Drying: Implications for Category 1 Water Intrusion Restoration," the authors investigated whether in-place carpet drying processes resulted in bacterial amplification after flooding residential carpet with clean water. They found that bacterial amplification occurred in all test areas and that appropriate response time for carpet pad salvage is considerably shorter than the current industry recommendation of 72 hours.

See page 8.

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YOUR ASSOCIATION

PRESIDENT'S MESSAGE

Mel Knight, REHS

A Call for the Initiation of a National Environmental Health Network

One of the best aspects of serving as NEHA president has been the opportunity to spend time with NEHA affiliates throughout the country and beyond. This past year I have been able to participate in affiliate conferences representing a dozen states, as well as international conferences in Jamaica and Lithuania. I have also represented NEHA serving on multiple national work groups established by both the Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention (CDC).

Without exception, I have found every conference and meeting to be an inspirational learning experience. The core issues of environmental health differ very little from state to state, or even country to country. While the problems are generally universal, I have been impressed with the unique innovations and resourceful solutions that are unfortunately all-too-often unknown outside of a single state or jurisdiction. NEHA, state affiliates, universities, and governmental agencies offer networking options including conferences, journals, newsletters, webinars, and other information-sharing outlets that have been somewhat successful in information dissemination. Building on that success, I'm convinced we have entered into a new era where established and emerging technology can enable an exponential expansion of networking opportunities for environmental health practitioners. Our profession is now ready for a national communication network, and NEHA is positioned to provide leadership in this endeavor.

I'm convinced we have entered into a new era where established and emerging technology can enable an exponential expansion of networking opportunities for environmental health practitioners.

I have had extensive experience with environmental health information sharing systems, and these have included LISTSERVs, e-mail distribution lists, chat sites, and message centers. Nearly all systems have been useful, but their utility and utilization has been limited. Shortcomings have ranged from too little participation to an overwhelming volume of information. Many systems uniquely serve a single program area (e.g., air, water, food safety, etc.), while others attempt to broadly cover all areas of public health. More than once I have enthusiastically signed on to a system to later see a decline in interest and participation by myself and others.

I've now grown to believe that the traditional mechanism of building and maintaining distribution lists to push information out to recipients is no longer the best way to network and share information. A network that allows users to selectively pull in relevant information is much more efficient and productive. The successful environmental health networks of the future will not resemble the e-mail LISTSERVs or password-protected agency data repositories, but will look more like the more accessible social and professional networking sites such as Facebook or LinkedIn.

Just a few years ago it was a difficult task to efficiently search for information on environmental health practices, tools, and programs. Google and other search engines have revolutionized the access to information to the extent that the next task will be to better organize massive volumes of information to suit our unique and specific needs.

I was recently at a federal agency–sponsored work group session in which the sponsoring agency had created a Web site that was clearly being underutilized. The agency had hoped that environmental health professionals and their agencies would be posting useful information and tools, but little new content was being posted and very few practitioners were even aware of the site. This approach is a common strategy, but in most cases it is programmed to fail.

We need to adopt new strategies and utilize a technique that has historically served us well—learning from the experiences and successes of others. We know that modern social and professional networking sites have attracted the active participation of millions worldwide, including many environmental health agencies and practitioners. The next logical step will be to see what we can learn from these successful systems and incorporate key elements into our prospective initiatives.

I can envision that in the near future environmental health professionals will be able to more easily network with colleagues to seek out best practices, innovative tools, and peer support. An environmental health specialist may wish to find out if other jurisdictions have implemented a body art ordinance. An environmental health manager might be interested in obtaining fee schedules that have allowed many environmental health programs to recover some or all of their costs. A sanitarian could become part of an interactive group that is developing the environmental health role in sustainable land use planning. There could be a repository established for the development and distribution of environmental health smartphone applications—yes, there's an app for that!

Environmental health professionals have an interest and need for all of these things and more. Most governmental agencies and many private entities have an interest in efficient and effective access to the community of environmental health professionals. The participants, the tools, and the applications already exist but must be linked in a manner that eases access and utility. I personally believe NEHA is positioned to be a key organization to provide leadership in establishing a national professional network for environmental health practitioners. Other professional organizations and governmental agencies cover some elements of environmental health practice, but NEHA uniquely has the broad-based membership and resources that encompass the breadth of our entire field. NEHA members represent governmental agencies, the private sector, and academia. NEHA has members in every one of the United States, plus many international members. NEHA has appointed technical advisors supporting 30 environmental health program areas that cover virtually every aspect of environmental health practice.

NEHA has established alliances with other capable partners that collectively enable the necessary capacity to undertake the leadership on a significant initiative of this size and scope. I believe that the technology is now available to meet this unquestioned need. I invite you to join me in advocating for the initiation of a national environmental health network. To repeat an often-quoted line: "If not now, when? If not us, who?"

Mel Knight REHS
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Bacterial Amplification and In-Place Carpet Drying: Implications for Category 1 Water Intrusion Restoration

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Abstract **The study described in this article investigated whether in-place carpet drying processes resulted in bacterial amplification following water intrusion from a clean water source (category 1) in a residential indoor environment. Bacterial amplification was examined after wetting a 10-year-old carpet and pad that had no history of water intrusion. Three test areas were extracted and dried using industry-recommended procedures for in-place drying and compared to a control area that was not extracted or dried. Results from carpet, pad, and subsurface dust demonstrated that bacterial amplification occurred in all test areas. CFUs of bacteria per gram of carpet surface dust and subsurface dust prior to water intrusion were lower than levels in subsurface dust after in-place drying. The authors' study contributes to information regarding the restoration of water-based carpet damage by professional water damage restoration companies, building maintenance personnel, and housekeeping managers. Results suggest that the appropriate response time for carpet pad salvage is considerably shorter than the current industry recommendation of 72 hours.**

Introduction

Background

Carpet has long been recognized as a sink for the collection of dust, organic material, and microorganisms. Even with routine maintenance, dirt and associated particulates will collect in carpet over time (Bouillard, Michel, Dramaix, & Devleeschouwer, 2005). A Canadian Mortgage and Housing Corporation (CMHC) study found that the bacterial levels in unsieved carpet dust from nonproblem homes ranged from 6.78 x 10^5 CFU/g to 7.28 x 10^5 CFU/g and that "unhealthy" homes had bacterial levels of 1.45 x 10^6 CFU/g of carpet dust (CMHC, 2004). A third study analyzed sieved carpet dust (particles <250 microns) and found bacterial levels of 1.2 x 10^7 CFU/g in a nonproblem commercial building (Cole et al., 1996). In-place carpet drying is a water intrusion restoration method for drying buildings where carpet, pad, and other structural components are dried in place. According to The Clean Trust (formerly Institute of Inspection, Cleaning, and Restoration Certification [IICRC]) S500 *Standard and Reference Guide for Professional Water Damage Restoration*, "In-place drying involves extracting and drying carpet, cushion, and other structural and finishing components without disengaging the carpet installation" and can only be applied to a category 1 (clean) water intrusion (IICRC, 2006). Historically, structural drying services have involved the extraction of excess water, removal of pad, drying the carpet by air movement using specially designed fans (air movers and axial fans), and dehumidification. In-place drying involves more aggressive extraction, air movement, and dehumidification processes. Increased heat is also beginning to play a more important role as an in-place drying technique.

In-place carpet drying has gained acceptance in the water damage restoration industry as a structural drying method that can be used in some circumstances. When used, it is considered to be less expensive and results in little or no reconstruction cost. For these reasons, interest has increased in its use as a structural drying process. At the same time, there is recognition that in-place drying is not appropriate for every water damage situation. Depending upon the circumstances, a delayed mitigation response can result in increased risks of microbial amplification, resulting in adverse health effects for occupants, and liability for restorers that utilize this method (IICRC, 2006). To date, the parameters used for in-place drying have been largely based on assumptions and anecdotal information. While bacterial amplification has been studied previously under ideal laboratory conditions (Fishov, Zaritsky, & Grover, 1995) it has not been observed in an applied research design such as in our study.

Study Goal

The goal of our study was to identify those circumstances where in-place drying might or might not be appropriate. Presently, the standard of care says that carpet pad (cushion

or underlay) restoration can be considered if begun within a period of 72 hours, depending upon temperature (IICRC, 2006). The amplification of nonsewage carpet bacteria has not previously been studied *in situ* under different temperature and duration conditions.

Study Objectives

Our study was designed to address the following questions regarding in-place carpet drying, resultant bacterial amplification, and optimum response time for implementation following water intrusion:

1) What are the bacterial concentrations present in floor-covering dust that accumulate over time in carpet, in a pad, and under a pad in a nonproblem residence prior to a category 1 water intrusion?
2) To what extent does bacterial contamination amplify within and underneath wet carpet and pad as time passes without any mitigation effort?
3) At what point does exponential bacterial growth in carpet and pad begin after a significant water intrusion?
4) What influence does carpet surface temperature have on bacterial amplification and the point at which exponential bacterial growth in carpet and pad begins?
5) What is the extent of amplification to be expected if carpet and pad are dried using current industry-recommended in-place drying procedures within a "reasonable" response time?

Methods

Carpet and Dust Collection

The carpet, pad, and dust used in our study were originally collected from an apartment located in Sacramento, California. Upon examination, the carpet construction appeared to be a 26-oz. (737 g) tufted cut pile with a polypropylene primary and secondary backing and the pad was a 4-lb. (1.8 kg) rebond material with a permeable membrane. The carpet and pad were originally installed over a lightweight concrete floor approximately 10 to 12 years prior. The age is based on the manufacturer's date stamp on the pad showing November 18, 1996. No history or indication of previous water damage to the carpet or pad was present. The carpet appeared to be serviceable with a few stains. Some indication was present of what was believed to be pet urine (fluoresced under ultraviolet light) in several locations. Dust samples were taken to establish the carpet's condition as a baseline. Prior to removing the carpet, the top surface was vacuumed using a Nilfisk GP 1000 series vacuum cleaner with a new 4.5-L two-ply dust bag #82017201. The total weight of unsieved dust collected from the entire top of the carpet was found to be 85 g. Each apartment area of carpet was labeled, rolled, and wrapped in polyethylene. The pad from each room was labeled, folded, and wrapped in polyethylene. After the pad and carpet had been removed, the concrete floor was vacuumed using a new vacuum cleaner bag to collect the subsurface dust that had sifted through the carpet. It was noted that dust accumulation was heaviest under the traffic areas. The total weight of unsieved subsurface dust collected was found to be 1,360 g, or approximately 30 g/m^2. Samples of the dust collected from the top of the carpet and the subsurface dust under the carpet and pad were then analyzed for total bacteria. The dust from the top and underneath was combined to provide a homogeneous mixture of the dust that was used to seed the test areas.

Test Areas

Our study was carried out in a warehouse training facility in rooms previously constructed for simulated mold remediation with hands-on training. The carpet and pad were installed in preparation for testing. Areas 1, 2, and 3 were individual 8' by 8' carpeted rooms with 8' ceilings (14.5 m^3). Area 4 was an open area on the warehouse floor. A second round of testing in area 4 required the creation of a contained area to maintain heat. Approximately 30 g/m^2 of the composited top carpet and subsurface dusts were used to uniformly inoculate the floor by sifting the dust onto the floor before the pad and carpet were installed in all areas.

Flooding

All areas were flooded with three gallons of tap water per square yard (13.7 L/m^2). Areas 1, 2, and 3 were allowed to sit for four hours prior to extraction. The extracted water was collected and its volume measured. Areas 1–3 were then dried as described below. Area 4 remained wet.

Water Extraction

Extraction of the three rooms and the anteroom was performed using a Phoenix Hydro-X Xtreme Xtractor with the Vacuum Pac. The water that was extracted was measured to determine whether the remaining water left in the carpet and pad was consistent with the results achieved in the wet study conducted by the Society of Cleaning and Restoration Technicians (International Society of Cleaning Technicians [ISCT], 2003).

Drying

Area 1 was set up for hot air in-place drying of carpet and pad using a Phoenix Firebird Hot Air Drying System. The floor was unsealed concrete. The hot air drying unit is capable of delivering 18,000 British thermal units at 360 cubic feet per minute (cfm) providing a 46°F (25.6°C) temperature rise through the unit. The unit was initially installed to deliver six air changes per hour (ACH) (50 cfm). The excess heat generated was exhausted from the building using an existing warehouse ventilation fan. Airflow cfm delivered to the room was calculated using a Kestrel anemometer. In developing the drying protocol for our study, preliminary efforts demonstrated the need for an airflow delivery rate of 30 ACH, wherein complete drying could be documented in less than 24 hours.

Area 2 was set up to dry the carpet and pad using air movers and refrigerant dehumidification, with the substrate modified to simulate drying of carpet and pad over oriented strand board (OSB).

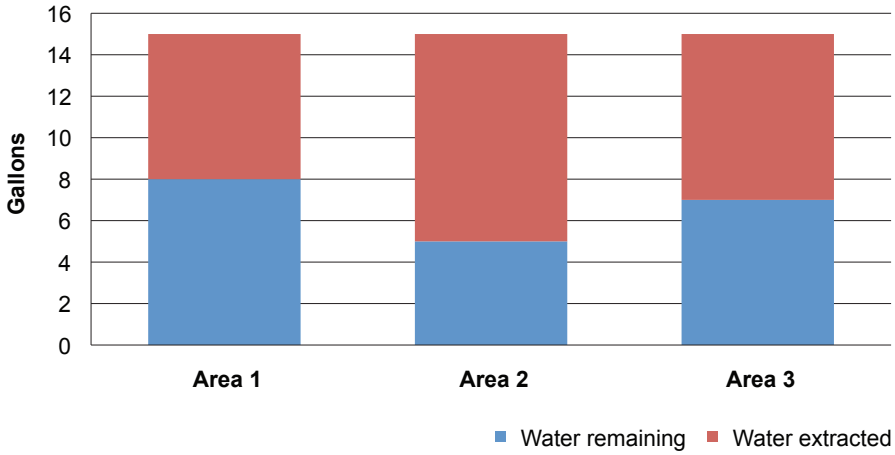
Area 3 was set up to dry the carpet and pad using air movers plus refrigerant dehumidification, with the carpet and pad over unsealed concrete.

The IICRC S500 makes recommendations for the initial numbers of air movers and dehumidifiers that can be used to start the drying process. In order to facilitate the use of these recommendations, areas 2 and 3 were set up with a common anteroom. Two air movers were placed in each room and one axial fan was placed in the anteroom to increase the surface evaporation rate. The air movers were installed so that each room would have one air mover per 16 linear feet of wall. The common anteroom was installed in front of the test rooms to enlarge the drying area to accommodate the dehumidifier, a DrizAir 1200 rated at 70 pints (33 L) removal as defined by Association of Home Appliance Manufacturers specifications. The anteroom had carpet and pad added to provide consistency in the drying environment. The total airspace was approximately 2800 ft^3 (79 m^3) for areas 2 and 3 and the anteroom.

Area 4 was constructed on the warehouse floor with 8' by 8' carpet and pad installed over polyethylene sheeting. PVC pipe was laid out around the perimeter of the test area under the polyethylene to create a dam to contain the water. Area 4 underwent two rounds of testing. Round 1 was performed in the open unconditioned warehouse with an average carpet surface temperature of 14°C, as measured by an infrared laser thermometer. The area was not extracted and no dehumidification or air movement was used to accelerate drying. Our study ended at 72 hours postflooding. At the completion of this first round of testing, the carpet, pad, and polyethylene dam were removed and disposed of and the area was cleaned. Then a new polyethylene dam was installed and a second round of testing was conducted using another section of the carpet and pad from the original apartment over the same distribution of dust inoculum. The second round was conducted inside a heated minicontainment to raise the carpet surface temperature to an average of 20°C. The second round of testing was ended at 36 hours postflooding.

FIGURE **1**

Water Extraction



Sampling

Carpet and Pad Sample Collection Prior to Flooding

Five 6.5-cm^2 samples each of carpet and pad were collected by cutting the material with a clean razor knife. The materials were analyzed for total bacteria after the carpet and pad had been installed in the test areas. One sample was collected from each carpet in each of the four areas. One sample was also collected from the unused portion of carpet and pad that was not flooded in the study.

Water Sample Collection

A 1-mL sample of the tap water used for flooding was collected as a control. One-mL samples of water were collected from the floor below the pad with a sterile pipette and placed in a sterile microcentrifuge tube. Water samples were collected from each of the four areas immediately upon flooding. For round one of testing, a total of 20 1-mL water samples were collected by sterile pipette into individual sterile microcentrifuge tubes, one each hour for the first eight hours, one every two hours for the next 16 hours, then one morning and evening for a total of three days. For round two, a total of 14 1-mL water samples were collected by sterile pipette into individual sterile microcentrifuge tubes, one every two hours for the first 24 hours, then one at 30 and 36 hours.

Carpet and Pad Sample Collection

At the completion of drying areas 1–3, five bulk samples of carpet and five bulk samples of pad were collected from each of the four areas.

Temperature, Humidity, and Moisture Monitoring

1. Temperature and humidity readings were data logged using calibrated Hobo Pro Series monitors that were set up in areas 1–4 and the anteroom.
2. Temperature and humidity readings were manually recorded each time samples were collected using the Kestrel 3000 or a sling psychrometer. Prior to beginning our study, the instrument calibration was checked using a sling psychrometer.
3. Prior to wetting, the moisture levels in the concrete substrate in areas 1 and 3 were measured using a Tramex concrete encounter. A Tramex moisture encounter was used to take moisture readings of the OSB in room #2 prior to wetting.
4. The carpet was initially monitored to determine when dry using a Dri-Eaz HydroPro 1 moisture sensor.
5. When the moisture sensor indicated that the carpet was dry in each area, a nonpenetrating Tramex moisture encounter then a pin type Tramex compact moisture meter were used to determine that the carpet, pad, and substrate were dry.
6. Infrared temperature readings of carpet surfaces were taken and recorded each time that water samples were collected in area 4.
7. The amount of water added and extracted from each area was measured and recorded.

Sample Analyses

Water

Serial dilution plates were prepared on tryptic soy agar (TSA) and incubated for 48 hours (overnight at 37°C, then overnight at room temperature). After incubation, all plates were quantified and CFU/mL of water were calculated.

Dust

Each unsieved dust sample was weighed, suspended in sterile water, and dilution plated, incubated, and quantified as described above.

Plugs From Carpet and Pad

To prepare the samples for analysis, a 1.0 cm^2 slice of each carpet or pad sample was separately collected with a sterilized razor. The samples were each placed in 1.0 mL of sterile water and vortexed for approximately 30 seconds to elute the bacteria from the sample. Serial dilution plates were prepared on TSA and were enumerated after incubation at 25°C for 48 hours.

FIGURE **2**

Subsurface Dust Analysis

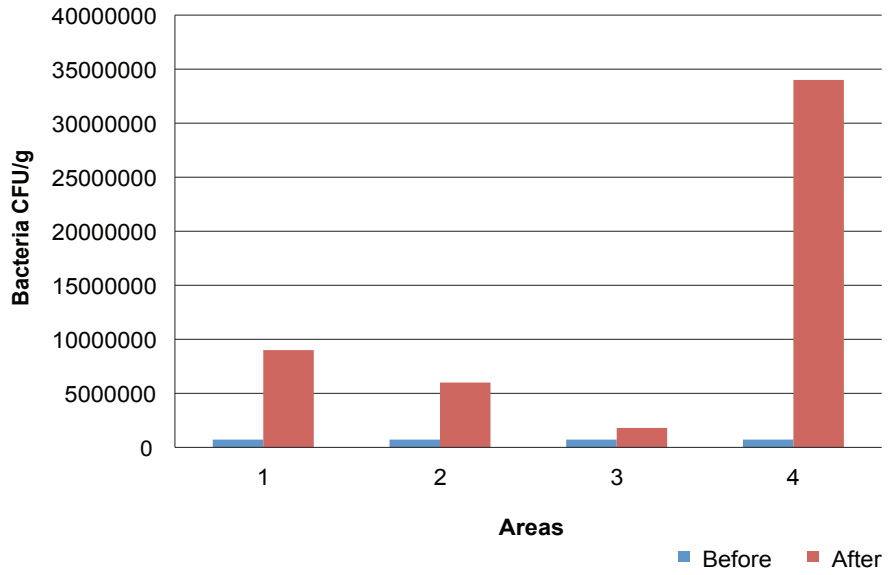
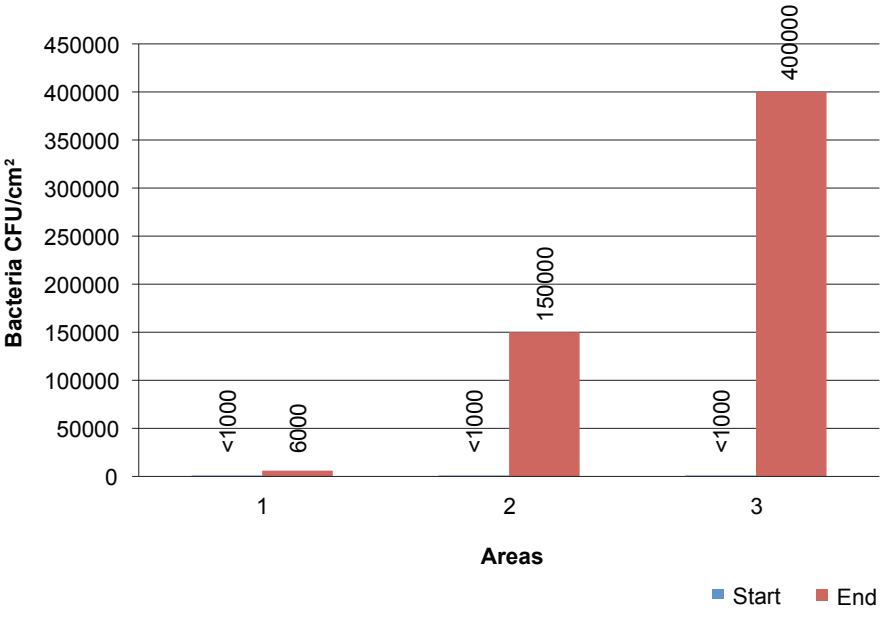


FIGURE **3**

Pad Samples (Plugs)



Results and Discussion

The analysis of the composite dust collected from the top of the carpet showed bacterial levels of 7.9 x 10^5 CFU/g of dust, and dust collected from the floor surface (i.e., under the pad) showed bacterial levels of 7.2 x 10^5 CFU/g of dust. Analysis of total bacterial levels for the dust from the carpet surface demonstrated that the level of bacteria in the carpet was consistent with levels identified in previously published studies for "nonproblem" buildings (CMHC, 2004). Although no data have been previously published describing bacterial levels in the subsurface dust accumulated on the floor under carpet and pad, our results demonstrated that for this apartment residence, the levels of bacteria per gram of subsurface dust were similar to the levels of bacteria in the dust collected from the carpet surface. Interestingly, 1,360 g of subsurface dust was vacuumed from the floor surface, in contrast to 85 g that was collected from the carpet. It could not be determined if the carpet had recently been cleaned in some manner prior to our taking possession. For our study, no effort was made to determine how much soil was bound to the carpet or pad and not removed by vacuuming. Mixing the dust collected from the top of the carpet with that collected from the floor underneath was considered appropriate mixing that occurs when the water is added and then extracted through the carpet.

In areas 1, 2, and 3 the pilot study was conducted with a four-hour response time from the point of water intrusion until extraction and drying began. One study demonstrated that extraction of water from carpet and pad can remove up to a maximum of 95% of the water when installed over a sealed concrete floor (ISCT, 2003). When floors are not sealed, the amount of water that can be extracted has been predicted to be less due to the absorption of water into the porous concrete (Hedenblad, 1993). A higher amount of water absorbing into the unsealed concrete floor used in our study is believed to account for the smaller amounts of water that were able to be extracted prior to drying (Figure 1). The carpet, pad, and substrates were dried aggressively, monitored, and adjustments were made to the drying system until dried. All materials except the OSB subfloor in area 2 were dry within 48 hours from the time of extraction.

The carpet and pad in area 1 dried the fastest in spite of the delay caused by inadequate ACH initially used. The subsequent adjustments to the ACH were able to more than make up for the delay. The carpet and pad in area 2 dried the slowest.

Prior to flooding the test areas, the bacterial levels in subsurface dust were determined to be 7.2 X 10^5 CFU/g of dust. After flooding and drying the bacterial level in the

subsurface dust in area 1 increased to 9.0 X 10^6 CFU/g of dust, area 2 increased to 6.0 X 10^6 CFU/g of dust, and area 3 increased to 1.8 X 10^6 CFU/g of dust (Figure 2).

All preflooding samples of carpet and pad began with CFU/cm^2 ≤ 10^3. As shown in Figures 3 and 4, after flooding and drying, the bacterial level in the pad of area 1 increased to 6.0 X 10^3 CFU/cm^2 and the carpet increased to 3.0 X 10^3 CFU/cm^2. The pad in area 2 increased to 1.5 X 10^5 CFU/cm^2 and the carpet remained <10^3 CFU/cm^2. The pad in area 3 increased to 4.0 X 10^5 CFU/cm^2 and the carpet increased to 8.0 X 10^4 CFU/cm^2. The carpet and pad in these three areas consistently showed a greater amplification in the pad than in the carpet. The greater amplification in the pad is considered likely to be due to the nature of in-place drying, which occurs from the top down. The carpet would dry before the pad, resulting in a longer period of time for amplification in the pad and in greater numbers.

Several anomalies occurred in each of the test areas.

1. Although area 1 dried the fastest, the initial six to nine ACH of hot air during the first 24 hours may have created a more favorable growing environment, resulting in this area having the highest amplification in the subsurface dust.
2. Area 2 dried the slowest; however, the increased drying time for the OSB subfloor may explain the greater amplification of subsurface dust as compared to area 3.
3. A number of possible reasons may explain why bacterial levels after drying were lowest in the area 3 subsurface dust, but highest in the carpet and pad. The initial water and dust samples collected from the carpet showed that area 3 had approximately 10 times more bacteria than the other areas. The dust used to inoculate each floor was homogenous and may have resulted in lower initial bacterial concentrations. The carpet that was used in area 3 was originally from a higher traffic area in the apartment than the carpet used in the other study areas.
4. Although the moisture measurements of the carpet, pad, and substrate indicated that they were dry, the measurement of the concrete, after the removal of the carpet and pad, exceeded the range of the Tramex concrete encounter (i.e., >6.0). Readings prior to the start of the study were 3.0 to 3.5.

FIGURE **4**

Carpet Samples (Plugs)

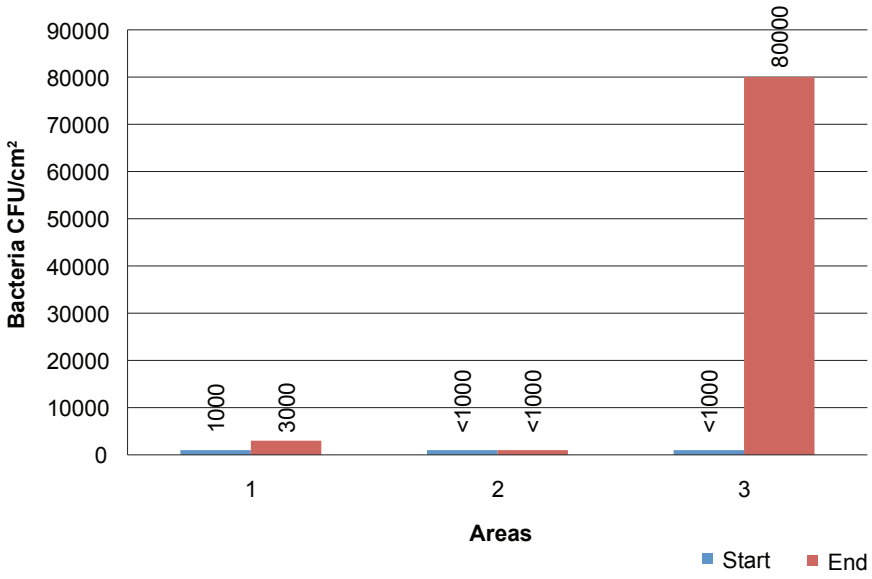
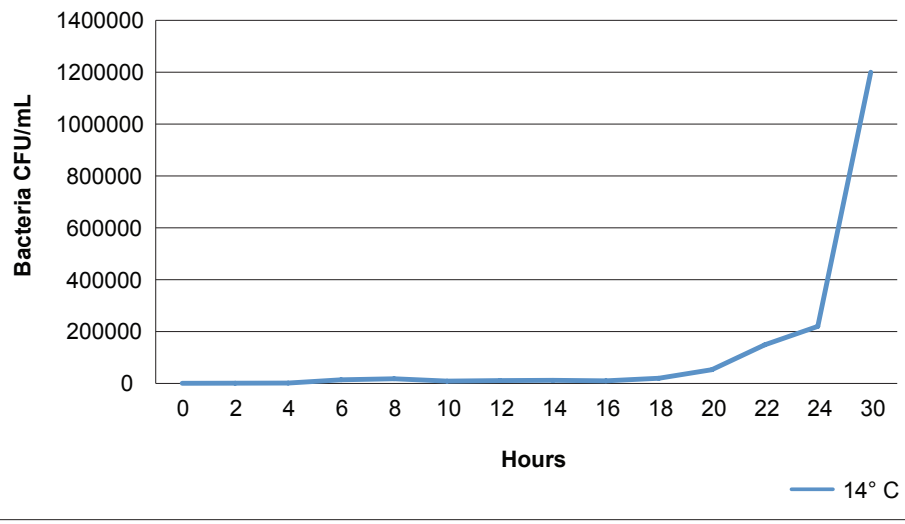


FIGURE **5**

Area 4 Lag to Log Phase, 14°C



No direct comparison of the amplification levels with the subsurface dust (CFU/g) and the carpet and pad (CFU/cm^2) could be made due to the differences in sample type and resulting calculations provided by weight or by surface area, respectively. Additionally, our study was not designed to compare the drying systems used in the different test areas since variability between specific carpet pieces used in each area, subfloor materials, and drying equipment did not allow for direct comparison.

Results of our study have demonstrated that in-place drying according to IICRC S500 recommendations with a four-hour response time was successful in drying the carpet and pad in-place. Even with a prompt response

FIGURE **6**

Area 4 Lag to Log Phase, 20°C

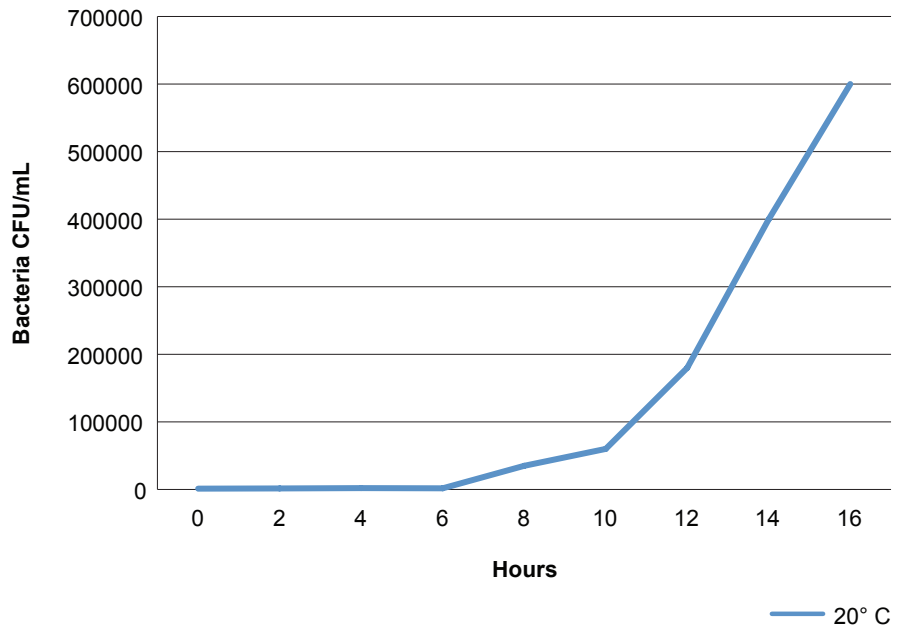
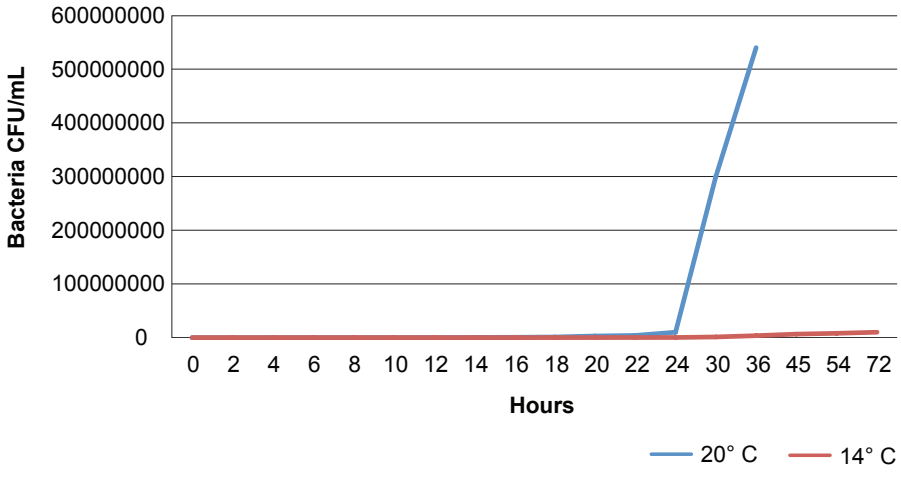


FIGURE **7**

Area 4 Lag to Log Phase, 14°C and 20°C



amplification of bacteria occurred. Area 4 provided a demonstration of what could happen with slower responses to a water intrusion.

The bacterial amplification from the inoculated floor and in the wet carpet and pad in area 4 demonstrated the same standard bacterial growth curve observed in laboratory studies for bacterial amplification with an initial lag phase where some amplification of bacteria occurs slowly followed by a log phase where amplification is exponential (Fishov, Zaritsky, & Grover, 1995). Our study was ended before bacterial levels reached a stationary phase or death phase. The carpet and pad used for the two rounds of investigation in area 4 were from areas of light traffic. The zero-time bacterial level at 14ºC was 570 CFU/mL and at 20ºC it was 1,200 CFU/mL. It was observed that the amplification of bacteria in the test area was temperature dependent. At 14ºC, the lag phase lasted approximately 18 hours (Figure 5). At 20ºC, the lag phase was reduced to approximately eight hours (Figure 6). Bacterial amplification at 14ºC increased four orders of magnitude over 72 hours. At 20ºC the amplification had reached four orders of magnitude at 24 hours, and was over five orders of magnitude at 36 hours, when the study ended (Figure 7). The results support the hypothesis that the longer carpet material remains wet, the greater the bacterial amplification. Furthermore, at temperatures up to 20ºC, the log phase of growth can begin as early as eight hours postflooding.

Additional research is needed to replicate and expand the results of our study under various conditions. Some of the variables that need further investigation would include quantities of dirt that accumulate under carpet over time; the types and quantities of bacteria present in dirt under carpet; factors that affect amplification of bacteria in carpet such as drying response time, temperature, soiling, previous water damage, and subfloor substrate materials; various drying techniques; and the influence of antimicrobials.

Conclusion

Our study has demonstrated that more information is needed to determine those situations where in-place drying may be an appropriate restoration response. Even with a prompt four-hour response appreciable amplification of bacteria occurred. Laboratory results demonstrated that occupant traffic patterns are an important consideration when studying bacterial levels in carpet. Careful consideration in selecting areas of carpet and pad would be required to make direct comparisons of the effectiveness of drying carpet using different methods and conditions. Establishing an appropriate response time is dependent upon soiling and carpet surface temperature.

The two rounds of testing to compare differences in amplification based on temperature were performed on similar carpet from the same residence. Our data indicate that a restoration response needs to be made within a shorter

period of time than 72 hours (IICRC, 2006). As an indoor environment becomes warmer, an increase in the carpet surface temperature occurs that leads to more rapid bacterial growth. Thus the response to the flooding of the carpet might need to be less than 24 hours.

Additional research is recommended to develop a matrix that addresses initial response time, material temperatures, material conditions, drying methodology, and other important considerations for in-place carpet drying and the return of the indoor environment to a clean and sanitary state. In this regard, we put forth our methodology as a potential standardized approach to the continued investigation of bacterial amplification in floor covering materials.

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2005 Hurricane Surveillance: Measures to Reduce Carbon Monoxide Poisoning in All Floridians

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Abstract **The 2005 Florida hurricanes caused widespread power outages, increasing generator use that directly resulted in a surge in carbon monoxide (CO) poisonings. Of the 126 CO poisonings documented, 77% were related to generator use and 43% of these generators were placed outside but near a window. African-Americans and Latinos had a higher incidence of CO poisoning. The strength of the authors' study described here was the inclusion of the first responder network in one surveillance system for hurricane response. Notable advances have occurred since the authors' study, including CO poisoning listed as a reportable condition, regulation requiring CO detectors, CO generator warning labeling, and the development of a local surveillance and classification program for the county health departments. To prepare for future multiple hurricane seasons, comprehensive outreach should be focused at the local level through the first responder network and community groups to reduce CO poisonings in all populations.**

Introduction

Several reasons warrant revisiting carbon monoxide (CO) poisoning surveillance during the Florida 2005 hurricane season. Emergency responders provided on-scene detailed and reliable incident reports and field observations (e.g., generator placement, hospital transport) that included information not collected by medical facilities or accurately through questionnaires. Monitoring the emergency response stakeholders' interagency data sharing systems (e.g., State Warning Point [SWP], Florida Poison Control Information Network [FPCIN], and emergency management) provided the most complete and accurate information. This information was compared with additional multiple sources (National Response Center [NRC], coroner reports, medical records, emergency response incident reports, fire departments, hazmat) to collate the most accurate information and precise number of CO poisonings. In addition, it is important to expound on why African-Americans and Latinos had a higher-than-expected incidence of CO poisoning.

To summarize the 2005 hurricane season the following descriptions were provided by the Federal Emergency Management Agency (FEMA) for Hurricanes Dennis, Katrina, and Wilma in Florida (FEMA, 2006).

- On Sunday, July 10, Hurricane Dennis made landfall as a category three storm near Navarre Beach, Florida. Dennis left 680,000 people without power.
- On Thursday, August 25, Hurricane Katrina came ashore south of Fort Lauderdale, causing power outages to over 740,000 homes, and four days later came ashore in the Florida Panhandle, resulting in more than 100,000 homes and businesses losing power.
- On Monday, October 24, Hurricane Wilma, a category three hurricane, came ashore at Cape Romano located in Collier County and crossed the state, hitting Miami, West Palm Beach, and Fort Lauderdale. It resulted in widespread power outages affecting 3.5 million customers in 42 counties.

Background

CO is a colorless, odorless, and nonirritating gas produced during incomplete combustion. CO is an asphyxiant and disrupts oxygen transport and delivery by interfering with oxygen binding to hemoglobin (Leikauf & Prows, 2001). CO poisoning is often associated with accidental exposure to exhaust from generators used during power outages related to natural disasters (Hampton & Zmaeff, 2005).

Low-level CO exposure to environmental levels (100 parts per million [ppm]) may cause nonspecific symptoms such as headache, nausea, and lightheadedness. Higher CO exposure levels (150–200 ppm) may result in central nervous system symptoms including disabled coordination, syncope, coma, convulsions, pulmonary edema, and death (Centers for Disease Control and Prevention [CDC], 2006a). The Consumer Product Safety Commission (CPSC) has collected death certificates for all CO fatalities since 1999 and found that fatalities have carboxyhemoglobin (COHb) levels from 40% to 60%, indicating that CO exposure levels

in the air likely exceeded 1,000 ppm (CPSC, 2008). COHb levels do not correlate with the severity of the signs and symptoms (Benignus, Muller, & Malott, 1990). The blood sample often is not collected at the scene but collected in the emergency room after treatment with oxygen and after an extended period of time due to transport. The Council of State and Territorial Epidemiologists has recommended the use of a pulse oximetry to establish a standard COHb measurement that can be determined in a more timely manner.

Factors that influence COHb formation and elimination include CO concentration in air, duration of exposure, and physical activity (CPSC, 2008). Fatalities may also occur at lower COHb levels in at-risk groups such as fetuses, infants, and the elderly; and in at-risk people with conditions such as chronic heart disease, anemia, or respiratory illness (CDC, 2008; CPSC, 2008).

Low-level CO concentrations in the air may exceed the U.S. Environmental Protection Agency (U.S. EPA) National Ambient Air Quality Standard for CO in outdoor air of 35 ppm for one hour and 9 ppm for an eight-hour period (U.S. EPA, 2009). In addition, generators near an open window may contribute to indoor air levels of CO that may exceed the National Institute of Safety and Health exposure limit of 35 ppm for a 15-minute period and the Occupational Safety and Health Administration (OSHA)–recommended permissible exposure level of 50 ppm over an eight-hour period (CDC, 2005a). CO levels of 23.7 ppm may result in lower maximum aerobic power in people with a previous history of CO poisoning (Horvath, Raven, Dahm, & Gray, 1975).

Observance of increased risk of CO poisoning among minority populations following a weather disaster is not uncommon. In Washington State, a study showed that CO poisoning occurred in the Hispanic populations at four times the risk of the Caucasian population, and the African-American population had a risk of CO poisoning three times greater than the Caucasian population (Ralston & Hampton, 2000).

Many positive changes have occurred related to the CO surveillance conducted in our study as well as in previous studies in the Gulf Coast. Much still needs to be investigated, however, including identifying why minorities experienced a higher rate of exposure than expected, the development of a local concerted outreach community network, and improved first-responder investigations of CO incidents with patient monitoring and environmental monitoring.

Methods

Data Sources

The most robust data sets used for CO surveillance were the SWP and the FPCIN. Disposition of patient transport and subsequent request of medical records, emergency response incident reports, and contact with the first responder were possible in most cases.

SWP

The SWP receives reports of emergency response of naturally occurring and human-made emergencies (e.g., chemical agents, hazardous materials) generally through the emergency management in the county. The SWP provides notification to incidents in real time and agencies have the opportunity to add to the information. Additional information could then be requested from the emergency response incident reports.

FPCIN

The FPCIN provides real-time case reports online through a password access to programs involved in department of health surveillance. A chemical query code developed through the American Association of Poison Control Centers and the FPCIN in Jacksonville was used to monitor selected chemical exposures, harmful effects, and particular contaminants.

CDC Classification for CO Poisoning

The cases were classified according to CDC's case definition for CO poisoning (CDC, 2005b). Cases were classified as probable or confirmed and suspected cases were excluded from the data analysis. The CO poisonings were tracked until the electricity was operational and generator use subsided.

A *probable* case was clinically compatible with a high index of suspicion (credible threat or patient history regarding location and time) for CO exposure or had an epidemiologic link to a laboratory-confirmed case (CDC, 2005b).

A *confirmed* case was clinically compatible and had laboratory evidence of CO poisoning from biologic samples confirming exposure (CDC, 2005b) or had a predominant amount of clinical and nonspecific laboratory evidence that CO was present.

A *suspected* case was defined as a potential that the exposed person was being evaluated by health care workers or public health officials for poisoning by a particular chemical agent, but no credible threat existed (CDC, 2005b). Once the cases were deemed to be suspect, noncases, or informational, they were excluded from subsequent analysis.

We excluded children from the confirmed category with a COHb level below 3% based on normal levels for COHb which may range from 0% to 3% (Pagana & Pagana, 2006). We also excluded adults from the confirmed category with COHb below 10%. The precedence for this is based on the surveillance completed in Alabama and Texas, which included CO cases for nonsmokers with CO levels greater than 2.5% and smokers greater than 9% (CDC, 2006b; Radford & Drizd, 1982).

The racial/ethnic makeup of Florida counties was calculated using the 2000 U.S. census (U.S. Census Bureau, 2000), table P8: Hispanic and Latino by Race. In addition, race/ethnicity data were available for 30% of the cases since FPCIN did not routinely collect this information.

Results

A total of 126 nonfatal CO poisoning victims were reported after the 2005 Hurricanes Dennis, Katrina, and Wilma (Table 1). Of these exposures, 52% were confirmed and 48% were probable using the CDC classification criteria. Seventy-seven percent were associated with generator use. Thirty percent of these cases placed their generators in the home, and 43% placed their generator outside the home. The location of the generator was not reported for 27% of the cases.

Nine CO poisoning deaths were reported in Florida from Escambia (n = 2), Broward (n = 3), Collier (n = 1), Miami-Dade (n = 2), and Palm Beach (n = 1) counties. Two of these deaths were associated with Hurricane Dennis, four deaths were associated with Hurricane Wilma, and three deaths were associated with Hurricane Katrina.

Figure 1 shows the location by county of nonfatal CO poisonings of the three hurricanes of 2005. Most cases occurred in the southeastern part of the state in Palm Beach, Miami-Dade, and Broward counties. There were no nonfatal cases reported from Hurricane Dennis.

The sources of CO poisoning cases reported from Hurricane Wilma were FPCIN (n = 46), first responders (n = 14), and medical records (n = 22). The sources of CO poisoning cases reported from Hurricane Katrina (n = 38) were from FPCIN. Coroner reports were the source of the two poisonings from Hurricane Dennis.

Hurricane Wilma

Eighty-six CO nonfatal poisoning cases were reported to the chemical surveillance program from October 24 to November 8, 2005, as a result of effects from Hurricane Wilma (Table 1). Forty-five percent of these were confirmed. Seventy-nine percent of the cases were related to the use of a generator, with 16% of these having used a generator indoors and 47% having used the generator outdoors near the home. The location of the generator was unknown for the remainder of the incidents (37%).

Four confirmed deaths from Broward, Collier, Miami-Dade, and Palm Beach counties were documented after Hurricane Wilma.

Hurricane Katrina

Thirty-eight CO poisoning cases were reported to the chemical surveillance program after Hurricane Katrina (August 25–August 29, 2005) (Table 1). All reported CO cases (n = 38) were reported by FPCIN. Thirty-seven percent of these cases were confirmed and 63% were classified as probable. Seventy-one percent of the cases were related to the use of a generator. Of these, 59% resulted from generator use inside the home and 37% of the cases were related to generators used outside the home. The location of the generator was unknown for the remainder of the incidents (4%).

Eleven cases were attributed to having a grill or gas powered burner inside the home. The symptoms were a little more severe for these cases (five females; six males) and included altered consciousness, lethargy, and confusion with additional nonspecific symptoms associated with CO exposure such as headache, dizziness, and lightheadedness.

Three confirmed deaths were documented from coroner reports. Two of the deaths occurred in Broward County and one occurred in Miami-Dade County.

Hurricane Dennis

Two cases were documented from coroner reports. Both occurred in Escambia County.

TABLE **1**

Total Number of Carbon Monoxide Case Reports Obtained by the FL HSEES[a] Program in 2005 Related to Generator Use and Location of Generator

Hurricane	No. of Victims	CDC Modified Classification No. (%)	No. (%) of Generator-Related Incidents*	No. (%) of Generator Incidents by Known Location**
Wilma	86	39 (45) Confirmed 47 (54) Probable	68 (79)	11 (16) Inside home 32 (47) Outside home 25 (37) Unknown
Katrina	38	14 (37) Confirmed 24 (63) Probable	27 (71)	16 (59) Inside home 10 (37) Outside home 1 (4) Unknown
Dennis	2	2 (100) Probable	2 (100)	2 (100) Inside home
Total	126	65 (52) Confirmed 61 (48) Probable	97 (77)	29 (30) Inside home 42 (43) Outside home 26 (27) Unknown

[a]Florida Hazardous Substances Emergency Events Surveillance.
*Number of generator-related incidents divided by total number of incidents.
**Number by known location of generator divided by number of generator-related incidents.

Occupational

Eleven CO cases occurred at work. Three emergency medical technicians were exposed and overcome with fumes when responding to a CO incident that involved a generator outside a window. Another eight cases occurred in various offices in which generators were running outdoors over an extended period and fumes drifted in open windows. No environmental measurements of CO concentration were measured for any of these cases and in some cases the workers were exposed to the fumes over an eight-hour period.

Demographics

Fifty-three percent of all hurricane-related cases were female. Thirty percent of the victims were between 0 and 19 years, 43% were between 20 and 39 years, and 22% were between 40 and 59 years. The cases ranged in age from 1 month to 84 years old. The coroner's reports were the only source that had a significantly higher median age (55 years) than the overall median age (29 years) for all sources.

Race/Ethnicity

Limited race/ethnicity data were available for 2005. The first responder data, hospital data, and coroner reports included this information. The majority of the cases (Table 2) were among Hispanics (43.9%) followed by African-Americans (36.6%) and Caucasians (14.6%). Table 2 shows the expected and observed number of cases that occurred among each race/ethnicity group comparing expected number of cases by race/ethnicity to the observed number of cases by race/ethnicity. African-American and Hispanic/Latino cases of CO poisonings were overrepresented (χ^2 = 22.45, p = .0001). The 2005 race/ethnicity data were available for 30% of the probable and confirmed cases.

Discussion

During extended power outages associated with hurricanes, residents may decide to use alternative power sources. A strong relationship exists among the number of CO poisonings, number of homes experiencing power outages, length of power outage, and the number of homes utilizing generators.

It is very likely that the fumes reentering the home or business could cause CO poisoning over an extended time with similar or lower levels than allowed in the work environment. The National Institute of Standards and Technology (NIST) study in 2009 reported that studies of CO from generators outside the home should focus on generator exhaust direction, distance of generator placement from the house, size of open windows, and environmental factors (NIST, 2008, 2009). Generator use over an extended amount of time should

FIGURE **1**

The Incidence of Nonfatal Carbon Monoxide Exposure by Hurricanes Wilma and Katrina

Symbols have been placed at random within the geographic extent of their respective counties. One symbol = one case report. Total number of cases on map differs from Table 1 due to incomplete information provided by multiple reporting sources (e.g., missing addresses or zip codes). Deaths are not included on the map. Hurricane Dennis did not have any nonfatal probable or confirmed cases.

Disclaimer: The product is for reference purposes only and is not to be construed as a legal document. Any reference to the information contained within is at the user's own risk. The department of health and its agents assume no responsibility for any use of the map printed October 2006. Map created by Prakash Patel and Alan Becker, Florida Department of Health, in 2006 using ESRI ArcMap version 9.1.

be monitored in the work environment to prevent exceeding the OSHA ceiling of 50 ppm over an eight-hour period. Danger labels are now required on all portable generators manufactured or imported on or after May 14, 2007 (Consumer Product Safety Commission [CPSC], 2007). Better outreach efforts need to be provided describing the dangers of generator fumes drifting into open windows.

A CO detector was available and worked properly in one incident in our study, which alerted the residents and enabled them to evacuate safely. It is estimated that half of all CO poisonings deaths could be prevented with the use of a CO alarm (Yoon, McDonald, & Parrish, 1998). A new requirement for CO detectors, Florida Statute 583.885, requires that a CO detector be installed in new construction in an attached garage and placed within 10 feet of bedrooms (Carbon Monoxide Alarm Required, 2009). CO detectors that meet the UL 2034 or CSA 6.19 safety requirements are recommended (CPSC, 2008).

Although limited data were available on race/ethnicity for this study, the data show an overrepresentation of CO-poisoned African-Americans and Hispanics/Latino compared to Caucasians. Several possible explanations for these findings may exist, including a higher use of generators among these populations, length of time needed to restore power, and the condition of the housing.

It appears that from 2004 to 2005, CO poisonings in the Caucasian population were reduced from 45.5% (CDC, 2005c) to 14.6% (Becker et al., 2006), respectively. This is possibly due to outreach that may have selectively reached the Caucasian population through the more traditional methods of distributing fact sheets and media through the Florida Department of Health and other agencies. More information needs to be collected concerning race/ethnicity, and outreach efforts should be targeted to the African-American and Hispanic/Latino populations at the local level. In addition, African-Americans and Hispanics/Latinos were overrepresented in hospital and coroner data, suggesting that these population groups were both more frequently and more severely poisoned than others.

The predictability of generator use and CO poisoning during severe weather seasons underscores the necessity of public health initiatives and provides the opportunity to obtain safety information from different sources such as product packaging and public service announcements via mass media. Since the quality of the sources from which consumers can obtain information may influence the information received, the manner of information distribution is of upmost importance. We must keep in mind the fact that financially disadvantaged minorities are more likely to reside in areas in which electricity is slow to be restored (e.g., outside city limits). Exacerbating these potential problems is the possibility that these populations are less likely to have access to information regarding the hazards related to portable generator use.

Collection of detailed information on those exposed to CO in order to determine unexplored and underexplored risk factors for CO poisoning is imperative. Employment, income, education, and neighborhood socioeconomic characteristics may be predictors of increased risk of CO poisoning among disadvantaged minority populations. Such information will allow for the exploration of issues expanding beyond the mere presence and legibility of safety (proper use) information on product packaging, but also the comprehension level and the successful/unsuccessful delivery of the safety message. This research is imperative.

Limitations

The findings of our study are subject to several limitations. First, the symptoms of CO poisoning may be nonspecific. Therefore possible underreporting due to underdiagnosis and misdiagnosis must be considered. No active CO poisoning surveillance system existed at the county level, so the suspect cases could not be evaluated or fully investigated due to manpower and time constrains during major and multiple disasters.

Conclusion

The major accomplishments after the completion of our study that will likely reduce future CO exposure following hurricanes in Florida included the addition of CO poisoning as a reportable condition, using the more active classification system developed for county health departments to conduct surveillance at the local level, and requiring CO detectors and warning labels on generators. Additional work needed includes monitoring COHb in a standardized manner to assure accuracy; better prediction of severity of exposure; predictive prognosis; developing networks of reporting that include first responders, local county health department, and local emergency management; and the development of outreach materials and techniques for all race/ethnicity populations. Funding is needed in counties with high population centers most affected by hurricanes (e.g., Miami-Dade, Broward, Palm Beach) to further develop the local surveillance network to improve environmental monitoring, incident causation, and investigation. In addition, an outreach web to the community needs to be developed to effectively communicate CO risks to all populations. It is imperative that county health departments collaborate with local first responders, hazmat, and fire departments to provide outreach to all citizens of Florida to address the race/ethnicity disparity in the surveillance of CO poisonings.

TABLE **2**

Race/Ethnicity Data Collected From First Responder, Hospitals, and Mortality Data Death Certificates on Carbon Monoxide (CO) Poisonings

Race/Ethnicity	2000 Census of Florida Counties No. (%)	Expected No. According to Census	2005 CO Poisonings Observed No. (%)
Caucasian	2,961,564 (50)	21	6 (14.6)
African-American	1,050,037 (17.50)	7	15 (36.6)
Hispanic/Latino	1,803,337 (30.10)	12	18 (43.9)
Other*	125,746 (2.10)	1	2 (4.9)

Note. Data were collected from Broward, Collier, Escambia, Lee, Miami-Dade, and Palm Beach counties. There is a difference between the distribution of the CO cases and the distribution of the population of Florida counties (Broward, Collier, Escambia, Lee, Miami-Dade, and Palm Beach) ($\chi^2 = 22.45$, $p = .0001$). Due to sample size of the study, those participants who were Native American, Asian, and Pacific Islander were combined. For the county population, the "Other" category did not include *some other race* and *two or more races*, as defined by the U.S. Census Bureau.

*Other includes Middle Eastern and Black Haitian.

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Occupational and Environmental Exposures Among Alaska Native and American Indian People Living in Alaska and the Southwest United States

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Abstract **Most occupational and environmental research describes associations between specific occupational and environmental hazards and health outcomes, with little information available on population-level exposure, especially among unique subpopulations. The authors describe the prevalence of self-reported lifetime exposure to nine occupational and environmental hazards among 11,326 American Indian and Alaska Native (AI/AN) adults enrolled in the Education and Research Towards Health (EARTH) Study in the Southwest U.S. and Alaska. The top three hazards experienced by AI/AN people in Alaska were petroleum products, military chemicals, and asbestos. The top three hazards experienced by AI/AN living in the Southwest U.S. were pesticides, petroleum, and welding/silversmithing. The study described here found that male sex, lower educational attainment, AI/AN language use, and living in the Southwest U.S. (vs. Alaska) were all associated with an increased likelihood of hazard exposure. The authors' study provides baseline data to facilitate future exposure-response analyses. Future studies should measure dose and duration as well as environmental hazards that occur in community settings.**

Introduction

Most occupational and environmental health research has focused on associations between a particular hazard and health outcomes, such as asbestos exposure and lung cancer and respiratory diseases, radiation exposure among uranium miners, or insecticide application and risk of leukemia (Alevanja, Ward, & Reynolds, 2007; Archer, 1981; Frost, Harding, Darnton, McElvenny, & Morgan, 2008). Some hazard surveillance or monitoring data have been collected on potential chemical exposure in work settings (Boiano & Hull, 2001; Froines, Wegman, & Eisen, 1989). Research in the Arctic and subarctic regions has examined associations between environmental contaminants, wild food use, and health effects on indigenous people (Egeland, Feyk, & Middagh, 1998; Muckle, Ayotte, Dewailly, Jacobson, & Jacobson, 2001; Mulvad et al., 1996). No studies have looked at population-level exposures in the U.S. to a variety of hazards and very little hazard surveillance data have been collected on a national level (Froines et al., 1989).

For many occupational and environmental hazards, the effects from long-term exposure are not clearly understood. The actual health effects on an individual posed by any particular occupational or nonoccupational hazard depend on the toxicity of the substance, the dose and duration of exposure, an individual's genetic susceptibility to the effects of the hazard, and other behavioral and environmental influences such as use of tobacco. These hazards can cause a variety of health effects such as mutagenic, carcinogenic, neurologic, and endocrine impairment (Rom & Markowitz, 2006).

Many hazards have multiplicative effects. For example, a study of malignant mesothelioma found that Native American silversmiths routinely used asbestos mats to insulate worktables while making silver jewelry (Driscoll, Mulligan, Schultz, & Candelaria, 1988), which exposed them to a hazard (asbestos) that was seemingly unrelated to the occupational activity (silversmithing). Other studies among American Indian, Alaska Native, and First Nations peoples in Canada have explored the effects of heavy metals, mining dust, and lead on the health of native people (Denham et al., 2005; Patel et al., 2008; Wheatley & Paradis, 1995). Surveying a variety of potential hazards provides baseline data for future examination of multiple simultaneous exposure pathways.

No studies to date have surveyed the variety of occupational and environmental hazards to which American Indian and Alaska

Native (AI/AN) people might be exposed. AI/AN people work in many occupations with the potential for exposure to health hazards, from uranium and coal mining and processing and agricultural work among Navajo people (Brugge & Goble, 2002; Dawson & Madsen, 1995; Roscoe, Deddens, Salvan, & Schnorr, 1995) to Alaska Native people who work in the Alaska petroleum or mining industry, but the prevalence of exposure has not previously been quantified. Additionally, AI/AN people are overrepresented among U.S. military veterans ages 18–64 in comparison to the general U.S. population so special relevance exists for exposure to military chemicals for those who are active duty or had prior service in the military (U.S. Census Bureau, 2003).

The Education and Research Towards Health (EARTH) Study is a multicenter study of AI/AN people designed to examine risk and protective factors for chronic diseases. We report here on the prevalence of self-reported exposure to occupational and environmental hazards in a large cohort of AI/AN people living in Alaska and the Southwest U.S. and compare the sociodemographic characteristics of persons who reported hazard exposure to those reporting no exposure. These data can be used to provide a baseline for further focused research on the associations between health and occupational and environmental hazards among AI/AN people.

Methods

Study Population

A detailed description of the study design, survey methods, and measurement instruments for the EARTH Study is given elsewhere (Slattery et al., 2007). Participants from Alaska (95% Alaska Native and 5% American Indian) were recruited from one urban center and 26 small villages in southwest (Yukon-Kuskokwim Delta, primarily Yupik Eskimo), southeast (Panhandle, primarily Haida, Tlingit, and Tsimshian), and south central (Anchorage area, combination of Alaska Native ethnicities) Alaska. Most participating communities were located off the road system and were accessible only by airplane or seasonal access by snowmobile or boat. Navajo participants from the Southwest U.S. were recruited from 48 communities in northern New Mexico and Arizona.

Methods of recruitment included presentations to tribal groups and health care providers, informational tables with brochures and posters staffed by study personnel at community events or high-traffic locations, house-to-house recruiting, referrals, brochures and flyers in public locations, and public service announcements on local radio and in newspapers. In each community, attempts were made to enroll all eligible residents of the community who met the following criteria: self-identified Alaska Native or American Indian eligible for health care through the Indian Health Service, age ≥18 years of age, and able to give informed consent. Those who were pregnant or receiving chemotherapy were asked to participate at a later date due to health changes caused by those conditions. Our report considers data collected from 11,326 participants enrolled in the study from March 2004 through October 2007. Enrollment ranged from 2% to 49% (median = 29%) of those eligible for participation in each community. A greater proportion of persons in smaller communities participated in the study. Of the total study participants, only 0.2% (n = 19) did not do the occupational and environmental health questionnaire at all, and 0.5% (n = 55) were missing answers for at least one of the occupational and environmental hazard questions.

Data Collection

EARTH participants completed self- and interviewer-administered questionnaires on demographics, diet, physical activity, lifestyle and cultural practices, environmental exposures, cancer screening practices, medical and reproductive history, and family history of chronic diseases. In addition, height, weight, waist and hip circumference, blood pressure, fasting glucose, and a lipid panel were measured. Participants completed the occupational and environmental hazards questionnaire by using computer-assisted self-interview on touch-screen panels while listening to an audio version of the questionnaire by headphone in English, Dine' (Navajo), or Yup'ik (Eskimo) (Edwards et al., 2007).

The study protocol was approved by the Alaska Area Institutional Review Board (IRB), the Navajo Nation Human Research Review Board, the Indian Health Services IRB, the University of Utah IRB, the research and ethics committees and governing boards of each of the participating regional health corporations, and the tribal councils of the participating communities. All participants gave written informed consent before participating in the study.

Measurement of Occupational and Environmental Exposures

Tribal leaders and the study advisory board in the study areas determined local environmental hazards of concern. The final aggregated questionnaire included the major occupational and environmental hazards among the AI/AN populations surveyed. Participants were asked about possible exposures to nine hazards of interest. Participants were to answer yes if they had ever worked with or around specific materials at least once a month for six months or more and to include materials they may have been exposed to in and around their house or yard, at work, or during their spare time. Participants were also asked to include any self-employment or work done for family members or in a family business. Exposures queried included mineral or mining dust; pesticides including crop or livestock insecticides, weed killers, or fungicides; heavy metals such as cadmium or mercury; lead; radioactive materials including X-ray radiation; welding or silversmithing; asbestos; and gasoline or petroleum products (not including pumping gas for home use). Participants were also asked if they had ever served in the U.S. military and if yes, whether they had been exposed to biological or other chemical agents either in training or combat used in the military including Agent Orange or depleted uranium.

Statistical Analysis

Summary statistics provide an overview of the demographic characteristics of EARTH Study participants. Responses to exposure questions were analyzed by gender, age, education, language spoken at home, and EARTH Study center. Age group, sex, and study center differences were evaluated using the Chi-square test. All analyses were two-tailed and $p < .05$ was considered statistically significant. Multivariate logistic regression analysis was used to model prevalence of self-reported exposure to occupational and environmental hazards. Data

from participants who answered "don't know" or who did not answer the question were excluded from the analysis. Prevalence odds ratios (*OR*) and corresponding 95% confidence intervals (*CI*) were calculated for the following variables of interest: age (continuous), gender, level of formal education, language spoken at home, and EARTH Study center. The models included all variables of interest. All analyses were conducted with the Statistical Packages for the Social Sciences version 15.0.

Results

Demographic descriptions of the Alaska (n = 3,821) and Southwest U.S. (n = 7,505) study populations are shown in Table 1. Participants in the EARTH Study ranged from age 18 to 94 (median 40.0) at the time of recruitment. More women than men enrolled in the study (61% vs. 39%). Over one-quarter of participants (26%) had not completed high school, with slightly more men than women not completing high school. Distributions of participants in both Alaska and the Southwest U.S. were similar in age and marital status. Compared to the Southwest U.S. study center, the Alaska study center had a slightly higher proportion of men than women enrolled (39% vs. 37%); a smaller proportion of low income participants (annual household income ≤$15,000) (41% vs. 54%); fewer participants who spoke a language other than English at home (33% vs. 71%); and slightly more participants who reported their health status as excellent/very good/good (75% vs. 72%).

Only 19 (0.2%) participants did not answer the exposure questions at all. Some participants were not sure, however, if they had been exposed to specific occupational or environmental hazards queried. The percentage of participants who did not know whether they had been exposed varied by hazard type: asbestos (17%), lead (11%), heavy metals (10%), pesticides (7%), mining dust (6%), petroleum (4%), radioactive material (3%), welding/silversmithing (1%), and military chemicals (0.2%). Almost 64% of participants reported no hazard exposure at all, 28% reported exposure to one to two hazards, and 8% reported three or more hazards (data not shown).

Table 2 shows the number and percentage of those who answered "yes" or "no" to the hazard questions. The top three most commonly reported hazards were petroleum products (15%), pesticides (11%), and welding/silversmithing (9%). These were followed by asbestos (9%), military chemicals (8%), and mining dust (7%). The least commonly reported hazards were heavy metals, lead, and radioactive material, each reported by about 5% of study participants. The prevalence of reported hazard exposure varied by sex, age, and study center: reported hazard exposure was higher among men than women, higher among participants in the middle age bracket (40–59), and higher among those living in the Southwest U.S. compared to Alaska.

These associations were explored further in multivariate logistic regression models of occupational and environmental hazards as shown in Table 3. Younger participants were more likely to report exposure to most of the occupational and nonoccupational hazards that were queried, with the exception of heavy metals and petroleum. The odds of exposure to the various hazards among men were two to eight times the odds among women. Non-high school graduates reported more exposure to mining dust, radioactive material, welding/silversmithing, and petroleum (adjusted *OR* = 0.80, 0.65, 0.82, and 0.80, respectively). The odds of reported exposure for those who spoke an Alaska Native

TABLE **1**

Demographic Characteristics of Alaska Native and Southwest U.S. American Indian People Participating in the Education and Research Toward Health (EARTH) Study

Demographic	Alaska *n* (%)	Southwest U.S. *n* (%)	Total *n* (%)
Total	3821 (33.7)	7505 (66.3)	11,326 (100)
Age group			
18–39	1873 (49.0)	3760 (50.1)	5633 (49.7)
40–59	1517 (39.7)	3006 (40.1)	4523 (39.9)
60+	431 (11.3)	739 (9.8)	1170 (10.3)
Sex			
Male	1501 (39.3)	2765 (36.8)	4266 (37.7)
Female	2320 (60.7)	4740 (63.2)	7060 (62.3)
Education			
Less than high school	851 (22.5)	2022 (27.0)	2873 (25.5)
High school or higher	2932 (77.5)	5455 (73.0)	8387 (74.5)
Employment status			
Employed or self-employed	1595 (41.7)	3228 (43.0)	4823 (42.6)
Not currently employed	2226 (58.3)	4277 (57.0)	6503 (57.4)
Marital status			
Married/living as married	1630 (42.8)	3272 (43.6)	4902 (43.4)
Separated/divorced/never married	2176 (57.2)	4225 (56.4)	6401 (56.6)
Annual household income			
≤$15,000	1342 (41.1)	3428 (53.7)	4770 (49.4)
$15,001–$25,000	526 (16.1)	1058 (16.6)	1584 (16.4)
$25,001–$35,000	446 (13.7)	771 (12.1)	1217 (12.6)
$35,001–$50,000	444 (13.6)	624 (9.8)	1068 (11.1)
≥$50,001	504 (15.5)	504 (7.9)	1008 (10.5)
Language spoken at home			
Native only	302 (7.9)	896 (12.0)	1198 (10.6)
English only	2541 (66.8)	2176 (29.2)	4717 (41.9)
Both native and English	960 (25.2)	4375 (58.7)	5335 (47.4)
Self-reported health status			
Excellent/very good/good	2863 (75.0)	5337 (72.1)	8200 (73.1)
Fair/poor	954 (25.0)	2061 (27.9)	3015 (26.9)

TABLE **2**

Number and Percentage of American Indian and Alaska Native Participants Reporting Occupational and Environmental Exposures by Sex, Age, and Alaska and Southwest U.S. Study Center of the Education and Research Towards Health (EARTH) Study*

Exposure	Total *n* (%)	Sex		Age			Study Center	
		Men *n* (%)	Women *n* (%)	18–39 *n* (%)	40–59 *n* (%)	60+ *n* (%)	Alaska *n* (%)	Southwest U.S. *n* (%)
Petroleum	1673 (15.4)	1256 (31.0)	417 (6.1)	857 (15.8)	717 (16.6)	99 (8.8)	658 (17.9)	1015 (14.1)
Pesticides	1131 (10.8)	599 (15.3)	532 (8.1)	510 (9.6)	507 (12.2)	114 (10.7)	116 (3.2)	1015 (14.7)
Welding/ silversmithing	1055 (9.4)	821 (19.7)	234 (3.3)	529 (9.5)	427 (9.6)	99 (8.6)	158 (4.2)	897 (12.1)
Asbestos	794 (8.5)	501 (14.4)	293 (5.0)	305 (6.6)	408 (10.9)	81 (8.2)	190 (6.0)	604 (9.7)
Military chemicals†	881 (7.8)	754 (17.7)	127 (1.8)	253 (4.5)	453 (10.0)	175 (15.0)	447 (11.7)	434 (5.8)
Mining dust	686 (6.5)	457 (11.6)	229 (3.4)	285 (5.4)	335 (8.0)	66 (6.1)	91 (2.5)	595 (8.5)
Heavy metals	518 (5.1)	397 (10.7)	121 (1.9)	280 (5.5)	203 (5.1)	35 (3.3)	106 (3.1)	412 (6.1)
Lead	500 (5.0)	363 (9.8)	137 (2.2)	231 (4.6)	228 (5.8)	41 (4.0)	123 (3.7)	377 (5.7)
Radioactive material	495 (4.5)	247 (6.1)	248 (3.6)	221 (4.0)	222 (5.1)	52 (4.6)	154 (4.2)	341 (4.7)

Note. $p < .05$ for all differences except welding by age, military chemicals by sex and age, and radioactive material by study center.
*Of participants who answered the question.
†Of those participants who reported military service.

or American Indian language at home were 1.21 to 1.59 times higher than the odds among those who spoke only English in the home. By study center, *OR*s were significantly higher for the Southwest U.S. study center than Alaska (range: adjusted *OR* = 1.61 for lead to *OR* = 5.12 for pesticides) except for exposure to petroleum, where the odds were lower among Southwest U.S. participants (adjusted *OR* = 0.72). A significant difference did not exist in the odds of radioactive material exposure between the two study centers.

Discussion

These data summarize self-reported occupational and environmental hazards and associated sociodemographic factors for American Indian and Alaska Native study participants. To our knowledge, no data were available on population-level prevalence exposures for a large number of American Indian and Alaska Native people prior to our study. Exposure to various occupational and environmental hazards was reported by 5% to 15% of study participants. The actual exposure prevalence could be higher, since some participants did not know if they had been exposed to certain hazards, in particular asbestos, lead, and heavy metals. The types of hazards reported represent a range of industries and industrial by-products and are associated with diverse health effects. The highest reported hazard among the Alaska participants was petroleum products (18%), while the highest reported type of hazard in the Southwest U.S. was pesticides (15%), both of which can have mutagenic and carcinogenic effects on human health (Bhalli et al., 2008; Lohi, Kyyronen, Kauppinen, Kujala, & Pukkala, 2008; Orsi et al., 2009; Paz-y-Mino, Lopez-Cortes, Arevalo, & Sanchez, 2008; Perrotta, Staines, & Cocco, 2008). Our study found that male sex, lower educational attainment, and speaking an Alaska Native or American Indian language in the home were associated with higher likelihood of hazard exposure. Compared to Alaska participants, those living in the Southwest U.S. were more likely to report exposure to all but one of the occupational and environmental hazards studied.

Unfortunately, no other national-level surveys exist to compare with these data. In 1981–1983 the Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (CDC/NIOSH) completed a National Occupational Exposure Survey (NOES). NOES resulted in a list of substances and an estimated number of workers exposed but did not examine the percentage of the population exposed or potential simultaneous exposures, nor did it estimate potential differential exposure by race/ethnicity. The National Health Interview Survey (NHIS) in 1988 included an occupational health supplement that included exposure to pesticides (6.1% of those surveyed, compared with 10.8% among EARTH Study participants) but did not query other exposures included in the EARTH Study. No occupational health supplement has been conducted as part of the NHIS since 1988 (U.S. Department of Health and Human Services & National Center for Health Statistics, 1988). The NIOSH Surveillance Strategic Plan includes a proposal for a new nationally representative hazard survey that might provide more of this type of data in the future, and CDC's National Center for Environmental Health has called for increased surveillance and tracking systems in order to track exposures and health effects potentially related to environmental hazards (National Institute for Occupational Safety and Health, 2001; U.S. Department of Health and Human Services, 2006).

TABLE **3**

Multivariate Associations With Occupational and Environmental Exposures Among American Indian and Alaska Native (AI/AN) People Participating in the Education and Research Toward Health (EARTH) Study*

Demographic	Petroleum *OR*[a] (95% *CI*[a])	Pesticides *OR* (95% *CI*)	Welding/ Silversmith *OR* (95% *CI*)	Asbestos *OR* (95% *CI*)	Military Chemicals§ *OR* (95% *CI*)	Mining Dust *OR* (95% *CI*)	Heavy Metals *OR* (95% *CI*)	Lead *OR* (95% *CI*)	Radioactive Material *OR* (95% *CI*)
Age, years	1.01 (1.00–1.01)‡	0.99 (0.99–1.00)‡	1.00 (0.99–1.00)	0.98 (0.98–0.99)†	1.00 (0.99–1.01)	0.99 (0.98–0.99)†	1.01 (1.00–1.02)‡	0.99 (0.99–1.00)	0.99 (0.98–1.00)‡
Sex									
Female¶	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Male	6.87 (6.09–7.74)†	2.20 (1.94–2.5)†	7.54 (6.46–8.80)†	3.34 (2.87–3.89)†	1.62 (0.98–2.68)	3.93 (3.32–4.64)†	6.30 (5.11–7.78)†	4.94 (4.04–6.05)†	1.78 (1.48–2.14)†
Education									
Less than high school¶	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
High school or higher	0.80 (0.70–0.92)‡	0.91 (0.79–1.06)	0.82 (0.70–0.96)‡	0.89 (0.75–1.05)	0.60 (0.35–1.03)	0.80 (0.67–0.97)‡	1.08 (0.88–1.33)	0.90 (0.73–1.11)	0.65 (0.51–0.82)†
Language spoken at home									
English only¶	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AI/AN language	1.21 (1.07–1.37)‡	1.2 (1.04–1.40)‡	1.59 (1.35–1.87)†	1.11 (0.93–1.32)	1.14 (0.80–1.63)	1.34 (1.11–1.63)‡	1.32 (1.07–1.63)‡	1.03 (0.83–1.27)	1.00 (0.81–1.23)
EARTH Study center									
Alaska¶	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Southwest U.S.	0.72 (0.63–0.81)†	5.12 (4.16–6.29)†	3.05 (2.53–3.68)†	1.71 (1.42–2.06)†	1.80 (1.28–2.54)†	3.63 (2.85–4.61)†	1.91 (1.51–2.41)†	1.61 (1.29–2.02)†	1.18 (0.95–1.46)

[a]*OR* = odds ratio; *CI* = confidence interval.

**OR*s adjusted for all other variables in the model (i.e., all listed characteristics).

§Of those participants who reported military service.

‡$p < .05$ (two-tailed).

†$p < .001$ (two-tailed).

¶Reference category.

Although ours is the largest study of its kind to date, it has limitations. The EARTH Study queried participants about hazards experienced at work or around the house or yard and during military service. No data were collected on dose, duration, or when in the lifespan exposure occurred. No data were gathered on environmental hazards that occur in residential or community settings, such as persistent organic pollutants (POPs). POPs are of concern to indigenous peoples of Alaska and across the Arctic due to their historic use in military facilities and long distance transport via ocean and air currents that deposit contaminants in the Arctic from distant industrial and agricultural sources. In addition to contaminating the air, land, and water, these chemicals bioaccumulate in the tissues of wild animals and plants that are then used for food by northern indigenous peoples (Arctic Monitoring and Assessment Program, 1997; Chan, Kim, Khoday, Receveur, & Kuhnlein, 1995; Rubin et al., 2001; Wheatley & Paradis, 1995).

No occupational or environmental monitoring was done to validate self-reported hazard exposure. Other studies, however, have found good reliability and validity between self-administered occupational health history questionnaires and other assessments of exposure (Eskenazi & Pearson, 1988; Lewis et al., 2002; Rosenstock, Logerfo, Heyer, & Carter, 1984). It is possible that prevalence of hazard exposure may actually be higher than reported as many participants in our study were unsure of past exposures.

Conclusion

Future research into the association of health and occupational and environmental hazards among American Indian and Alaska Native people is necessary to understand the types of hazards and their associated health risks. The results of our study provide a better understanding of the epidemiology of

occupational and environmental exposures experienced by American Indian and Alaska Native people. It also provides baseline surveillance data to facilitate future exposure-response analyses. Further studies should include data on dose and duration as well as expand analyses to include study of environmental contaminants in wild foods consumed by AI/AN populations.

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DIRECT FROM ATSDR

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The Burden of Environmental Disease in the United States

Editor's Note: **As part of our continuing effort to highlight innovative approaches to improving the health and environment of communities, the *Journal* is pleased to bring back the bimonthly column from the U.S. Agency for Toxic Substances and Disease Registry (ATSDR). The ATSDR, based in Atlanta, Georgia, is a federal public health agency of the U.S. Department of Health and Human Services and shares a common office of the Director with the National Center for Environmental Health at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.**

The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment and their impact on human health and how to protect public health. We believe that the column will provide a valuable resource to our readership by helping to make known the considerable resources and expertise that ATSDR has available to assist communities, states, and others to assure good environmental health practice for all is served.

The conclusions of this article are those of the author(s) and do not necessarily represent the views of ATSDR, CDC, or the U.S. Department of Health and Human Services.

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Introduction

The U.S. spends the most of any nation on health—over $2 trillion every year—yet ranks 37th in overall health among nations of the world (Healthiest Nation Alliance, 2011). Over 17% of the U.S. gross domestic product was spent on health expenditures in 2009 (Centers for Medicare and Medicaid Services, 2009). As our emphasis moves to health protection through health promotion, prevention, and preparedness, it is helpful to identify the economic burden of major disease groups in order to develop and support the best evidence-based health protection strategies. In an effort to establish environmental health prevention strategy targets, we have focused this report on defining the economic burden of environmental disease in the U.S.

The Top Environmental Disease Groups in the United States

In 2006, the World Health Organization (WHO) published a report entitled, "Preventing Disease Through Healthy Environments: Towards an Estimate of the Environmental Burden of Disease." WHO defined the environment as "all the physical, chemical, and biological factors external to the human host, and all related behaviors, but excluding those natural environments that cannot reasonably be modified (Prüss-Üstün & Corvalán, 2006)." WHO produced complimentary profiles for the countries examined in the report. These profiles detailed the major disease categories that made up each country's burden of environmental disease.

WHO used the disability-adjusted life year (DALY) to measure the burden of disease in the U.S. in 2004. A DALY is a weighted

TABLE **1**

Top 12 Diseases Attributable to the Environment in the United States

Rank	Disease/Injury Group	Disability-Adjusted Life Years (DALY) per Year
1	Cardiovascular disease	1,072,800
2	Neuropsychiatric disorders	894,000
3	Cancer (excluding lung cancer)	625,800
4	Other unintentional injuries (excluding road traffic injuries)	596,000
5	Lung cancer	357,600
6	Asthma	298,000
7	Intentional injuries	268,200
8	Chronic obstructive pulmonary disease	238,400
8	Musculoskeletal diseases	238,400
9	Road traffic injuries	208,600
10	Diarrhea	89,400
11	Respiratory infections	59,600

Source: World Health Organization (2007).

measure of death, illness, and disability. DALYs are calculated as the sum of the years of life lost due to premature mortality in the population and the years lost due to disability for cases of the disease. In the U.S., 13% of the total burden of disease is attributable to the environment. This amounts to 5,662,000 DALYs and 398,000 deaths annually (World Health Organization [WHO], 2007). The attributable fraction is the decline in disease or injury that could be achieved in a given population by reducing the risk (Prüss-Üstün & Corvalán, 2006).

Many environmental exposures are preventable; therefore, ranking disease groups by DALY and focusing prevention efforts on those groups that present the largest opportunity for impact is useful. Table 1 shows the 12 diseases with the greatest burden attributable to the environment in the U.S. and their associated DALYs. Our report focuses on those disease groups most applicable to the mission of the National Center for Environmental Health (NCEH)/Agency for Toxic Substances and Disease Registry (ATSDR). The mission of NCEH/ATSDR is to serve the public through responsive public health actions to promote healthy and safe environments and prevent harmful exposures. The following disease groups that are discussed in detail in this report are shown in bold type in Table 1.

Cardiovascular Disease

Cardiovascular disease accounts for the greatest burden of disease that is caused by the environment: 1,072,800 DALYs annually in the U.S. (WHO, 2007). Cardiovascular disease includes high blood pressure, coronary heart disease, congestive heart failure, and stroke. The estimated direct and indirect cost of all cardiovascular disease, attributable to the environment and otherwise, was $393.5 billion in 2005 (American Heart Association, 2005).

Cardiovascular disease is associated with environmental risks such as air pollution (Pope et al., 2002), occupational hazards (Steenland, Burnett, Lalich, Ward, & Hurrell, 2003), and lead exposure (Schwartz, 1995). Fine particulate-matter pollutants are strongly associated with cardiovascular mortality (Evans & Smith, 2002; Samet, Dominici, Curriero, Coursac, & Zeger, 2000).

Neuropsychiatric Disorders

Neuropsychiatric disorders account for the second-greatest burden of disease caused by the environment and are responsible for an estimated 894,000 DALYs annually in the U.S. (WHO, 2007). Neuropsychiatric disorders include Alzheimer's disease and other dementias, Parkinson's disease, multiple sclerosis, schizophrenia, epilepsy, bipolar affective disorders, depression, alcohol and drug abuse, insomnia, migraine, panic disorder, post-traumatic stress disorder, and lead-induced mild mental retardation. Many of these conditions have a small-to-moderate link to the environment or occupation (Prüss-Üstün & Corvalán, 2006). Neuropsychiatric disorders are linked to environmental risks such as stress at work (Tennant, 2001), occupational noise (Passchier-Vermeer & Passchier, 2000), and exposure to toxic chemicals (Huang, de la Fuente-Fernandez, & Stroessl, 2003).

The estimated combined cost of Parkinson's disease, neurodevelopmental effects, and deficits in intelligence quotient (IQ) in the U.S. amounted to between $405.709 and $625.818 billion in 1999 dollars. Weight of evidence suggested that from 10% to 50% of these annual costs, which amounted to between $41 and $313 billion, respectively, were environmentally induced (Muir & Zegarac, 2001). Muir and Zegarac stated that "it is beyond the scope of this review to factually determine what proportion of the grand total cost is attributable to environmental causes," therefore, their estimate had a very large range.

Each year's U.S. birth cohort gained an estimated $110–$300 billion in total lifetime productivity because IQ scores increased as a result of reductions in lead exposure in the U.S. between the mid-1970s and the late-1990s (Grosse, Matte, Schwartz, & Jackson, 2002). One hundred percent of childhood lead poisoning cases are attributable to the environment. The estimated present value of economic losses attributable to lead exposure in the birth cohort of five year olds in 2002 was $43.4 billion annually (Landrigan, Schechter, Lipton, Fahs, & Schwartz, 2002).

Cancer (Excluding Lung Cancer)

The third-largest burden of disease due to the environment comes from cancer, excluding lung cancer. These cancers account for an estimated 625,800 DALYs annually in the U.S. (WHO, 2007).

The National Institutes of Health estimated direct and indirect cost of all cancers, including lung cancer, at $219.2 billion in 2007. $89 billion of this was for direct medical costs, $18.2 billion was for indirect morbidity costs, such as cost of lost productivity due to illness, and $112.0 billion was for indirect mortality costs, such as cost of lost productivity due to premature death (American Cancer Society [ACS], 2008). These figures include cancers

believed to be caused by the environment and cancers believed to be caused by other factors.

Environmental (nonhereditary) factors, such as tobacco use, poor nutrition, inactivity, obesity, certain infectious agents, certain medical treatments, sunlight, naturally occurring carcinogenic agents in food, occupational carcinogens, and carcinogenic pollutants account for an estimated 75%–80% of all cancer cases and deaths in the U.S. About 4% of cancer deaths are thought to be caused by occupational exposures and 2% by environmental pollutants (ACS, 2008). If we take the American Cancer Society's estimate that 75%–80% of cancer cases are due to environmental factors, then the total cost of all cancers caused by the environment would be approximately $164.4–$175.4 billion.

Stomach, skin, liver, bladder, breast, and nasopharyngeal cancers, as well as leukemia, all have environmental links (Woodruff, Axelrad, Caldwell, Morello-Frosch, & Rosenbaum, 1998). Benzene, specifically, causes leukemia (Agency for Toxic Substances and Disease Registry [ATSDR], 2007).

Lung Cancer

Lung cancer, the fifth-largest burden of disease due to the environment, is responsible for an estimated 357,600 DALYs annually in the U.S. (WHO, 2007). It causes the greatest disease burden of any one cancer—13% of the burden of all cancers comes from lung cancer. In developed nations, approximately 30% of the lung cancer burden can be attributed to environmental factors (Prüss-Üstün & Corvalán, 2006).

Cigarette smoking is the greatest risk factor for lung cancer, causing 87% of lung cancer deaths. Smoking resulted in more than $167 billion in annual health-related expenses in the U.S. (ACS, 2008).

Other risk factors for lung cancer include occupational or environmental exposure to environmental tobacco smoke (ETS) (otherwise known as secondhand smoke), radon and asbestos (risk elevated by smoking), certain metals (chromium, nickel, cadmium, and arsenic), some volatile organic compounds, radiation, and air pollution (ACS, 2008).

Asthma

Asthma due to the environment is responsible for an estimated 298,000 DALYs annually in the U.S. (WHO, 2007). Asthma development and exacerbation can be triggered by indoor or outdoor air contaminants such as mold, dust mites, pet and pest allergens, ETS, and air pollution (Prüss-Üstün & Corvalán, 2006).

In 2006, the estimated total cost of asthma to society (incremental direct cost and productivity costs) was $32.6 billion in 2008 dollars (Barnett & Nurmagambetov, 2011). This includes all asthma cases, not just those attributable to the environment.

The direct and indirect costs of asthma due to residential risk factors for children younger than 16 years of age were estimated to be $807 million (in 1997 dollars) annually (Lanphear, Aligne, Auinger, Byrd, & Weitzman, 2001; Lanphear et al., 2001). Approximately 30% of acute exacerbations of childhood asthma are environmentally related, and the environmentally attributable cost of all pediatric asthma was estimated to be $2.0 billion annually in 2002 (Landrigan et al., 2002).

Ground-level ozone is the principle source of outdoor air pollution that triggers and exacerbates asthma (Friedman, Powell, Hutwagner, Graham, & Teague, 2001). Meeting the eight-hour ozone standard could have saved approximately $5.7 billion (averaged over three years, 2000–2002) in reduced health effects such as premature death, hospital admissions, asthma emergency department visits, school absences, and restricted activity days (Hubbell, Hallberg, McCubbin, & Post, 2005).

Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD) that is attributable to the environment accounted for an estimated 238,400 DALYs annually in the U.S. in 2007 (WHO, 2007). COPD actually refers to two lung diseases, chronic bronchitis and emphysema, which are characterized by obstruction of airflow that interferes with normal breathing (American Lung Association [ALA], 2006). It is a slowly progressing disease that is characterized by a gradual loss of lung function.

In 2004, all COPD cases, environmentally induced and otherwise, cost the U.S. approximately $37.2 billion. This figure included direct health care expenditures of $20.9 billion, $7.4 billion in indirect morbidity costs, and $8.9 billion in indirect mortality costs (ALA, 2006). In developed nations, approximately 10%–30% of COPD cases can be attributed to the environment (Prüss-Üstün & Corvalán, 2006). If we assume this attributable fraction is accurate for the U.S., then the cost of COPD cases due to the environment is approximately $3.7–$11.2 billion.

Smoking is the greatest risk factor for COPD. Other environmental risk factors include air pollution, occupational exposure to dust and chemicals, and ETS (Prüss-Üstün & Corvalán, 2006).

Respiratory Infections

Respiratory infections caused by the environment accounted for an estimated 59,600 DALYs annually in the U.S. in 2007 (WHO, 2007). These infections included pneumonia, common cold, and influenza. The cost to employers of patients with respiratory infections, environmentally caused and otherwise, was $112 billion in 1997. This included costs of medical treatment and time lost from work due to disability and medical treatment; however, it did not include time away from work due to sick leave (Birnbaum, Morley, Greenberg, & Colice, 2002).

Indoor and outdoor air pollution, smoking, and ETS are environmental risk factors for respiratory infections. In developed countries, 20% of lower respiratory infections and 12% of upper respiratory infections are attributable to the environment (Prüss-Üstün & Corvalán, 2006). If we assume 15% of respiratory infections are due to the environment, the environmental burden of respiratory infections would be $16.8 billion (in 1997 dollars).

Conclusion

The environmental burden of disease in the U.S. is very costly. It is estimated that 5,662,000 DALYs and 398,000 deaths annually can be attributed to the environment (WHO, 2007). Environmental interventions exist that can decrease the number of DALYs from which Americans suffer. Some of these include improving housing conditions by abating lead-based paint and interior moisture, which can decrease the burden of childhood lead poisoning and asthma (Jacobs, Wilson, Dixon, Smith, & Evens, 2009). The Centers for Disease Control and Prevention (CDC) recommend targeting lead poisoning–prevention efforts to communities and populations at highest risk for elevated blood lead levels (CDC, 2000). Smoking and tobacco-cessation

programs and reducing exposure to ETS can decrease the burden of cardiovascular disease, cancer, asthma, COPD, and respiratory infections (ACS, 2008; Johnson, 2003).

Providing economic incentives, such as tax credits or subsidized transit passes, as well as modifications to the built environment can encourage people to use alternative transportation (bus, train, carpool, walk, bike, or drive low-emissions vehicles). These actions can facilitate more active lifestyles and improve air quality by reducing pollution from vehicles which, in turn, may reduce DALYS due to cardiovascular disease, cancer, asthma, COPD and respiratory infections (Frank & Engelke, 2005; Prüss-Üstün & Corvalán, 2006). Understanding the cost of environmentally caused diseases, then systematically identifying and evaluating the efficacy of interventions, can help us direct limited resources towards public health programs that will have the greatest impact.

Limitations

This review was subject to several limitations. Due to the limited scope of the project, a literature review was conducted, as opposed to original economic analysis. A more in-depth study could be conducted using Medical Expenditure Panel Survey data to estimate the prevalence and dollar cost of each of these conditions. The etiology of many diseases is not completely known; therefore, it is difficult to predict which fraction of the incompletely understood causes are environmental. WHO consulted worldwide experts on each of the diseases and asked them to estimate the proportion of the disease that was attributable to the environment. Many of the studies available in the literature and referenced here provide the entire cost of a particular disease, but do not specify the proportion of the disease due to the environment. Other studies focus on a small geographical area and cannot be accurately extrapolated to the entire U.S. Methods vary substantially among studies, making it difficult to compare study results. Therefore, an original economic analysis examining the entire cost of disease attributable to the environment in the U.S. would be a useful addition to the literature.

Disclaimer: The findings and conclusions in this paper have not been formally disseminated by the Agency for Toxic Substances and Disease Registry and should not be construed to represent any agency determination or policy.

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Students Don't Be Left Out!

Applications for the 2012 NEHA/AAS Scholarship Program are now available. Last year, $4,000 was awarded to students with outstanding achievements in environmental health and with public health majors in their schools. If you would like an application or information about the NEHA/AAS Scholarship, do one of the following before the deadline:

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Did You Know?

For the 2010–2011 academic year, 1,541 undergraduate students and 255 graduate students were enrolled in National Environmental Health Science and Protection Accreditation Council (EHAC) accredited environmental health programs.

Source: Association of Environmental Health Academic Programs, aehap.org

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES BRANCH

Rob Blake, MPH, REHS

Jay Peters

Model Aquatic Health Code (MAHC) and International Swimming Pool and Spa Code (ISPSC)

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 this column, EHSB and guest authors from across CDC will highlight a variety of concerns, opportunities, challenges, and successes that we all share in environmental public health. EHSB's objective is to strengthen the role of state, local, and national environmental health programs and professionals to anticipate, identify, and respond to adverse environmental exposures and the consequences of these exposures for human health. The services being developed through EHSB include access to topical, relevant, and scientific information; consultation; and assistance to environmental health specialists, sanitarians, and environmental health professionals and practitioners.

The conclusions in this article are those of the author(s) and do not necessarily represent the views of the CDC or the International Code Council.

Rob Blake is chief of the EHSB at CDC and has been working in the environmental health field for more than 30 years. Jay Peters is a senior staff member with the International Code Council and leads the association's efforts to promote and support safety initiatives related to the disciplines of plumbing, mechanical, fuel gas, pools, and spas.

Swimming is the third most common form of physical exercise in the U.S. (U.S. Census Bureau, 2010). A lot of swimming occurs in facilities with inadequate public health protection, however. This is often due to local or state codes that are not up-to-date or are not based on the latest science. In 2010, the Centers for Disease Control and Prevention (CDC) reviewed 2008 data from four state and 11 local pool inspection programs. Pool codes in those jurisdictions were not uniform, resulting in inspection data recorded in different ways. The data analysis showed, however, that of approximately 120,000 inspections, more than 12% documented serious health and safety violations that resulted in immediate pool closure (Centers for Disease Control and Prevention [CDC], 2010).

This lack of consistent health regulation in state and local codes results in uncertainty and confusion for pool and spa owners, operators, suppliers, and users. And in some existing laws and regulations, gaps or outdated standards leave many people unnecessarily vulnerable to disease and injury. The need for a menu of regulatory and policy provisions becomes clear: a menu to help state and local governments review their laws and revisit the design, construction, operation, and maintenance of all aquatic venues within their jurisdictions.

Recent years have seen a steady increase in reported disease outbreaks tied to aquatic facilities (Dziuban et al., 2006). Table 1 contains examples of recreational water illnesses attributed to aquatic venues. Waterborne pathogens can cause a variety of ailments, many of which cause diarrhea. In fact, diarrheal disease is so common that some 5% of the public contracts it monthly (Roy, Scallan, & Beach, 2006). Annually, the incidence is up to 3.5 cases of diarrhea per person, with even higher rates for young children (Roy et al., 2006). Behaviors such as swallowing water, inadequate showering before entering the water, and the lack of toilet use and diaper changes all increase the likelihood of disease in aquatic venues.

The disease burden doesn't end there. Each year, from 2001 to 2008, more than 30,000 children aged 0–9 years sustained swimming-related injuries that were treated in emergency departments. Many injuries were fall-related (42.0%), followed

TABLE **1**

Examples of Recreational Water Illnesses and Documented Causes

Illness	Possible Causes
Acute gastroenteritis	*Cryptosporidium* Toxigenic *E. coli* *Giardia* *Shigella* Norovirus Chemicals
Dermal infections	*Pseudomonas* Fungi
Ear infections	*Pseudomonas*
Eye infections and irritation	Adenoviruses Chloramines
Respiratory infections and irritation	*Legionella* *Mycobacterium* Chloramines Chemicals
Neurologic infections	Echovirus
Hepatitis	Hepatitis A virus
Urinary tract infections	*Pseudomonas*

by struck by/against (31.4%), drowning (6.6%), and cut/pierce (4.1%) injuries—and nearly one-half of the injuries resulted in lacerations (46.9%) (Mack, 2009). It is likely that many of these injuries were preventable through better dissemination and enforcement of pool safety guidelines such as prohibitions against running on the pool deck (falls), glass objects near the pool (cut/pierce), and diving near other swimmers (struck by/against).

Sadly, tragic injuries, including fatal and nonfatal drowning, also occur in aquatic venues. The CDC's Wide-ranging OnLine Data for Epidemiologic Research (WONDER) found that each year in the U.S., more than 600 persons drown in swimming pools (CDC, 2012). Most are children 1–4 years of age, but African-Americans 5–19 years of age drown at higher rates (CDC, 2011). In June 2002, the drowning death of a young girl entrapped in a pool suction fitting prompted national legislation aimed at preventing suction-fitting entrapment injuries and deaths. In June 2011, the story of a woman drowning in a Boston public pool made national headlines because her body was not noticed for two days. These examples highlight the need for injury prevention measures and for adequate pool operation and maintenance.

The Model Aquatic Health Code

In response to the growing body of evidence that aquatic venue public health and safety is inadequate, CDC sponsored a workshop in Atlanta, Georgia, in February 2005. Workshop participants recommended the following:

- Data-driven, knowledge-based, risk-reduction efforts to prevent disease and injuries.
- A model code that would give health jurisdictions needed information for creating local and state codes.
- Regular updating of the model code based on new data.
- Open access to information in the model code.

The workshop ideas led to the development of the Model Aquatic Health Code (MAHC) to promote safe design and operation at aquatic venues. A steering committee was created along with technical committees to address the various draft code modules. The committees comprise volunteer subject-matter experts and, inclusively, stakeholders from many walks of life. The MAHC Web site (www.cdc.gov/healthywater/swimming/pools/mahc/) allows for open, timely, and transparent data sharing. And during public comment periods, interested parties are encouraged to participate in the draft code construction and editing process.

MAHC committees were encouraged to construct draft code sections that were 1) easy to read, 2) cross referenced, and 3) supported by the scientific literature. The overall process borrowed heavily from the process the Food and Drug Administration Conference for Food Protection uses for the creation and biennial update of its Model Food Code.

The MAHC is expected to lead to the following:

- Reductions in recreational water-related illnesses.
- Adoption of minimum aquatic venue health standards throughout the U.S.
- Mandatory training and education for pool operators.
- Improved surveillance systems.
- Improved data collection.
- Data-based decision making.
- Systems-based approaches to facility design, maintenance, and operation.
- Construction of a research agenda supporting regular MAHC updates.

As of March 2012, all 14 modules were in various degrees of steering committee review. Nine modules are posted (www.cdc.gov/healthywater/swimming/pools/mahc/structure-content/). CDC requires agency clearance of each module. The target date for initial posting of all the MAHC modules is June 2012. After the first 60-day comment period on each module, the modules will be revised, knit into a single MAHC document, and posted for another 60-day public comment period. After a second revision, the complete first edition will be available. Existing modules are already available for use as a tool for aquatic health law and regulation review.

International Swimming Pool and Spa Code

While the MAHC has been under development, the International Code Council (ICC) and organizations such as the Association of Pool and Spa Professionals (APSP) have provided some level of aquatic venue protection, mostly for injury prevention. ICC is a 50,000+ member nonprofit association of public safety officials such as code and fire officials who are concerned with the built environment. ICC has developed approximately 15 model codes and several American National Standards Institute (ANSI) standards. Many of these code provisions and

standards have been adopted internationally and at the state and local level in the U.S. ICC's model International Building Code (IBC) and International Residential Code (IRC) both contain provisions for swimming pool safety, including provisions for suction entrapment, glazing, plumbing, and fencing.

In 2009, in partnership with APSP, ICC began development of the International Swimming Pool and Spa Code (ISPSC)—a comprehensive pool and spa code to address all facets of pool safety and construction. The new ISPSC includes not only public pools and spas, but also residential pools and spas, exercise spas, and even water parks.

ISPSC development has progressed rapidly. ISPSC uses ICC's consensus code development process to build on existing language from the IBC and IRC and APSP's established ANSI consensus standards. During a series of public meetings in 2009 and 2010, a committee of health and safety experts, pool and spa manufacturers/contractors, product testing laboratories, and pool and spa operators developed the first version. The resulting document was subjected to a full, formal round of code development using ICC's well-established code development process.

Baltimore, Maryland, (November 2010) and Dallas, Texas, (May 2011) hosted public code development hearings. In late October 2011, at the final public hearing in Phoenix, Arizona, the membership discussed and voted on the final version. All public comments have been Web-site posted, and the final comment period is now complete. With the content finalized, the 2012 ISPSC will be published in 2012 and will be available for state and local adoption.

Like all ICC model codes, the ISPSC will be updated every three years. Accordingly, planning is already underway for the 2015 ISPSC. Anyone can submit proposed code changes for that document. Proposed changes are due by January 3, 2013. Hearings on those changes will occur throughout calendar year 2013. In early 2014, the ICC will release the 2015 ISPSC for adoption and use.

MAHC and ISPSC's Interrelationship

CDC and ICC officials are exploring ways the MAHC and ISPSC can complement each other and avoid potential overlaps and conflicts. The key issues in the interrelationship between MAHC and ISPSC are to identify clearly the respective roles of building and health officials and to promote mutual respect and coordination so that the public has access to safe and healthy aquatic venues. In December 2010, CDC and ICC agreed that

- building officials should have principal responsibility for design and construction, but health officials should be involved in the process and
- health officials should have principal responsibility for operation and maintenance, but building officials should be involved with renovations and facility upgrades.

As of the publication date of this article, many jurisdictions had already considered both the ISPSC and MAHC elements for adoption. That these efforts mesh with one another thus becomes imperative—any conflicts or provisions that could lead to confusion or to serious injury need to be eliminated. This collaboration needs to be ongoing. For the second, 2015 ISPSC version, CDC and ICC are looking into coordinated code strategies that address design and construction as well as operation and maintenance issues. The ICC is considering CDC environmental health representative membership on the ICC pool code committee charged with reviewing changes for the 2015 ISPSC.

To improve coordination between the codes, CDC, NEHA, and other national organizations that represent environmental health professionals are likely to become more involved in the ICC processes. CDC will have no veto power, nor should CDC's involvement be construed as ICC code endorsement. By bringing the latest scientific findings into the process, however, CDC involvement will promote public health protection. In fact, this cooperative relationship could be the key to creating, adopting, implementing, and regulating safe aquatic venues.

The move to broaden collaboration between building and health officials may have begun with pools and spas. In addition, health and building officials would undoubtedly benefit from such collaboration in other areas of the built environment. For example, the ICC creates many other model codes such as the International Private Sewage Disposal Code and the International Green Construction Code. These codes contain important, health-related provisions for items such as air quality, drinking water quality, property maintenance, and carbon monoxide detection. In these and other areas, public health will benefit from closer collaboration between the distinct but connected communities of public health experts and building officials. Clearly, the goal of both groups is to improve public health and safety.

With this in mind, CDC and ICC plan to coordinate their respective model pool code efforts. If we work together to support state and local jurisdictions that plan to review or revise their aquatic health laws using the MAHC and the ISPSC, we can help to protect as many people as possible and ensure that people in the U.S. will continue to be safe and healthy while participating in their third-favorite form of physical exercise.

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DEMYSTIFYING THE FUTURE

Thomas Frey

28 Major Trends for 2012 and Beyond: Part 2

Editor's Note: Significant and fast-paced change is occurring across society in general and our profession in particular. With so much confusion in the air, NEHA is looking for a way to help our profession better understand what the future is likely to look like. The clearer our sense for the future is, the more able we are to both understand and take advantage of trends working their way through virtually every aspect of our lives today. To help us see what these trends are and where they appear to be taking us, NEHA has made arrangements to publish the critical thinking of the highly regarded futurist, Thomas Frey.

The opinions expressed in this column are solely that of the author and do not in any way reflect the policies and positions of NEHA and the *Journal of Environmental Health*.

Thomas Frey is Google's top-rated futurist speaker and the executive director of the DaVinci Institute®. At the Institute, he has developed original research studies enabling him to speak on unusual topics, translating trends into unique opportunities. Frey continually pushes the envelope of understanding, creating fascinating images of the world to come. His talks on futurist topics have captivated people ranging from high-level government officials to executives in Fortune 500 companies. He will be the keynote speaker at the NEHA 2012 AEC. He has also authored the book *Communicating with the Future*. Frey is a powerful visionary who is revolutionizing our thinking about the future.

Understanding trends is more of an art form than an exact science. But for those who can read the tea leaves and make bold moves, leveraging trends can give them a serious competitive advantage.

As an example, LinkedIn just posted its annual list of top buzzwords, the ones most commonly used on their members' professional profiles. The top word people in the U.S. use to describe themselves on LinkedIn is "creative." Last year "creative" didn't even make it into the top 10, when "extensive experience" topped the list.

And it's not just the U.S. This was the most used word in Britain, Canada, Netherlands, and Germany. So what business decisions will you make that tie into people's recast dreams of being "creative?"

Obviously, trends don't happen in one-year cycles. They are constantly evolving, and all of the content below is, in one way or another, already happening. In last month's column we began our journey with trends 1–16 of the "28 Major Trends," and this month we will finish it. Here are trends 17–28.

17.) **The Gamification of Business**—Currently a huge buzzword in techie circles, gamification is moving mainstream. Simply defined, gamification involves applying game techniques such as leveling, rewards, and competition to any human experience.

Many limit their thinking about gamification to mobile apps but it has far broader implications. Imbedded game features such as leader boards, achievements, and skill-based learning are becoming common in day-to-day business processes, driving adoption, performance, and engagement.

One recent example is the Nike campaign to gamify the process of personal training. People who visit the site enter details of their running times and the routes they were on and compete for prizes with others around the world.

Another example is the geolocation service Foursquare, which encourages people to use its check-in technology by giving them an incentive when they check in to a certain venue. Many restaurants have picked up on this and offer free cupcakes or desserts to customers who talk about their experience on Foursquare and other social networks.

It's all about adding fun to the daily tedium of living. Look for gamification to start making major inroads into college offerings as well as nontraditional K–12 educational programs.

18.) Going Cashless—Signs of our emerging cashless society have been popping up in small doses since 2005. And while 2012 may not be the year that consumers instantly go cashless, it will be the year that major players like Google and MasterCard roll out their cashless initiatives around the world.

For consumers, the initial attraction will be convenience, but eventually mobile payments will create an entirely new data-driven ecosystem of rewards, purchase history, daily deals, and more. Key to this movement will be near field communication (NFC), a technology that allows for encrypted data to be exchanged between two devices in close proximity ("near field") to each other.

Here are a few of the changes happening in this market over the past few months:

- In October 2011, the Google Wallet, a free, NFC-enabled mobile payment system became operational at select retailers across the U.S. Licensing MasterCard's PayPass technology, shoppers simply tap their mobile device on special terminals at points-of-sale to pay instantly.
- In June 2011, PayPal demonstrated its own mobile payment app for Android devices.
- Twitter founder Jack Dorsey's latest venture, Square, is an electronic payments service that enables users to accept credit card payments by using a portable card-reader device that plugs into iPhone, iPad, or Android devices. Both the Square card-reader and app are free, although there is a 2.75% charge for each payment made. In November 2011, Richard Branson and Visa became investors in Square.
- In June 2011, Swedish-based iZettle was launched to enable consumers to accept anywhere-anytime credit card payments. The iZettle app works with iPhones and iPads. Bills can also be paid or money transferred using this service.

Google CEO Larry Page sees himself as the next great visionary, following in the footsteps of Steve Jobs, Nikola Tesla, and Thomas Edison, as he attempts to rewrite the rules for major industries by pushing initiatives like driverless vehicles, wireless power, and a cashless society. With our hero-based culture, look for Larry Page to emerge as the heart and soul of the movement to turn virtually every electronic device into a payment device.

19.) Ending the Dream of Home Ownership—If you had to choose between starting your own company, traveling around the world, or owning your own home, which would you choose?

Attitudes among Gen X and Gen Y are increasingly shifting towards creating a full life experience rather than settling down and building a nest egg.

Home ownership in the U.S. dropped to 66.9% last year from a high of 70% in 2005, and some are forecasting it will drop as low as 62%, a level not seen since the census began tracking this data in 1963, as the hurdles to owning a home increase.

Naturally, this leads to the question: Is a 62% home-ownership rate so bad? It's still far higher than in most European countries. And, more importantly, why is it assumed we need to own our own homes?

Trillions of dollars have been spent propping up the American Dream of owning our own home. But the dream is shifting, so look for Congress to quit spending money on it. Instead, look for new experimental approaches for redefining the relationship between people and the places they're living in. The stage has been set; it is only a matter of time before a new paradigm unfolds.

20.) Accomplishment-Based Education—Writing a book, receiving a patent, or starting a business are all symbols of achievement in today's world. But being the author of a book that sells 10,000 copies, or inventing a product that 100,000 people buy, or building a business that grosses over $1 million in annual sales are all significant accomplishments that are far more meaningful than their symbolic starting points.

Much of what happens in today's colleges and universities is based on "symbols of achievement," not actual accomplishments.

Students who enter a classroom will typically find themselves immersed in an academic competition, a competition that pits students against each other to produce results that best match the teacher's expectations. Only rarely will the work product of a student in a classroom rise to any notable level of significance. Completing a class is nothing more than a symbol of achievement.

Look for this to change quickly as the tools for creating and managing "accomplishments" remotely become more pervasive.

21.) Driverless Cars and Autonomous Vehicles—The next revolution in transportation will be here soon, and it won't be streetcars, monorails, Segways, or electric vehicles. It will be self-driving cars, and the adoption of this technology will change virtually everything in the field of transportation planning.

The idea of jumping into a vehicle and having it shuttle you to your destination without anyone "driving" may sound like pure fantasy to some, but it's far closer than most of us think.

- Google's self-driving car project has already racked up over 200,000 driverless miles on highways. Google reports these cars have required intervention by a human copilot only about once every thousand miles and the goal is to reduce this rate to once in one million miles.
- In 2010, VisLab ran VIAC (VisLab Intercontinental Autonomous Challenge), a 13,000 km test run of autonomous vehicles. In this competition, four driverless electric vans successfully drove from Italy to China, arriving at the Shanghai Expo on October 28, 2010. This was the first intercontinental trip ever completed by an autonomous vehicle.
- Many car companies including General Motors, Volkswagen, Audi, BMW, and Volvo have begun early testing of driverless car systems.
- General Motors has stated that they will have a driverless model ready for final testing by 2015, going on sale officially in 2018.

Even though car companies are making plans for the transition, planning departments are not. Most local and regional transportation departments are working with models that assume 20 years from now transportation systems will be basically the same, with only slight variations around the edges.

Driverless cars will be far safer. Human-based foibles like speeding, inattention, inexperience, impairment, and fatigue all contribute to road accidents. Driverless cars will remove the human variable from the system. Along with fewer accidents will come the eventual elimination of traffic cops, traffic courts, stoplights, and parking lots.

Look for rapid advancement in this area and for Google to make a play to design an

Android-like operating system for all driverless cars.

22.) The Drone Side of Life—Sometime over the coming months you can expect to see a version of the following help wanted ad:

"Help Wanted: Full-time aerial drone pilots needed to help manage our growing fleet of surveillance, delivery, and communication drones. We are also looking for drone repair techs, drone dispatchers, and drone salesmen."

In 2010 the U.S. military spent $4.5 billion on drones, increasing to $4.8 billion in 2011.

With this kind of focused spending, military drone technology has improved dramatically over the past decade. But as a technology, future drones will go well beyond military uses. The stage is being set for thousands of everyday uses in business and industry all over the world.

With basic drone hardware being matched up with smartphones, and the bottom-up design capabilities of app developers around the world, drones will quickly move from the realm of personal toys to functional necessities that we interact with on a daily basis.

For those of you looking to switch careers, the drone marketplace will create one of the hot new industries of the future.

23.) The Coming Transparency Wars—Can you feel the layers being lifted? Transparency is entering our lives in unusual ways and much like having individual veils lifted from a multiveiled garment, we are now able to see the world around us with far greater clarity.

Recently, several misguided thinkers have proposed the notion that the more transparent our society becomes, the better off we'll be. Using the logic that a self-watching society will be a safer one, they advocate for radical transparency. This is simply not true. And the privacy advocates will not let it happen.

The greatest danger of too much transparency is that we will become consumed by watching each other, and somewhere along the way, we will lose sight of the big picture. Each day will be filled with constant drama as we exhaust ourselves trying to right every wrong, and solve every problem.

We are all terminally human and have very limited ability to improve who we are simply because someone else may be watching. Drawing the correct dividing line between privacy and transparency, however, will not come easy. This will continue to be a volatile battleground for many years to come.

24.) Dismantling the Justice System—In a country that claims to be the land of the free, the number of people under the control of the U.S. corrections system has exploded over the last 25 years to more than 7.3 million, or one in every 31 U.S. adults, according to a report by the Pew Center on the States. The actual number of people behind bars rose to 2.3 million, nearly five times more than the world's average.

A new study by the University of North Carolina now shows a shocking 30% of all young people get arrested at least once by age 23.

People who enter prison cannot lead productive lives. Removing too many from wage-earning positions, turning them into wards of the state, is a recipe for economic disaster.

We are seeing some experimentation and improvements around the edges but so far nothing major. Even with its massive inertia to maintain the status quo, public tolerance has reached its limit for this kind of needless expenditure and constant friction between the government and its citizens.

Look for this to become one of the long-term movements splintering away from the Occupy Wall Street crowd. Ironically, the biggest changes in this area will happen when driverless cars start eliminating the need for street cops.

25.) Going Waitless—In our highly competitive business and social environments, we have a need to be active and engaged at all times. And waiting in line, for virtually anything, becomes irritating.

For this reason, Los Angeles-based QLess, Inc., has devised a text-messaging service to help eliminate the wait.

The department of motor vehicles seems to be the epitome of mind-numbingly long wait times and Johnson County, Kansas, was one of the first to implement QLess to alerts customers when it was their turn.

With this type of service, people don't have to be present as the grueling minutes click away. Many customers now go grocery shopping while waiting in a virtual line or come in closer to their estimated appointment time.

Since implementing the system three years ago, customers no longer camp out on the floor and spend far less time complaining.

Look for waitless systems to spring to life in doctor offices, auto service shops, pharmacies, Disneyland, and virtually every place in society where the wait needs to dissipate.

26.) Power of 10 Interface—The distance between information and our brain is getting shorter.

Twenty years ago if you had access to a large information base, such as the Library of Congress, and someone asked you a series of questions, your task would have been to pour through the racks of books to come up with the answers. The time involved could have easily have been 10 hours per question.

Today, if we are faced with uncovering answers from a digital Library of Congress, using keyboards and computer screens, the time-to-answer process can easily be reduced to as little as 10 minutes.

The next iteration of our information-to-brain interface will give us the power to find answers in as little as 10 seconds. Look for major advancements in "smart contacts" in the coming months to help close the gap towards the 10-second goal.

27.) Emergence of Food Printers—3D printing is a form of object creation technology where the shape of the objects are formed through a process of building up layers of material until all of the details are in place—a relatively slow process often requiring hours to complete.

Three-dimensional printing makes it as cheap to create single items as it is to produce thousands of items and thus undermines traditional economies of scale. It may have as profound an impact on the world as the coming of the factory did during the Henry Ford era.

Marcelo Coelho and Amit Zoran, a couple of ingenious minds at MIT working on the Cornucopias Project, have created a very visual way for us to imagine next generation food that will come from similar 3D printers. Each of their designs proposes an advanced way of mixing ingredients, forming new compounds, and building a layer-by-layer aesthetically pleasing menu item with perfect texture and shape.

Look for continuing progress in the area of 3D food printers, even though the Jetsons-style food synthesizers may still be a few years off.

28.) The Self-Health Movement—No one cares more about your health than you do. So it was only a matter of time until someone invented the self-diagnostic tools, self-monitoring devices, and self-analysis systems to put "self" into the center of the health care equation.

Apple's app store currently offers 9,000 mobile health apps, along with 1,500 cardio fitness apps, over 1,300 diet apps, more than 1,000 stress and relaxation apps, and over 650 women's health apps.

But apps are only part of the equation. Peripheral devices are setting the stage for the true self-revolution:

- All Apple stores now carry the Withings' Blood Pressure Monitor, a peripheral device that plugs into the iPad, iPhone, or iPod Touch and takes the user's blood pressure. Data can be sent directly to a doctor or saved (confidentially) to the cloud.
- Lifelens has created a smartphone app to diagnose malaria. The app can magnify a drop of blood (captured via a simple finger prick) and identify whether malarial parasites are present.
- In October 2011, Ford demonstrated three SYNC apps offering in-car health monitoring for drivers to track chronic conditions such as diabetes, asthma, and hay fever.
- Also in October 2011, AT&T announced it will begin selling clothes embedded with health monitors, able to track the wearer's vital signs—heart rate and body temperature—and upload them to a dedicated Web site.
- The X Prize Foundation is cosponsoring a $10 million prize for the best mobile device allowing consumers to diagnose their own diseases.

Every new peripheral device will create a market for hundreds of new apps, and we haven't even scratched the surface of what will seem like a massive influx of brilliant new peripherals over the coming months. Health care industry execs should be nervous.

Final Thoughts

I will end with a few comments about the new systems that will be needed to tie all of these trends together.

We are currently out of balance between backward-looking problem solving and forward-looking accomplishments. Forward accomplishments help erase past problems. They solve problems in a different way. We need more forward-looking accomplishments, and our greatest undertakings in the future will come in this area.

This need for future accomplishments will also dictate a need for new and better systems to regulate, manage, and leverage the activities surrounding them. These systems will need to be global in nature, and over time, a few will emerge to challenge the power of nations. National systems are already putting the brakes on emerging global systems, but it will only serve as a short-term delay of the inevitable.

The era of global systems is coming very soon.

Interested in sharing your thoughts? Go to www.FuturistSpeaker.com.

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CAREER **OPPORTUNITIES**

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Information and opportunities abound behind the research and development button on NEHA's homepage. Visit neha.org/research to obtain the latest on the following NEHA federally funded programs, many of which include free or low-cost training and educational opportunities:

- Biology and Control of Vectors and Public Health Pests Program
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- Radon/Indoor Air Quality Program
- Workforce Development Program

EH CALENDAR

UPCOMING NEHA CONFERENCES

June 28–30, 2012: San Diego Marriott Marquis & Marina, San Diego, California. For more information, visit www.neha2012aec.org.

July 9–11, 2013: Hyatt Regency Crystal City at Reagan National Airport, Washington, DC.

NEHA AFFILIATE AND REGIONAL LISTINGS

Alabama
June 6, 2012: 2012 Annual Education Conference, sponsored by the Alabama Environmental Health Association, Alabama 4H Youth Development Center, Columbiana, AL. For more information, visit www.aeha-online.com/5522.html.

Colorado
September 26–28, 2012: 2012 Annual Education Conference & Exhibition, sponsored by the Colorado Environmental Health Association, Keystone Lodge & Spa, Keystone, CO. For more information, visit www.cehaweb.com/aec.html.

Connecticut
September 26–28, 2012: 50th Annual Yankee Conference, hosted by the Connecticut Environmental Health Association, Mystic Marriott, Groton, CT. For more information, visit www.cteha.org.

Florida
September 6–8, 2012: Annual Education Meeting and Trade Show, sponsored by the Florida Environmental Health Association, Royal Plaza Resort, Lake Buena Vista, FL. For more information, visit www.feha.org.

Georgia
July 11, 2012: 2012 GEHA Annual Education Conference, sponsored by the Georgia Environmental Health Association. For more information, visit www.geha-online.org.

Illinois
August 29–30, 2012: South Chapter Annual Educational Conference, sponsored by the Illinois Environmental Health Association, Holiday Inn, Mount Vernon, IL. For more information, visit www.iehaonline.org.

Indiana
September 23–26, 2012, IEHA Annual Fall Educational Conference, sponsored by the Indiana Environmental Health Association, Inc., Bloomington Monroe County Convention Center, Bloomington, IN. For more information, visit www.iehaind.org.

Minnesota
May 10–11, 2012: 2012 Annual Spring Conference, sponsored by the Minnesota Environmental Health Association, Ruttger's Bay Lake Conference Center, Deerwood, MN. For more information, visit www.mehaonline.org/events.

Nevada
July 31–August 2, 2012: 2012 NvEHA Annual Educational Conference, sponsored by the Nevada Environmental Health Association, Three Square, Las Vegas, NV. For more information, visit www.nveha.org/conf_reg_2012.html.

North Carolina
July 18–20, 2012: 66th Annual Interstate Environmental Health Seminar, hosted by the North Carolina Environmental Health Association, Fontana Village Resort, NC. For more information, visit www.wvdhhr.org/wvas/IEHS/index.asp.

Utah
September 19–21, 2012: UEHA Fall Conference, sponsored by the Utah Environmental Health Association. For more information, visit www.ueha.org/events.html.

Wyoming
September 18–20, 2012: 2012 WEHA Annual Education Conference, sponsored by the Wyoming Environmental Health Association, Best Western Tower West Lodge, Gillette, WY. For more information, visit www.wehaonline.net/events.asp.

TOPICAL LISTINGS

Children's Environmental Health
May 30–June 1, 2012: 2012 Research Conference—The Contribution of Epigenetics in Pediatric Environmental Health, sponsored by the Children's Environmental Health Network, San Francisco, CA. For more information, visit www.regonline.com/cehn.

INTERNATIONAL LISTINGS

May 21–27, 2012: 12th IFEH World Congress on Environmental Health, sponsored by the International Federation of Environmental Health and the Lithuanian Union of Hygienists and Epidemiologists, Vilnius, Lithuania. For more information, visit www.ifeh2012.org/welcome.

Did You Know?

May is Clean Air Month.
North American Occupational Safety and Health Week is May 6–12, 2012.
Recreational Water Illness and Injury Prevention Week is May 21–27, 2012.

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!

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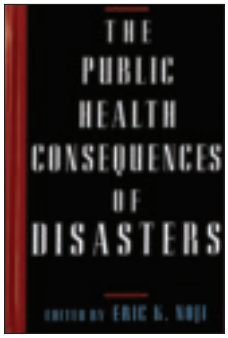
The Public Health Consequences of Disasters

Edited by Eric K. Noji (1997)



Illustrated with examples from research in the field, this book summarizes the most pertinent and useful information about the public health impact of natural and human-made disasters. It is divided into four sections dealing with general concerns, geophysical events, weather-related problems, and human-generated disasters. The author starts with a comprehensive discussion of the concepts and roles of surveillance and epidemiology, highlighting general environmental health concerns, such as sanitation, water, shelter, and sewage. The other chapters cover discrete types of natural and technological hazards, addressing their history, origin, nature, observation, and control.

468 pages / Hardback / Catalog #583
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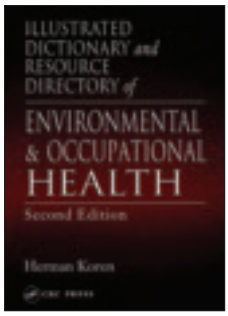
Illustrated Dictionary and Resource Directory of Environmental and Occupational Health (Second Edition)

Herman Koren (2005)



This is a one-of-a-kind, comprehensive reference source for the vast and diverse collection of interrelated terms and topics that encompass the fields of environmental science and preventive medicine. This second edition reflects the expansion and evolution of the field with the addition of more than 8,500 new terms, including new terminology related to equipment and environmental control, new and emerging diseases, hazardous chemicals, and terrorism and emergency response. All definitions are supplemented with cross-referenced synonyms, acronyms, abbreviations, and more than 1,000 illustrations to visually depict the concepts in the book.

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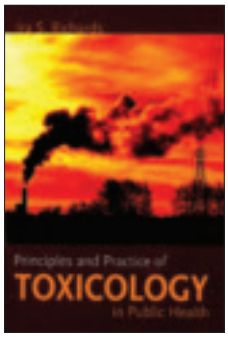
Principles and Practice of Toxicology in Public Health

Ira S. Richards (2008)



In four sections, this book offers an introduction to the field. It covers the basics of toxicology principles, systemic toxicity, and toxicology practice. The book provides thorough coverage of the basic principles of toxicology without being too technical or specialized. *Principles and Practice of Toxicology in Public Health* uses reader-friendly language, making it accessible to professionals from a variety of backgrounds including environmental health, industrial hygiene, engineering, and more.

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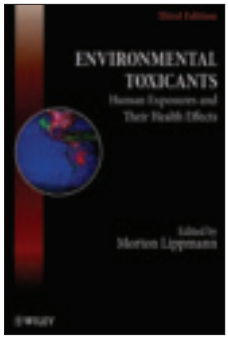
Environmental Toxicants: Human Exposures and Their Health Effects (Third Edition)

Edited by Morton Lippmann (2009)



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FEATURED ARTICLE QUIZ #6

Bacterial Amplification and In-Place Carpet Drying: Implications for Category 1 Water Intrusion Restoration

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Quiz Registration

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➔ Quiz deadline: August 1, 2012

1. The following are drying processes historically used by structural drying services:
   a. removal of carpet pad.
   b. extraction of excess water.
   c. drying of carpet using air movement.
   d. dehumidification.
   e. all the above.

2. __ is beginning to play a more important role as an in-place drying technique.
   a. The application of drying chemicals
   b. Increased heat
   c. Slow velocity air flow
   d. Humidification

3. The benefits of in-place carpet drying are that it is less expensive and results in minimum or no reconstruction costs.
   a. True.
   b. False.

4. In-place carpet drying can be applied to all water intrusion categories.
   a. True.
   b. False.

5. The standard of care says that carpet pad restoration can be considered if begun within a period of __ hours after flooding.
   a. 12
   b. 24
   c. 36
   d. 72

6. In the study, samples of dust were collected from just the top of the carpet.
   a. True.
   b. False.

7. After flooding, study areas 1, 2, and 3 were allowed to sit for __ hours prior to water extraction.
   a. four
   b. eight
   c. 12
   d. 24

8. The only area to undergo two rounds of testing was
   a. area 1.
   b. area 2.
   c. area 3.
   d. area 4.

9. The carpet and pad in the three study areas showed a greater bacterial amplification in the __ than in the __.
   a. carpet, pad
   b. carpet, flooring
   c. pad, carpet

10. It was observed that the amplification of bacteria in the test area was dependent on
    a. humidity.
    b. temperature.
    c. surface area size.
    d. none of the above.

11. At 14°C, the lag phase of growth lasted approximately __ hours.
    a. 18
    b. 24
    c. 32
    d. 48

12. At temperatures up to 20°C, the log phase of growth can begin as early as __ hours postflooding.
    a. two
    b. four
    c. six
    d. eight

JEH Quiz #4 Answers
January/February 2012

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

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NEHA **NEWS**

NEHA Historian Position

Last April, the NEHA board of directors approved a new position, NEHA historian, that is appointed by the NEHA president and reports to the NEHA president and the executive director. The president guides the historian's role on issues related to the board of directors, and the executive director directs the historian in his/her role with respect to record archival, research, and other organizational roles.

The historian provides a historical context for issues, policies, and other board-related discussion topics as needed. In addition, the historian updates and preserves all documentation, award information, artifacts, and other historically related information from NEHA and the board of directors. The board president and NEHA's executive director designate the specific duties and responsibilities of the historian.

The newly appointed NEHA historian is NEHA Past President Dick Pantages, who has a long and distinguished career in environmental health and on the NEHA board of directors. His experience includes 35 years in California's Alameda County Department of Environmental Health. His career began in 1965 as a sanitarian trainee until he retired as its assistant director in 2001. He was a member of the NEHA board of directors for 19 years, including 14 years as vice president for Region 2 and five years as a board officer. He served as NEHA president in 2008–2009.

NEHA and the board of directors are honored to have Dick Pantages as the NEHA historian. Dick's extensive knowledge of the board and NEHA ensures the safekeeping of NEHA historical documents and records in an organized manner.

IN MEMORIAM

CAPT John C. Eason, Jr.

CAPT John C. Eason, Jr. (Ret.), was the first African-American to be commissioned by U.S. Public Health Service (USPHS). He received his commission in 1943 as an assistant sanitarian working for the Baltimore City Health Department. In 1945, CAPT Eason was selected to serve as liaison officer to the U.S. mission to Liberia. He was one of the first officers to be assigned to the Office of International Health (OIH), where assignments took him to numerous countries all around the world. After 30 years of service, CAPT Eason retired in 1974. Throughout his career, CAPT Eason rose above many obstacles and struggled for recognition, credibility, and advancement in an arena that often undervalued and underestimated the abilities of African-Americans. Not only during his USPHS career, but also in retirement, CAPT Eason demonstrated leadership, dedication, and commitment to the mission of the USPHS. NEHA would like to extend its sympathies to CAPT Eason's family and friends. Source: EHOPAC-L Digest, 21 Feb 2012 to 22 Feb 2012 (#2012-10).

Thank You for Supporting the NEHA/AAS Scholarship Fund

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Managing Editor's Desk
continued from page 66

enough experience and data to catalog the answers that we have been getting to this most crucial of all questions—Why do you exist? The complete listing looks as follows:

- Safe Community
- Economic Health and Vitality
- Sustainable, Healthy, Attractive Environment
- Cultural, Learning, and Recreational Opportunity
- Effective Transportation Systems
- Quality of Life Communities and Neighborhoods
- Ecological Stewardship
- Thoughtful Growth Management
- Reliable Urban Infrastructure
- Effective and Authentic Communication with Citizenry
- Nurturing, Connected Communities
- Sound Fiscal Management
- Responsiveness and Customer Service

Once we get local officials (and often citizens as well—through a strong public participation component that we have built into our process) to identify why their governments exist, we don't then allow the discussion to end. Instead, we next insist that they tell us what they mean by public safety or economic health, etc. This is where the process gets even more fascinating.

What we have learned is that "public safety"—the overwhelmingly number one reason for why communities exist—means much more than just police and fire. Among other things, it also encompasses emergency response capability, enforcing environmental regulations, well-planned communities, providing for physical and mental well-being, healthy communities, and structurally sound built environments to cite but a handful of elaborations as to what policy makers mean by public safety.

When we looked more closely at economic health and vitality, we found similar enlightenments. This concept includes well-planned community development, sound land use planning, quality of life, sound and efficient urban infrastructure (think drinking water, recreational facilities, wastewater disposal, etc.), attractive environments, energy efficiency, green industries, ecological stewardship, and natural resource renewal.

Going down this list of "reasons for being," we see numerous other priorities that have environmental health written all over them—sustainability, healthy environments, recreational opportunities, quality of life, quality neighborhoods, ecological stewardship, smart growth, etc.

Let's take a step back and think about what we've learned.

When we listen to and then absorb the language of the very people we're trying to communicate with and influence, we discover that in fact, environmental health is nearly as important to them as it is to us! In fact, environmental health is embedded in the most important considerations holding sway in our communities today.

The challenge is that most policy makers don't realize that they are talking about environmental health and we haven't exactly been helping them to understand that. This has therefore become a priority area for NEHA. We are moving forward with strategies that enable policy makers to more easily see the environmental health threads that are woven into many of their primary interests. (As but one example, we've made arrangements to have published in the ICMA [International City/County Management Association] journal a stirring paper that details why local governments should be using their environmental health staff to help them with their sustainability programs and goals.)

But beyond enlightening local officials, we also need to have more environmental health people adopt (or at least become fluent in) the language used by policy makers. If public safety is the unbridled top concern of policy makers and if within this issue we can find many environmental health considerations, then why wouldn't we approach policy makers to tell them that we can help them meet their *public safety* goals? If we instead stay on that street corner with our bullhorns and demand that policy makers (and even the public) respect and appreciate public and environmental health, does anyone really believe that we would get anyone to even listen?

If we can extend our opportunities to protect the public we serve from threats to their health, simply by tuning into and using the language of the policy makers who oversee our programs (and budgets), then why wouldn't we do this?!

Over my 40+ year career in environmental health, I've never seen the unsettledness that I see today in our economy and in even the way our government works (or should I say, doesn't work!). Things *are* different. But the methods being employed by advocacy groups for change continue to look much like those used in past worlds, which were different from this new and fascinating new world of uncertain budgets, unpredictable energy costs, unsustainable energy consumption patterns, structural unemployment, etc., etc., etc.

The premium today is on innovation, experimentation, speed, and an openness to seeing complex issues from multiple points of view.

NEHA well understands its mission to advance this profession and its capabilities. But what gives that sentence meaning is that we're open to the possibility that there are new and different ways to realize our mission. The bullhorn approach (and the marketing approach that held currency for years within NEHA), just hasn't gotten us anywhere. So we've dared to be different. We've been experimenting and we've been innovating.

Who would have thought that someday an "environmental" organization would be helping major American cities like Cincinnati, Sacramento, and San Jose—to name just a few—develop and finalize their budgets?! Who would have thought that we could attach environmental health as justifiably to public safety as we attach this discipline to public health? But if it works and if these different methods of advocacy end up helping us to carry out our work in this new world with greater policy and financial support, then why not?

As we venture onto some of these new paths, we are also building new friendships, just as we continue to maintain our existing friendships within the public and environmental health community.

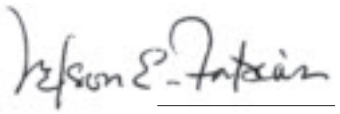
We count among our new friends the likes of ICMA and the Alliance for Innovation—professional societies that represent the leadership of local governments throughout the nation (and our bosses' bosses!). Just recently, in a conversation I was having with the leadership of ICMA, a most interesting comment was made. That professional society believes that this next decade will be "the decade of local government." They

observe that the federal government is broke and dysfunctional. The same can be said for many states.

At the local level of government, however, the housing crash and its taxation consequences have forced local leaders to both change and innovate. From the bottom up, fascinating things are happening. And NEHA is there and in the process, we are telling local leaders how environmental health can help them to build healthier, more sustainable, and more economically viable communities.

No one is proposing that we decouple environmental health from our public health heritage. We are open, however, to the idea that environmental health can also be coupled to public safety—for after all, doesn't our work serve to protect the public from threats to their health? And isn't that public safety?

If this concept makes some uncomfortable, we ask only that you judge us by our results, which we're confident will surpass any that arise from the use of the street corner bullhorn.



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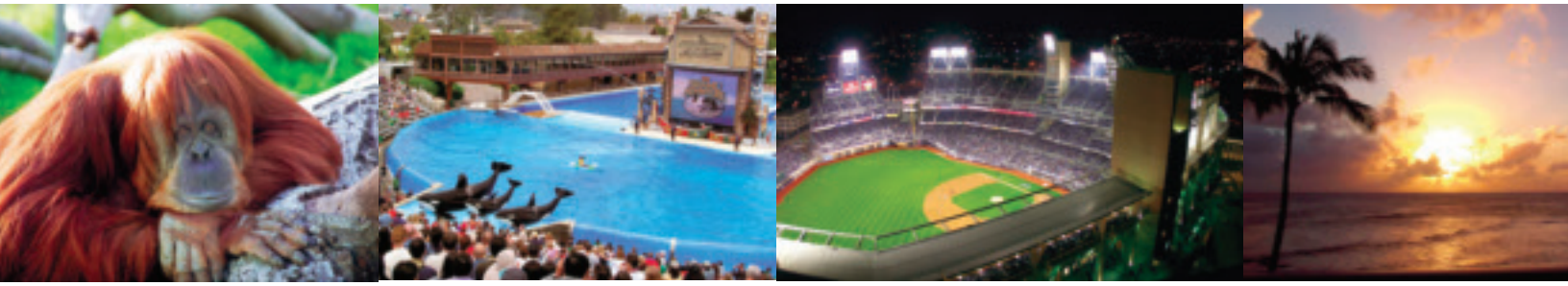

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- Designing an HIA: You Take the Lead
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Food Protection and Defense

- My Restaurant Did What?!
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- ROP HACCP: Hazards, Preventive Measures, and Educational Opportunities

General EH

- Business Networking 101
- Radiological Tales: Lessons Learned for the EH Professional
- Tracking in Action: Using the Tracking Network to Impact Environmental & Public Health Programs

Informatics/Leadership/Management

- Making the Message Stick
- Wake Up to the Social Media Planning Challenge
- Woodstock to WWF: How to Benefit from Generational Differences in the Workplace

Onsite Wastewater

- (Field Trip) Tour of an Ecological Wastewater Treatment and Reuse: Decentralized Model
  Session sponsored by Living Machine Systems

Technology and EH

- Mobile Phone Usage: More, More, More or Less, Less, Less?
- There's an App for That
- (Field Trip) University of California, San Diego: California Institute for Telecommunications and Information Technology—Cal-(IT)2 Tour

Terrorism/All-Hazards Preparedness

- Using Community-Based Participatory Research to Build Capacity for Environmental Emergency Preparedness and Disaster Resilience

The sessions below are a special group of Learning Labs that are scheduled for several hours each day during the AEC. At any one time, there will be multiple sessions taking place. Like other Learning Labs, these sessions will have a presenter and will be highly interactive. However, you are in charge of when you want to attend and the pace at which you wish to learn about a particular topic.

Children's EH

- Sanitation in Classroom and Food Preparation Areas in Child Care Facilities from North and South Carolina

Food Protection and Defense

- Food Establishment Resource Library (FERL) on the Southern Nevada Health District Website
- What's Cooking? Ethnic Foods 101

Healthy Homes and Communities

- The Effects of Indoor Air Pollutants on the Lung Health of Asthmatic Patients

EDUCATION

Knowledge. Understanding. Expertise.

Education

LECTURE SESSIONS

Acquire comprehensive information from environmental health subject matter experts and industry leaders, and learn from your peers as you share stories and best practices to address common challenges.

Children's EH

- Effectiveness of Local Lead Poisoning Prevention Laws
- Food Safety Risk, Response, and Resources: A School Food Service Action Guide
- Lead Guidelines for Children's Play Areas: The Need for Clean Soil Policies to Protect Children
- Methamphetamine Contamination Closes West Virginia School
- Pediatrician's Perceptions on Child Lead Poisoning
- Protecting Children: Tools to Improve Environmental Health in Child Care Settings
- What Got Into the Kids?

EH Health Impact Assessments (HIA)

- Community Engagement and Health Impact Assessments
- Environmental Impact Assessment: An Unrealized Opportunity for Environmental Health
- Using Health Impact Assessments for Comprehensive Plan Updates

Emerging EH Issues

- Medical Marijuana in California: Legal Standing and Dealing with Edible Products
- The Role of Public Health in Promoting a Food System that Is Safe, Secure, and Sustainable: S3
- What Is the Matter with Raw Milk?

Food Protection and Defense

- Addressing Illegal Food Vending and Food Defense with Education and Innovation
- Are You on the Cutting Edge?

- (Food Safety Focus) FSMA: What it Signifies for the Training and Certification of Regulatory Personnel
  Session sponsored by MindLeaders and Prometric
- (Food Safety Focus) What Does it Mean to be Epi-Ready? How the Emergency Response Network Works
  Session sponsored by MindLeaders and Prometric
- Impact of Internet Posting of Restaurant Inspection Scores on Critical Violations
  Session sponsored by Decade Software Company
- New Deli Slicer Standards in Food Safety
- Pets in Retail Food Outlets: A Literature Review
- Scores and More: Can You be Sued for Giving a Restaurant a Good Grade?
- The Fight Against Food Allergens: What Regulators and Industry Need to Know
  Session sponsored by San Jamar
- The Role of Rapid Cycle Improvement in Addressing Recurrent Critical Violations in Restaurants
- What's Hiding in Your Sandwich?
  Session sponsored by San Jamar

General EH

- Effective Strategies to Reduce Motor Vehicle Injuries in Native American Communities
- How an Agricultural Field Toilet Inspection Program Reduced Food Contamination Risk and Improved Farm Worker Health
- Human Mercury and Antibiotic Resistant Bacterial Sampling Along the Indian River Lagoon, FL: Dolphin and Human Health
- Nanomaterials for Environmental Remediation: Nanoinformatics for State Agencies' Safety and Health Regulatory and Oversight
- Outdoor Air Quality Impacts at Hydraulic Fracturing ("Fracking") Sites in Fort Worth
- Rat Hoarder Case
  Session sponsored by Orkin

Hazardous Materials and Toxic Substances

- California's Unified Approach to Hazardous Material Programs
- Interagency Cooperation Helps Solve Mercury Mystery Threatening Children in Twin Falls, Idaho
- Methamphetamine Lab Contamination: A Different Look at the Impact of the Meth Epidemic
- Responding to Mercury Incidents
- San Bruno—Restoring a Community
- What Do You Do When You Have a Bomb Factory in Your Neighborhood?
- What Goes Up Must Come Down: Lessons Learned from Emergency Air Monitoring During the Escondido Bomb House Burn

Healthy Homes and Communities

- Home Is Where the Hazards Are
- Indoor Air Quality in Rural Alaskan Homes
- Preserving Our Past to Protect Our Future
- The Fungus Among Us: Blasto Isolated in the Home Environment
- The Inspector's Guide to Indoor Pool Air Quality
- "Why Don't People Walk?!" A Case Study of Active Travel at a Sustainable University

Informatics/Leadership/Management

- Cross Community Collaborations for Environmental Health
- EPH & Priority Based Budgeting—This Happened to Me!
- Look Inside a Statewide Environmental Reporting System Project
  Session sponsored by Decade Software Company
- State Environmental Health Policy
- Sustainable Policy in Environmental Public Health
- Using Dashboards to Make More Sense of Your Data
- Using Environmental Public Health Tracking Data to Assess State Public Health Laws

International EH

- Contents of Heavy Metals in Arable Soils and Birth Defect Risks in Shanxi, China: A Small-Area Level Geographical Study
- Implication of E-Waste Trafficking on Human Health
- Rapid Evaluation and Improvement of Drinking Water Supplies in Africa
- Understanding Team Organizational and Incident Command Challenges: Practice and Application During Two Different International Outbreak Responses

Onsite Wastewater

- Ecological Wastewater Treatment and Reuse: The Decentralized Model
  Session sponsored by Living Machine Systems
- Recycled Coconuts as an Onsite Wastewater Technology?

The following sessions are being presented by the California Onsite Wastewater Association (COWA):

- Conducting a Small Community Assessment for Wastewater Infrastructure Improvements
- Contracts: Managing Expectations
- OWTS Inspections
- OWTS Management, Operations, Maintenance & Monitoring
- Principles of Plan Checking
- Technology Approval
- Writing a Successful Grant

Additional sessions will also be offered by the State Onsite Regulators Alliance (SORA).

Pathogens and Outbreaks

- Collaboration Between FDA and Local Agencies to Assess the 2011 Multistate Cantaloupe *Listeria monocytogenes* Outbreak
- Legionnaires' Disease Outbreak at a Long-Term Care Facility: Environmental Health Considerations
- Passing Parasites: A Rare Foodborne Giardiasis Outbreak at a Restaurant
- Rapid Response Teams and the FDA CORE Network: Improving Foodborne Outbreak Responses
- Severe Brain Infections and the Environment: The Changing Epidemiology of *Naegleria fowleri* Infections
- Water and Foodborne Enteric Protozoa: Current Considerations for Environmental Health
- Zygomycosis Issue Following the Joplin Tornado

Recreational Waters

- A Potpourri of New Standards You Need to Know about for Pool and Spa Inspections
- Biofilms in Recreational Water: What Makes Them So Hard to Treat?
- Building an Aquatic Health Program of Excellence
- National Swimming Pool Codes—Junction of Health and Building Officials
- Pool Safety: From Construction to Technology
- Ultraviolet for Aquatics & Spray Parks: Air Quality and *Cryptosporidium*

Sustainability/Climate Change

- Climate Change Impacts on the Built Environment and Public Health
- Confronting Climate Change Health Risks in the Pacific Northwest
- Environmental Health, Sustainability, and Land Use Planning—A Perfect Trifecta
- Innovative Solid Waste Permitting, Organics Diversion, and Sustainability in the Napa Valley
- Wildfire Particulate Emissions and Respiratory Health Under Climate Change Scenarios: Project Overview and Results

Terrorism/All-Hazards Preparedness

- A Day of Disaster: The Environmental Health Impact of the April 2011 Tornadoes in Alabama
- Functional Assessment Service Teams (FAST): Emergency Sheltering for People with Access and Functional Needs
- National Preparedness Measures and Their Implications for Environmental Health
- Response to Hurricane Irene
- Riverwatch 2011: An Environmental Public Health Response to a Major Flood Event
- Riverwatch 2011: How a Local Environmental Public Health Agency Implemented Health Codes to Condemn Private Residences
- Understanding Water Issues During Selected Natural Disasters

Vector Control and Zoonotic Diseases

Session track sponsored by Orkin

- Bed Bugs: A Re-Emerging Public Health Challenge
- Environmental Risk Factors for Re-Emerging Epidemic Typhus
- What Is the Buzz about PCRs?
- Where Have All the Vector Programs Gone?

Water Quality

- An Evaluation of Dual Bacteria Indicators for Urban Stormwater Control
- Minnesota's Assessment Source Water Monitoring Study
- Toolbox Approach of Source Tracking Human Sewage in Storm Drains

Pre-Conference Workshops

EHTER Emergency Response Training

▶ Tuesday & Wednesday, June 26 & 27, 8:00am–5:00pm

California Department of Public Health Center for Environmental Health, CDC, and NEHA are pleased to offer the Environmental Health Training in Emergency Response (EHTER) Awareness Level training course for environmental health professionals. This two-day EHTER Awareness Level course provides an overview of the environmental health roles and responsibilities, issues, and challenges faced during emergency response. The purpose of the course is to increase the level of emergency preparedness of environmental health practitioners and other emergency response personnel by providing them with the necessary knowledge, skills, and resources to address the environmental health impacts of emergencies and disasters.

Applicants are encouraged to complete basic NIMS/ICS/SEMS trainings prior to attendance.

This course offers sixteen hours of continuing education credit for California Registered Environmental Health Specialists.

Cost is $99 for members and $199 for non-members.
Limit 55 people.

Epi-Ready Team Training: Foodborne Illness Response Strategies Workshop

▶ Tuesday & Wednesday, June 26 & 27, 8:00am-5:00pm

NEHA is offering this training opportunity for environmental health professionals, epidemiologists, laboratorians, and public health nurses involved in conducting foodborne disease outbreak investigations. This two-day workshop is composed of interactive group exercises, Q&A sessions, and lectures spanning the scope of an investigation.

Workshop cost includes the Communicable Diseases book, IAFP's Procedures to Investigate Foodborne Illness, the course manual, and the Physician's Primer, which is a value of over $70.

Cost is $149 for members and $249 for non-members.
Limit 40 people.

Industry-Foodborne Illness Investigation Training (I-FIIT) Workshop

▶ Wednesday, June 27, 8:00am–5:00pm

I-FIIT is a one-day face-to-face workshop designed to bring together retail food service representatives and local and state regulatory officials in an effort to create stronger working relationships prior to a potential foodborne incident occurring, so that if and when it does, the foundation is already set for a collaborative effort. Additionally, the workshop provides a better understanding and clarification of the investigation process by identifying roles and responsibilities, discussing early detection strategies and establishing and implementing control measures based on model practices. By providing this training, I-FIIT aims to assist industry and regulatory officials in producing a more rapid, efficient and effective, response to foodborne illness incidents.

Applicants should be mid- to upper-level management from retail food service stores and restaurants. Deadline to submit an application is May 4, 2012. Applicants will be notified of their acceptance no later than May 16, 2012. For more information and a registration form, please visit neha2012aec.org.

Cost is $299 per person.
Limit 30 people.

Commercial Cooking Ventilation Requirements

▶ Wednesday, June 27, 8:00am–12:00noon

Mechanical Code and NFPA 96. This workshop will include information on recirculating systems—referred to as "ductless hoods"—and cooking appliances that do not require exhaust hoods. Information will be provided on key installation concerns, proper sizing of hoods, sanitation issues, and the scope and limitations of the listed products used in the commercial kitchen exhaust systems. This workshop will identify resources available to assist in plan checking and inspecting installations.

Cost is $109 for members and $159 for non-members.
Limit 24 people.

NSF Training Course "Plan Review for Food Establishments"

▶ Thursday, June 28, 8:00am–5:00pm

NSF International's Center for Public Health Education is pleased to announce a new training course entitled "Plan Review for Food Establishments." This course was developed by NSF International's leading environmental health professionals and represents the latest plan review information in a dynamic and interactive format. Whether you are a regulator or an industry professional hoping to build knowledge of the plan review process, the course will provide key information that ensures accordance with current U.S. Food and Drug Administration (FDA) guidelines. This one-day workshop will cover the Plan Review application process; regulatory authority compliance; design, installation and construction of a food establishment; compliance with Hazard Analysis Critical Control Points (HACCP) and Good Manufacturing Practices (GMPs); and a plan review outline as it pertains to the current food code. Students should bring a set of plans to work with and students will be provided with a copy of the year 2000 FDA/CFP Plan Review Blue Book.

"Plan Review for Food Establishments" is strongly recommended for sanitarians, consultants, local and state regulatory officials, industry professionals responsible for the preparation, design and approval of food establishment plans.

Cost is $109 for members and $159 for non-members.
Limit 30 people.

Careers. Aspirations. Respect.

Advancement

CREDENTIAL/CERTIFICATION COURSES AND EXAMS

Advance your expertise and career potential by obtaining a NEHA credential or certification at the AEC. You may choose to take just a credential/certification course, just an exam, or both a course and an exam while at the NEHA AEC. (Note: Only qualified applicants will be able to sit for an exam.)

Separate applications are required prior to registering for courses and exams. Additional fees also apply. For applications, deadlines to apply, and information on eligibility, visit neha2012aec.org.

Certified Professional of Food Safety (CP-FS)

Review Course: Tuesday, June 26, 8:00am–5:00pm & Wednesday, June 27, 8:00am–12:00noon

Cost: $299 for members and $399 for non-members, which includes the CP-FS Study Package (CP-FS Study Guide 2010 Edition, NEHA's Certified Professional Food Manager course book, 2005 and 2009 Food Code on CDs), a $145 value. *Limit 36 people.*

Exam: Wednesday, June 27, 1:00–3:00pm

Registered Environmental Health Specialist / Registered Sanitarian (REHS/RS)

Review Course: Tuesday & Wednesday, June 26 & 27, 8:00am–5:00pm and Thursday, June 28, 8:00am–12:00noon

Cost: $459 for members and $559 for non-members, which includes the REHS/RS Study Guide, a $179 value. *Limit 55 people.*

Exam: Friday, June 29, 8:00am–12:00noon

HACCP Manager Certification Course

Previous training with a minimum of Certified Professional Food Manager is highly recommended.

Review Course: Wednesday, June 27, 8:00am–5:00pm

Cost: $249 for members and $299 for non-members, which includes the NEHA textbook, HACCP: Managing Food Safety Hazards. *Limit 36 people.*

Exam: Thursday, June 28, 8:00–10:00am

NAWT Installer Training + NEHA CIOWTS Installer Exam (Basic)

Review Course: Wednesday, June 27, 8:00am–5:00pm. *Limit 40 people.*

Cost: $299 for members and $399 for non-members.

Exam: Thursday, June 28, 8:00am–12:00noon

CONTINUING EDUCATION CREDITS

Earn up to 24 hours of CE contact hours (enough to meet your full two year NEHA professional credential requirement) by attending and participating in the NEHA AEC. CEs can be fulfilled by attending:

- Training and educational sessions
- The Keynote Session
- Pre-Conference Workshops
- Credential Review Courses
- Educational sessions via the Virtual AEC while they are being shown live on the Internet during the AEC or as an archive after the AEC is over

For specific information about obtaining CEs at the AEC, visit neha2012aec.org. CE units have also been related for correlating portions of the AEC from the American Association of Radon Scientists and Technologists (AARST); American Board of Industrial Hygiene (ABIH); and National Center for Healthy Housing (NCHH).

Attention California Registered Environmental Health Specialists: *NEHA is designated by the California Department of Public Health as a continuing education accreditation agency for Registered Environmental Health Specialists.*

Fulfill your continuing education requirement by attending the NEHA 2012 AEC. Attending will count towards completion of your continuing education requirement with up to 24 CEs being awarded for attending the educational sessions and other events. To obtain CEs, a separate application and fee must accompany your AEC registration. For complete details, visit neha2012aec.org/CA_REHS.html.

Friends. Contacts. Connections.

Networking

The NEHA AEC offers several special events to network with your environmental health peers and other experts and professionals from across government and related industries. Visit neha2012aec.org for a listing of all of the special events that will be taking place.

The Annual UL Event will be held Wednesday, June 27, 2012, from 6:30 to 10:00 pm.

The Community Volunteer Event will be held from 1:00 to 4:30 pm on Wednesday, June 27, 2012.

Special Events at NEHA AEC

ANNUAL UL EVENT
Aboard the USS Midway

Come aboard the USS Midway Museum and prepare yourself for a lifetime memory! At the Annual UL Event, you'll explore a floating city at sea and relive nearly 50 years of world history aboard the longest-serving Navy aircraft carrier of the 20th century. During the Annual UL Event you'll enjoy a tour of the historic aircraft carrier, a delicious catered dinner on the hangar deck, and other entertaining features such as private access to the flight deck to tour at your leisure. Don't miss the opportunity to see this fascinating piece of history!

COMMUNITY VOLUNTEER EVENT
Balboa Park

NEHA will be holding a Community Volunteer Event as part of the 2012 AEC. This is the second year that NEHA has organized a Community Volunteer Event as part of our efforts to "green" the AEC, and to give back to the host city in which the AEC is held.

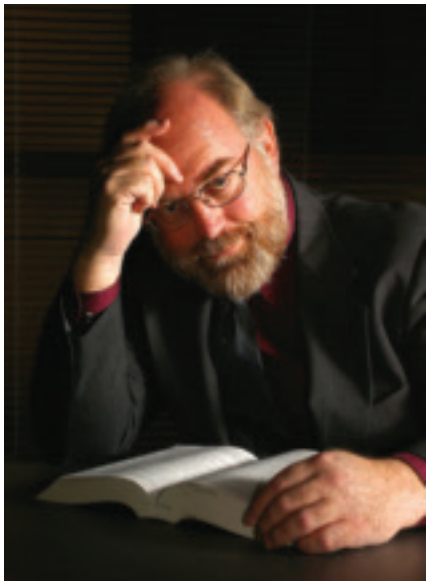
The event will be held at San Diego's Balboa Park. Balboa Park is the nation's largest urban cultural park. It is home to 15 major museums, renowned performing arts venues, beautiful gardens, and the San Diego Zoo. In addition, the Park has an ever-changing calendar of museum exhibitions, plays, musicals, concerts, and classes—all in the beautiful and timeless setting of this must-see San Diego attraction.

Volunteers will be working with Park Ranger Carole to help maintain and improve the park for future visitors. Projects will include planting, trail restoration, painting, and other physical activities. Volunteers will receive a $25 gift card to pay for lunch. A release form will also be required to participate.

Space is limited so make sure to sign up today! For more details and to sign up as a volunteer, visit neha2012aec.org.

Perspective. Leadership. Excellence.

Motivation and Inspiration



The Awards Ceremony & Keynote Address will be held Thursday, June 28, 2012, from 1:00 to 2:50 pm.

"The future is truly a magical place. I have been there and would love to have you join me on my next journey."
– Thomas Frey

KEYNOTE SPEAKER

Be Motivated and Inspired by Senior Futurist, Thomas Frey

The keynote speaker is sponsored by NSF International.

As things continue to change across our communities, there are "new normals" emerging. So what will the future world of work – and a profession like environmental health – look like? Attend the Keynote Address at the NEHA 2012 AEC for answers as Frey's presentation continues the discussion of "new normals" that began at the 2011 AEC, and explores where things are likely to go in the future.

Thomas Frey is Google's top-rated futurist and author of "Communicating with the Future: How Re-engineering Intentions Will Alter the Master Code of Our Future". He is Executive Director and Senior Futurist at the DaVinci Institute, and his keynote talks on futurist topics have captivated people ranging from high-level government officials to executives in Fortune 500 companies including NASA, IBM, AT&T, GE, Hewlett-Packard, Visa, Ford Motor Company, Lucent Technologies, Boeing, Capital One, Bell Canada, Times of India, Leaders in Dubai, and many more.

Frey's presentation will motivate and inspire you with provocative knowledge, humor, and tantalizing information bits that you can immediately put to use to help environmental health be effective in our communities in the future.

SCHEDULE OVERVIEW

Tuesday // June 26	Wednesday // June 27	Thursday // June 28	Friday // June 29	Saturday // June 30
Pre-Conference Workshops	Pre-Conference Workshops	1st Time Attendee Workshop	Breakfast and Town Hall Assembly	Educational Sessions
Credential Review Courses	Credential Review Courses	Educational Sessions	Exhibition Open	Networking Luncheon
	Credential Exams	Awards Ceremony & Keynote Address	Poster Session	President's Banquet
	Golf Tournament	Exhibition Grand Opening & Party	Silent Auction	
	Community Volunteer Event		Educational Sessions	
	Annual UL Event			

neha2012aec.org

Reasons Why

Attending the NEHA AEC Is a Wise Investment for You and Your Organization

Difficult times make it more important than ever that you NOT miss the skills, knowledge, and expertise that can be derived from the NEHA AEC, which can help you and your organization build for a better tomorrow.

1. The NEHA AEC is a unique opportunity for you to gain the skills, knowledge, and expertise needed to help solve your environmental health organization's daily and strategic challenges, and to make recommendations to help improve your bottom-line results.
2. NEHA's AEC is the most comprehensive training and education investment your organization can make all year.
3. Your attendance at the NEHA AEC is a solid investment in your organization that will result in immediate and longer-term benefits.
4. You can earn Continuing Education (CE) credit to maintain your professional credential(s).
5. NEHA provides a return on the investment made for you to attend the AEC.

Need additional reasons why you should attend?

Check out the videos on neha2012aec.org to hear what other environmental health professionals are saying about the NEHA 2012 AEC.

Enjoyment of the Destination

San Diego is a destination you don't want to miss! It is California's second largest city, where blue skies keep watch over 70 miles of pristine beaches and a gentle Mediterranean climate means paradise every day.

San Diego County's 4,200 square miles offer immense options for business and pleasure. San Diego is renowned for a dazzling array of world-class family attractions including the world-famous San Diego Zoo and San Diego Zoo Safari Park, Sea World San Diego, and LEGOLAND California. The city offers an expansive variety of things to see and do, appealing to guests of all ages from around the world!

Stay at the NEHA AEC designated hotel (the San Diego Marriott Marquis & Marina) and enjoy access to all there is to see and do in San Diego. The enchanting waterfront location of the hotel makes it easy to walk to areas like the Gaslamp Quarter—a 16-block historic district filled with restaurants, specialty shops, and more!

Visit neha2012aec.org and click on "About San Diego" to plan how you're going to enjoy the NEHA 2012 AEC destination!

The Virtual Experience

VIRTUAL AEC

Engaging in the Virtual AEC enhances your learning experience whether you attend the AEC in San Diego or participate online from your home or office via the Internet. The Virtual AEC provides you opportunities to participate in education and to network with other environmental health professionals, speakers, and exhibitors. It is also serves as a resource for you beyond the dates of the live AEC — continue networking and conversing with others and use the Virtual AEC to review valuable educational content over and over again!

Register to attend the AEC in-person or virtually and use the Virtual AEC to:

- (For virtual attendees only) View over 20 educational sessions **live** as they happen in San Diego
- (For virtual attendees only) Participate in sessions almost as if you were sitting in the room by submitting your questions via chat
- Network with other environmental health professionals, speakers, and exhibitors
- Access video archives of educational sessions, as well as, speaker presentations and other materials
- Earn continuing education credits

Already registered to attend the NEHA 2012 AEC in San Diego? The Virtual AEC is included in your registration as a free benefit. Once your registration is processed, you will receive an e-mail from admin@zerista.com inviting you to participate in the Virtual AEC. If you do not receive this e-mail, please contact NEHA Customer Service at 866.956.2258.

MANAGING EDITOR'S DESK

Nelson Fabian, MS

Coupling Environmental Health to Public Safety

Warning: This column is not for public health purists.

Warning: This column is not for ideologues who have difficulty exploring ideas that lie outside of their ideological comfort zone.

Two columns ago, I talked about how crucial it is that we (the environmental health profession) become energized about the possibilities that the future holds for us. I contrasted this optimism with the more prevalent and morose pining away for the good old days that I see in too many corners of environmental health today.

In my last column, I offered that we could achieve greater traction with our messaging if we would tune into the language that our target audiences speak and learn how to use their words (and not ours) to advance our cause and case.

Now in this column, I will take these ideas that final step by explaining how we've made them the centerpiece of our strategy to advance environmental health, which is the mission that drives this organization. I begin by recapping the story of our new Center for Priority Based Budgeting (CPBB).

Our new Center program was devised to help NEHA (and through NEHA, our profession) better connect with the policy makers who control our budgets and determine our roles. Through this program, we have found our way to the very table that mayors, county administrators, county executives, city managers, chief financial officers, and the like all sit at. In fact, in many cities and counties throughout America, we are now sitting down right next to them.

The premium today is on innovation, experimentation, speed, and an openness to seeing complex issues from multiple points of view.

More to the point, we are now guiding many of these local leaders in the development of what is arguably the single most important and powerful policy document that local governments produce—that being their budgets.

The process that we use (a values-based method of priority based budgeting) forces a government to think through why they even exist. We boldly ask, "Why do you exist and what exactly does this community expect from its government?"

Hold that thought for a second while I talk about why learning a new language is more important than yelling through a bullhorn when it comes to having an impact on public policy.

As I argued in my previous column, if all we do to safeguard our work and our future is stand on a street corner and yell about the importance of environmental health (which is metaphorically what so many professions are doing today), it's hard to imagine any other outcome than a sore throat! The 19% cut in the local public health workforce over the last three years stands as some pretty compelling evidence for how effective that tactic has been.

We need a different way. Using bullhorns to preach our case (or simply wishing for a magical journey back to the good old days) isn't going to enable us to achieve the standing that so many of us seek.

In my last column, I strenuously pressed the point that Stephen R. Covey made so elegantly in his book, *The 7 Habits of Highly Effective People*: "Seek first to understand and only then to be understood." I also pressed the point that we need to understand the language that policy makers speak and then talk to them in their language, not ours, if we have any hope of them hearing us.

OK—back to my main thread—by getting a seat at the policy maker's table, we have been able to learn why these governments (that so many NEHA members work for) exist and what the language of local policy makers sounds like.

When asked why do you exist, two issues utterly dominate the conversation. Local policy makers tell us in the most unequivocal of terms that their governments exist to

1. Provide a safe community and
2. Foster economic health and vitality.

In fact, in just a little over a year of our successful Center program, we've now amassed

continued on page 54

Do you know...

IF ...you are collecting all your inspection and permit fees?

...you are getting the most out of your human resources?

...you are under or over staffed?

...inspections can be automatically scheduled based on risk, location or inspector?

...you can answer media enquires in a timely manner?

...you can publish inspection results to the web?

...too much time is consumed manually sending out correspondence, notifications, permits and invoices?

...you can monitor effectively inspection frequency, targets and schedules?

...your high risk facilities are inspected regularly?

...critical violations are being followed up in a timely manner?

...inspections are overdue?

...you can easily report fee revenue to a central accounting system?

...revenue is generated by program, location or fee category?

...programs are having any impact?

...you can do better?

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