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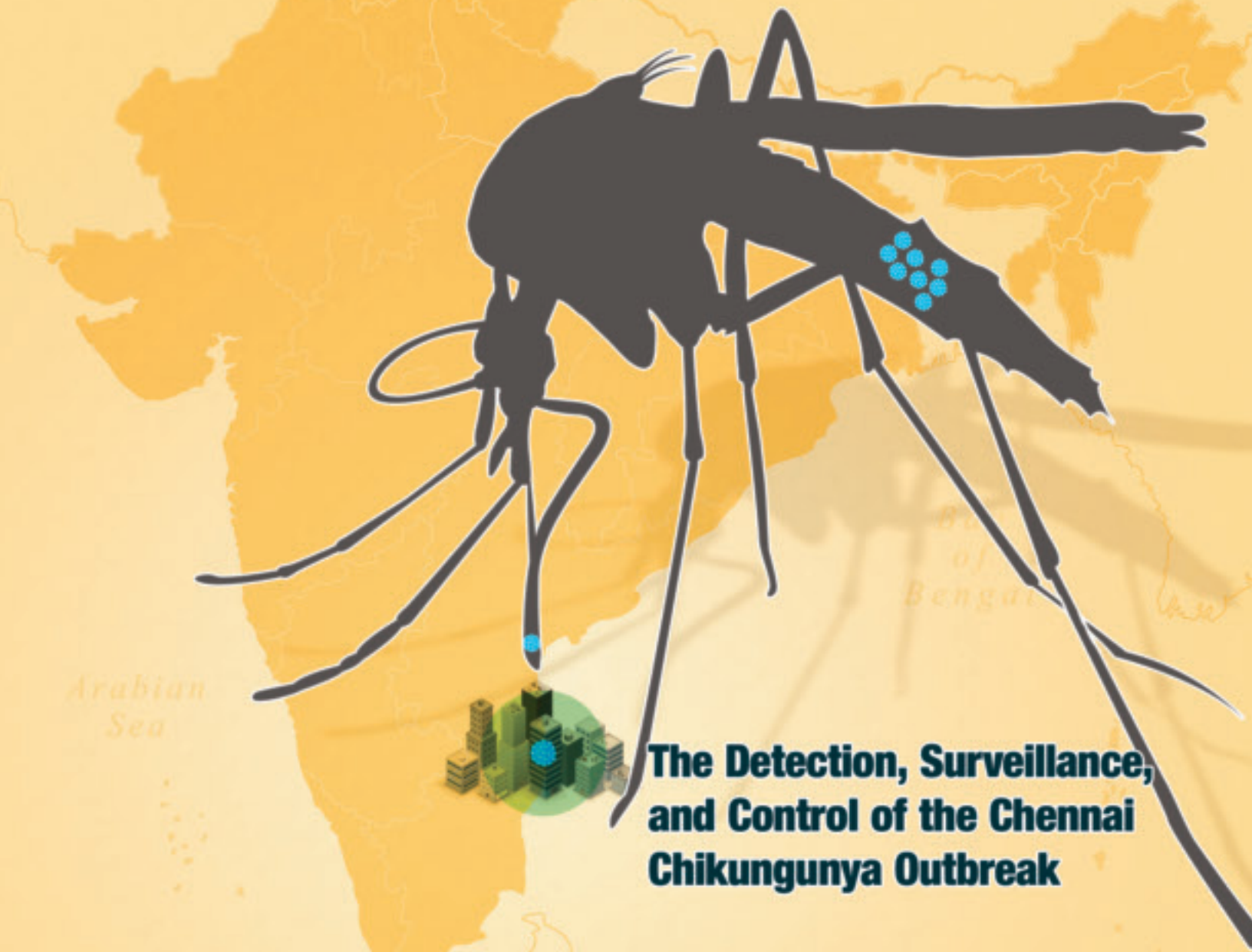

The Detection, Surveillance, and Control of the Chennai Chikungunya Outbreak

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Editor's Note: This special issue features *Journal* articles that were pre-published digitally in 2011 on NEHA's Members Only Web site.

ABOUT THE COVER

Chikungunya is a viral disease transmitted by the bite of an infected *Aedes* mosquito and was apparently absent from India for more than 30 years until its reemergence in 2005. In 2006, several southern states in India reported outbreaks of chikungunya. The goal of this month's cover feature, "A Chikungunya Outbreak in the Metropolis of Chennai, India, 2006," was to describe the detection, surveillance, and control of that Chennai outbreak. It is the first description of a chikungunya outbreak in a large urban area characterized by high population density and mobility.

See page 8.

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YOUR ASSOCIATION

PRESIDENT'S MESSAGE

Mel Knight, REHS

NEHA's International Vision: Environmental Health Knows No Borders or Boundaries

As NEHA president, I have thoroughly enjoyed the opportunity to participate in NEHA affiliate educational conferences. During the first half of my term I have been privileged to attend and speak at the Texas, Illinois, and Yankee conference meetings. While each affiliate is somewhat unique, the major issues facing environmental health professionals are clearly universal and I am always reminded that our similarities far outnumber our differences. This universal commonality was reinforced at an international level by my participation in the 65th Annual Educational Conference and Exhibition hosted by the Jamaica Association of Public Health Inspectors (JAPHI) in Ocho Rios, Jamaica, this past October.

Jamaica Welcomes NEHA

JAPHI has been an affiliate of NEHA since 2000 and has established an active presence at recent NEHA conferences. I first met with the JAPHI delegation at the Columbus, Ohio, Annual Educational Conference (AEC) & Exhibition last summer, and I was subsequently invited to participate in their annual meeting.

The JAPHI conference program was similar in content to the programs you would find at conferences in the U.S. Topics included foodborne illness investigations, commercial fish processing, the Food and Drug Administration's Food Safety Modernization Act, asbestos abatement, recreational water monitoring, cell phones as a fomite or source of electromagnetic field exposure, and much more. The presentations were some of the best I have seen in my career, and I was truly inspired by the engagement and enthusiasm of the attendees. I returned with a heightened awareness of the culture and great appreciation for our association with NEHA's Jamaican affiliate.

Since we are foremost a national organization, it might come as a surprise to some that NEHA has affiliates and members in other countries.

NEHA International Affiliations

Since we are foremost a national organization, it might come as a surprise to some that NEHA has affiliates and members in other countries. NEHA has a long history of active members who reside in Canada; the NEHA International Environmental Health/Climate Change Section is currently chaired by Ron DeBurger from Toronto. We also have many members from throughout the world who work or are stationed outside the U.S. For example, Jamaica and Saudi Arabia have sought and obtained affiliate status. NEHA's services are valued beyond our borders, and we have always strived to be responsive to all areas of request.

As a member of the International Federation of Environmental Health (IFEH), NEHA has hosted past IFEH meetings, and we look forward to hosting the 2014 IFEH World Congress. We have maintained close relationships and participated in professional exchanges with the United Kingdom's Chartered Institute of Environmental Health (CIEH) and the Canadian Institute of Public Health Inspectors (CIPHI). NEHA's primary focus will always be the U.S., and our active participation in the international environmental health community benefits our members and environmental health stakeholders throughout the world.

NEHA International Activities

During the past several years, NEHA has increasingly been establishing an international presence. Our training, credentialing, and publications are now utilized worldwide. We have participated in donations and shipments of books and supplies to developing countries in Africa and the Caribbean. Our web-based training and the "virtual" content from our AEC are readily available from anywhere on the globe.

NEHA International Vision

Led by Regional Vice President Bob Custard, the NEHA board of directors has adopted an "International Vision" platform that provides the roadmap for future NEHA participation in the

world environmental health community. Some of the major concepts include the following.

- As in the U.S., NEHA's goal will be to build environmental health workforce capacity through training, continuing education, and professional credentialing;
- complementing, not competing with, IFEH and other international environmental health organizations;
- becoming partners with, not patrons of, environmental health organizations in other countries;
- providing environmental health consulting in the areas of environmental health program development and management;
- partnering with existing international health organizations to leverage their resources and capabilities;
- establishing a new category of NEHA affiliation: the International Partner Organization (IPO);
- connecting NEHA members with opportunities to travel, train, and serve in the developing world;
- working with accredited environmental health degree programs in the U.S. to offer distance learning, student internships, and faculty exchanges;
- helping our IPOs to leverage resources by connecting them with donors of relevant and functioning technologies, equipment, computers, laboratory supplies, and training; and
- establishing a Global Environmental Health Fund that can be used to support or subsidize the costs associated with many of the activities listed above.

NEHA recognizes the role and importance of the many established international organizations and has no intention of replacing or displacing these groups. NEHA plans to add value to these existing efforts by sharing our resources and capabilities where needed and requested.

A Shrinking Planet

Web-based technology has enabled worldwide communication as an everyday occurrence. Modern transportation has made international travel affordable and practical. We import and export foodstuffs to and from all corners of the globe. We are all part of a global community, and environmental health knows no borders or boundaries.

As reinforced by my recent experience in Jamaica, many international environmental health professionals and organizations are interested in partnering with NEHA and we have a responsibility to expand our mutually rewarding partnerships in the worldwide environmental health community.

Postscript: If a NEHA affiliate is interested in inviting either the NEHA president or Executive Director Nelson Fabian to address your annual conference, please feel free to contact either Nelson or me directly. Nelson can be reached at nfabian@neha.org.

Mel Knight REHS
melknight@sbcglobal.net

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❖ ❖ ❖

Nominations for the 2012 *Walter F. Snyder Award* are being accepted for professionals achieving peer recognition for:

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

❖ ❖ ❖

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The 2012 Walter F. Snyder Award will be presented during NEHA's 76th Annual Educational Conference (AEC) & Exhibition to be held in San Diego, California, June 28-30, 2012.

For more information or to download nomination forms, please visit www.nsf.org or www.neha.org or contact Stan Hazan at NSF at 734-769-5105 or hazan@nsf.org.

INTERNATIONAL PERSPECTIVES

A Chikungunya Outbreak in the Metropolis of Chennai, India, 2006

Although most of the information presented in the Journal *refers to situations within the United States, environmental health and protection know no boundaries. The* Journal *periodically runs International Perspectives to ensure that issues relevant to our international constituency, representing over 60 countries worldwide, are addressed. Our goal is to raise diverse issues of interest to all our readers, irrespective of origin.*

Thomas Seyler
Patrick Sakdapolrak
S. Sanjeevi Prasad
R. Dhanraj

Abstract **In 2006, several southern states in India reported outbreaks of chikungunya. In the metropolis of Chennai, the first laboratory-confirmed chikungunya cases had an onset of symptoms at the end of May 2006. The authors reviewed surveillance data in which a suspected case of chikungunya was defined as a patient presenting with fever and arthralgia at a medical camp in Chennai on and after June 20, 2006. Over the same period, the authors reviewed surveillance data and larval indices for the vector *Aedes aegypti*. From June 20 to October 10, 2006, they reported 4,760 suspected cases of chikungunya (attack rate of 0.1%, no fatalities). Control measures included removal of breeding sites, daytime fogging against adult mosquitoes, and information campaigns. The early detection and effective prevention of future outbreaks rely on strengthened human and entomological surveillance, participation of private medical practitioners in case reporting, and community involvement to reduce potential breeding sites of the vector.**

Introduction

Chikungunya is a viral disease transmitted by the bite of an infected *Aedes* mosquito. The disease usually presents with sudden onset of fever and is characterized by arthralgia (joint pain) that can lead to chronic disability. Although the disease is considered self-limiting, the outbreak in Reunion Island (starting in March 2005) led to reports of deaths directly or indirectly caused by the disease (Josseran et al., 2006) and excess mortality has been associated with the outbreak of chikungunya in Ahmedabad, India, in 2006 (Mavalankar, Shastri, Bandyopadhyay, Parmar, & Ramani, 2008). No vaccine against chikungunya is available so prevention depends entirely on mosquito control and personal protection against mosquito bites.

After an apparent absence of more than 30 years, the virus reemerged in India in 2005. The first cases were serologically confirmed starting in December 2005 in the states of Andhra Pradesh, Karnataka, and Maharashtra (Chhabra, Mittal, Bhattacharya, Rana, & Lal, 2008). For the year 2006, the National Vector Borne Disease Control Programme reported 1.39 million suspected cases in 15 states and union territories throughout India (National Vector Borne Disease Control Programme, 2006). The reemergence and spread of chikungunya throughout India and other countries in Asia and in the Indian Ocean were influenced by a set of virological, environmental, social, and economic factors (Bhatia & Narain, 2009).

Chennai, with 4.7 million inhabitants, is the fourth-largest city in India. It is located on the coast of the Bay of Bengal, in the southern state of Tamil Nadu. Its average elevation is 6.7 m above sea level. The region is characterized by a monsoonal climate. The yearly average rainfall is 1,300 mm. Two-thirds of the annual precipitation falls between October and December during the northeastern monsoon (Glaser et al., 2007).

Two rivers and one canal flow through Chennai: the Cooum and Adyar rivers from west to east and Buckingham Canal from north to south. The hottest months of the year are May and June, with maximum temperatures reaching 42°C. The coolest month of the year is January, with minimum temperatures around 18°C. The estimated proportion of the population living in slums varies from 18.9% to 40.9% (Gupta, Arnold, & Lhugdim, 2009).

Because of chronic water shortages in the premonsoon period, inhabitants collect and store water in permanent and temporary containers (Kabilan et al., 2004). Water storage has been identified as a risk factor for malaria and dengue as it provides ideal breeding sources for their respective urban vectors, *Anopheles stephensi* and *Aedes aegypti*. Malaria is endemic in the city with a yearly incidence of 4 per 1,000 (Corporation of Chennai, unpublished data 2006), while dengue follows a more seasonal trend (Victor, Malathi, Asokan, & Padmanaban, 2007).

By the end of April 2006, the local health authorities of Chennai reported an increase in the number of patients showing symptoms compatible with the clinical features

of chikungunya. Medical doctors from Washermanpet, an area in the north of the city, noticed an unusually high number of patients with fever, arthralgia, and rash. Many of them had a recent travel history to the holy city of Thirupathy in the neighboring state of Andhra Pradesh, which was already experiencing a large-scale chikungunya outbreak.

In the last week of May 2006, 22 serum samples of suspected chikungunya cases were sent to the National Institute of Virology in Pune (Indian Council of Medical Research) and tested for immunoglobulin (IgM) antibodies against chikungunya virus using IgM-capture ELISA. Of these 22 serum samples, six tested positive. Daily surveillance reports of patients with clinically compatible chikungunya symptoms were available from June 20, 2006.

Whereas chikungunya posed a new public health challenge to the municipality, its vector *Aedes aegypti* was known for its role in the local transmission of dengue. The aim of this article is to describe the detection, surveillance, and control of the outbreak that occurred in Chennai in 2006. It is the first description of a chikungunya outbreak in a large urban area characterized by high population density and mobility.

Methods

The surveillance unit for vectorborne diseases at the Corporation of Chennai relies on a network of 36 public dispensaries located in all 10 administrative zones of the city, covering a population of 4.7 million. During the outbreak, mobile medical camps provided free consultations and treatment. They covered three divisions in each of the 10 zones on a daily basis (a total of 30 divisions per day).

We reviewed surveillance data available from the public health department of the Corporation of Chennai to describe retrospectively the outbreak over time. In accordance with the case definition used by the surveillance unit, we defined a suspected case of chikungunya as a patient presenting with fever and arthralgia at a medical camp on or after June 20, 2006. As chikungunya and dengue share similar clinical features (fever, myalgia, arthralgia, rash) we reviewed reported cases of dengue over the same period. Every month, the surveillance unit collected data on dengue cases from public and private hospitals that perform serological tests (Victor et al., 2007). We also reviewed the incidence of malaria to detect any unusual event.

The known vector of chikungunya in Chennai is the female *Aedes aegypti*, which is also responsible for transmission of dengue. Unlike the local vectors of malaria and filariasis (*Anopheles stephensi* and *Culex quinquefasciatus*) that primarily feed after sunset, *Aedes aegypti* takes its blood meal during the early hours of the day and before sunset. It breeds in clear water stagnating in artificial containers (e.g., plastic containers, tires, flower vases) (Centre for Research in Medical Entomology, 2004). During the outbreak, a team of entomologists from the Corporation of Chennai surveyed the surroundings of the residences of suspected cases on a daily basis to monitor the presence of *Aedes aegypti* larvae. From June 20 to October 12, 2006, we calculated daily the overall proportion of houses with larva-positive containers (house index) and the average number of positive containers per 100 houses (Breteau index). The house index and the Breteau index are used as indicators of the density of immature vector populations (World Health Organization, 1997). They were developed by entomologists in the first half of the 20th century to monitor vector control progress and to determine if prophylactic levels have been achieved (Focks, 2003). As the size and the competence of the vector population are influenced by climatic factors (European Centre for Disease Prevention and Control, 2007), we reviewed data on daily maximum temperature and daily rainfall provided by the regional meteorological department in Chennai (government of India).

With no vaccine currently available, prevention relies entirely on the reduction of mosquito bites. This can be done through personal protection against the day-biting mosquito (repellent) and control measures to kill adult mosquitoes (fogging) and eliminate immature stages of the mosquito (use of larvicide and removal of breeding sites). We reviewed activity reports from the vector control department at the Corporation of Chennai.

Results

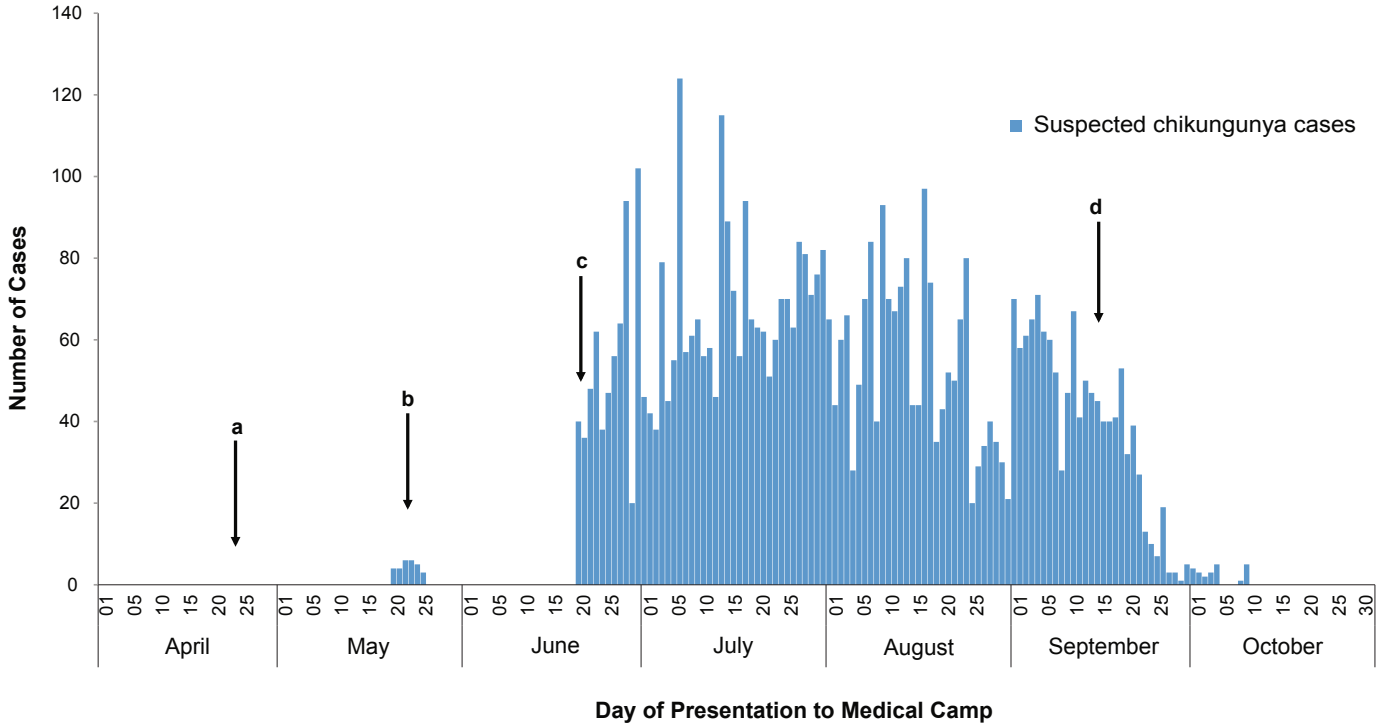
The epidemic curve in Figure 1 shows the number of daily chikungunya suspected cases. From June 20 to October 10, 2006, a total of 4,760 suspected cases were reported (attack rate of 0.1%). No deaths were reported and all patients were offered symptomatic treatment (painkillers and nonsteroidal anti-inflammatory drugs). Sixty-five percent of all suspected cases were males and 25% were below the age of five. Daily reported incidence peaked on July 7, 2006, with 124 cases. The last suspected case was reported on October 10, 2006. Over the same period, hospitals reported 130 cases of dengue to the public health department of the Corporation of Chennai. This was fewer than the 217 dengue cases reported over the same period in the previous year from June to October 2005. The cumulative incidence of malaria reported by the corporation dispensaries from June to October 2006 was 2.24 per 1,000 against 2.93 per 1,000 over the same period in 2005.

Average daily maximum temperature was 35.6°C over the period. It rained once (April 18, 7 mm) during the month of the first signal (Figure 2). From June 20 to September 13, entomologists and their staff covered an average of 732 houses per day and checked 2,758 water containers for the presence of *Aedes* larvae. Daily house and Breteau indices are shown in Figure 3. The house index ranged from 0.05% to 11.2%. It peaked on July 13, 2007. The Breteau index ranged from 0.05 to 11.5. It peaked on August 19, 2006. The house index was above the threshold indicating a high risk of dengue transmission (Figure 3) once on July 13, 2006. Both indices were at their lowest levels from the end of August to mid-September.

In parallel to surveillance, the Corporation of Chennai set up rapid action teams consisting of a medical officer, an entomologist, and a team of field workers in each of the 10 administrative zones. House-to-house antilarval measures included breeding sites elimination and the use of chemical larvicide (Temephos). Adult mosquito control using pyrethroid was conducted during the day given the daytime activity of the vector. It included the use of portable fogging machines (inside and around the premises of houses) and vehicles with fogging machines (covering entire streets). On average, the Corporation of Chennai mobilized 35 portable machines and 12 vehicle fogging machines per day. Fogging activities were intensified in the last two weeks of September, when the number of portable

FIGURE **1**

Epidemic Curve—Daily Suspected Chikungunya Cases From April 1, 2006, to October 31, 2006, in the City of Chennai



(a) First signal: Medical doctors in the north of the city notice an unusually high number of patients with fever, arthralgia, and rash.
(b) Laboratory confirmation of six suspected cases.
(c) Daily epidemiological surveillance is put in place and vector-control measures are implemented.
(d) Fogging against adult mosquitoes is intensified.

machines used quadrupled. From July 20 to October 18, 2006, a total of 20,100 streets of Chennai were covered by control measures aimed at reducing the population of *Aedes aegypti*.

In order to increase awareness and community participation, the corporation printed and distributed 100,000 information leaflets describing and encouraging personal protection measures and removal of breeding sites in private premises. An additional 10,000 copies were distributed in schools, where a message was read during morning assembly.

Discussion

We have described a chikungunya outbreak affecting a large Indian city in 2006. The disease reemerged in the region after 30 years of absence (or low circulation) and therefore no specific surveillance system was in place at the time of the outbreak. In an environment of limited resources, laboratory confirmation of chikungunya cases was not a priority. Specificity of the surveillance system was accordingly limited as the case definition was based on clinical features that are found in other febrile illnesses like dengue. Available data on laboratory-confirmed dengue cases showed no excess incidence, however, compared to previous years. This suggests that it is unlikely that many dengue cases were misdiagnosed as chikungunya cases. Malaria indicators were equally stable compared to previous years.

Regarding the sensitivity of the surveillance system, medical camps organized by the authorities during the outbreak were not the only health care providers in Chennai. Like other Indian cities, Chennai offers a wide range of health care services, both private and public. Patients going for treatment at government hospitals, private clinics, general practitioners, and traditional healers would not have been detected by the surveillance system. Reports from October 2006 from the main government hospital in Chennai, the communicable disease hospital, and private hospitals suggest that the number of suspected cases reported by the Corporation of Chennai should be at least multiplied by two (Corporation of Chennai staff, personal communication, January 2007).

Entomological indices on *Aedes aegypti* mosquitoes were available only from the start of the outbreak. It is therefore not possible to assess whether an overall increase in mosquito

FIGURE **2**

Daily Maximum Temperature (°C) and Rainfall (mm) From April 1, 2006, to October 31, 2006, in Chennai as Measured by Nungambakkam

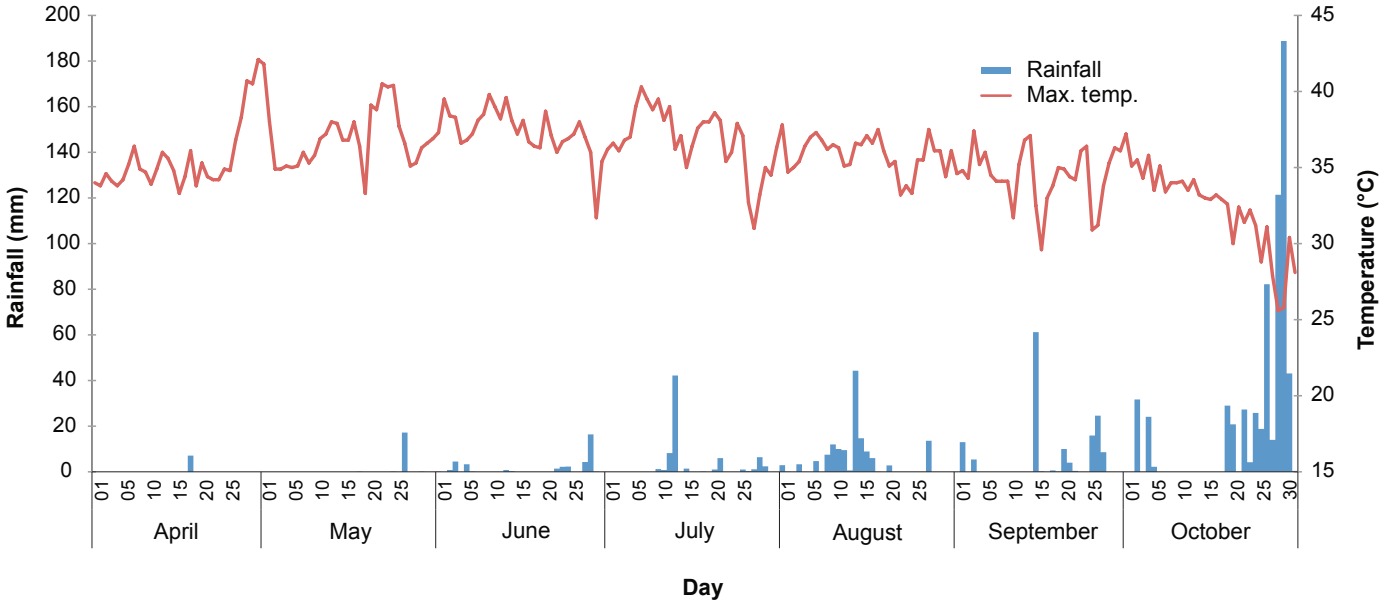
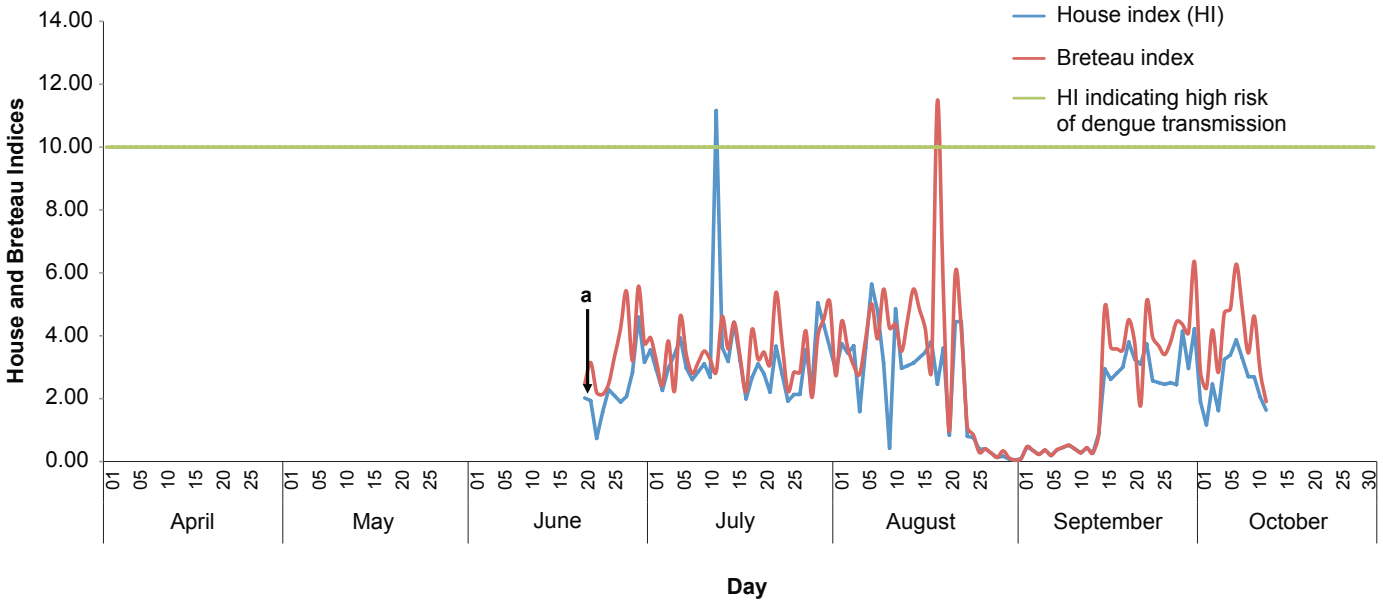


FIGURE **3**

Density of *Aedes aegypti*—House and Breteau Larval Indices From June 20, 2006, to October 12, 2006, in Chennai and House Index Threshold Indicating High Risk of Dengue Transmission



(a) Daily entomological surveillance is put in place and vector-control measures are implemented.

density (as measured by larval indices) would have triggered the outbreak. Indices were low during the epidemic period: the house index was greater than 10% only on one day and the Breteau index was always below 15. These numbers can be compared to the thresholds used by the Corporation of Chennai, which in turn are adapted from those of the World Health Organization and the Pan American Health Organization to estimate the risk of dengue transmission (Pan American Health Organization, 1994). A house index lower than 1% and a Breteau index lower than 5 indicate a low risk of dengue transmission. A house index greater than 10% and a Breteau index greater than 50 indicate a high risk of dengue transmission. The threshold indicating a high risk of dengue transmission was reached only once, more than a month after the start of the chikungunya outbreak.

These results suggest that chikungunya transmission occurred in Chennai while *Aedes aegypti* density was not unusually high and when no concomitant dengue outbreak was reported. This occurrence can be explained by two main factors. First, herd immunity against chikungunya infection in the population was much lower than herd immunity against dengue infection. The last documented chikungunya outbreak in Chennai before 2006 occurred in 1963 (and the strain emerging in 2006 was the novel central/East African genotype [Parola et al., 2006]), while dengue is endemic in the state (all four serotypes). Second, the extrinsic incubation period (the interval between the acquisition of the virus by a vector and the vector's ability to transmit the virus) is lower for chikungunya than for dengue viruses (Newton & Reiter, 1992; Vazeille et al., 2007). This implies, *ceteris paribus*, that chikungunya has a higher effective reproductive number and that transmission can be sustained at lower vector density than for dengue.

Larval indices should also be examined in light of potential measurement biases. As entomological data collected by the Corporation of Chennai were not spatially disaggregated, the apparently low larval indices could be due to the fact that aggregated data did not allow us to detect areas of high mosquito density. Entomological data were aggregated at the city level while the rapid action team surveyed various limited areas in the 10 different zones. This could have diluted small pockets of very high density. Another study in the nearby locality of Avadi supports this hypothesis (Kaur et al., 2008). Also, although entomological investigations were carried out around houses of cases, infection might have occurred at the workplace or at school, as *Aedes aegypti* is active during the day. Finally, it may be that larval indices are not appropriate proxies for adult mosquito density. Several attempts have been made by entomologists to develop new indicators based on pupae (Focks, Brenner, Hayes, & Daniels, 2000).

The impact of vector control measures can be assessed in terms of the intermediate target (reduction of the *Aedes* mosquito) and ultimate target (reduction in chikungunya cases). Fogging measures were intensified on September 16, 2006. Daily suspected cases started falling on September 22, 2006. Given an incubation of the disease that ranges from two to 12 days, the intensification of fogging activities probably played a role in the containment of the outbreak. The marked decrease observed in larval indices to levels below 1 (Figure 3), however, preceded the increase in fogging activity. Whereas it is difficult to assess the impact of control measures, the trend in rainfall and temperature cannot explain the decrease in cases. The precipitation observed in August and September 2006 would have favored the growth of *Aedes* population by multiplying potential breeding sites at a time when temperatures were still favorable for viral replication and transmission.

At the beginning of the outbreak, private health workers in the affected areas hypothesized that person-to-person transmission was explaining the rapid spread of the disease. In the general population, some confusion occurred between avian influenza (associated with chickens and birds) and chikungunya (sometimes understood as *chicken*-gunya). Erroneous beliefs about a disease can have an impact on its control, especially when personal protection and community involvement are crucial. In Chennai, however, the communication and information efforts made by the municipality and other public institutions were well relayed in the local media (Thirumalaikolundusubramanian, Srinivasan, Vinodhkumaradithyaa, & Uma, 2008).

Conclusion

The chikungunya outbreak that affected Chennai in 2006 showed that transmission can occur in large urbanized areas, where the vector (in this case *Aedes aegytpi*) is well established. It reminds us that competent vectors have found favorable human-made conditions in large cities where eradication is currently impossible. Although chikungunya surveillance should rely on local laboratories in the future, syndromic surveillance combined with the monitoring of laboratory-confirmed cases of dengue is a cost-effective approach. In Chennai, the surveillance system for chikungunya and other infectious diseases would gain both in terms of sensitivity and representativeness if it included health care providers from the private sector. Timely detection of future outbreaks will imply continuous entomological surveillance to monitor *Aedes* population in sentinel areas. Effort should focus on developing new indicators for vector density, possibly based on larvae and adult mosquitoes. Given the nature of *Aedes* breeding sites, prevention relies heavily on community involvement to clear potential breeding sites in private properties. Public health education is crucial to improve awareness of chikungunya transmission and prevention strategies (i.e., breeding site reduction and personal protection) in the population. It will also help in limiting the impact of future outbreaks.

Acknowledgements: The authors are grateful to the medical officers and entomologists from the Corporation of Chennai who collected the data, to Dr. Muller and Prof. Vasantha Kumaran for their support, and to Dr. Depoortere and Prof. Kistemann for their valuable comments and suggestions. At the time of the study, Mr. Seyler and Mr. Prasad were funded by the French Institute of Pondicherry, Mr. Sakdapolrak was funded by the German Research Foundation (DFG), and Mr. Dhanraj was chief vector control officer at the Corporation of Chennai.

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INTERNATIONAL PERSPECTIVES

Mold Growth in On-Reserve Homes in Canada: The Need for Research, Education, Policy, and Funding

Although most of the information presented in the Journal refers to situations within the United States, environmental health and protection know no boundaries. The Journal periodically runs International Perspectives to ensure that issues relevant to our international constituency, representing over 60 countries worldwide, are addressed. Our goal is to raise diverse issues of interest to all our readers, irrespective of origin.

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Abstract

The impact of mold growth in homes located on First Nations reserves in Canada is part of a national housing crisis that has not been adequately studied. Nearly half of the homes on reserves contain mold at levels of contamination associated with high rates of respiratory and other illnesses to residents. Mold thrives due to increased moisture levels in building envelopes and interior spaces. Increased moisture stems from several deficiencies in housing conditions, including structural damage to the building envelope, overcrowding and insufficient use of ventilation systems, and other moisture-control strategies. These deficiencies have developed due to a series of historical and socioeconomic factors, including disenfranchisement from traditional territory, environmentally inappropriate construction, high unemployment rates, lack of home ownership, and insufficient federal funding for on-reserve housing and socioeconomic improvements.

The successful, long-term reduction of mold growth requires increased activity in several research and policy areas. First, the actual impacts on health need to be studied and associated with comprehensive experimental data on mold growth to understand the unique environmental conditions that permit the germination and growth of toxic mold species. Second, field data documenting the extent of mold growth in on-reserve homes do not exist but are essential in understanding the full extent of the crisis. Third, current government initiatives to educate homeowners in mold remediation and prevention techniques must be long lasting and effective. Finally, and most importantly, the federal government must make a renewed and lasting commitment to improve the socioeconomic conditions on reserves that perpetuate mold growth in homes. Without such improvement, the mold crisis will surely persist and likely worsen.

Introduction

Mold and Health

Mold is a serious health risk in the dilapidated housing that characterizes much of the shelter available to the indigenous ("First Nations") people of Canada. Mold has been well documented as occurring in First Nations housing, but its health consequences remain implicit and the actual types of mold are understudied and largely unanalyzed. This article reviews the relevant conditions conducive to mold growth, what is known about the kinds of risks mold represents, the socioeconomic and historical factors that have led to this situation, and the circumstances that require action on the part of multiple levels of governance in Canada to address this issue.

Molds include all species of fungi that grow as multicellular filaments called hyphae. Over 100,000 types of mold are classified in the Zygomycota, Deutermycota, and Ascomycota phylums. Mold grows on solid culture media and gains nutrients through the decomposition of dead organic matter. Reproduction occurs both sexually and asexually within microscopic spores, which may contain one or several nuclei. Some spores can remain airborne indefinitely and are capable of surviving extreme levels of pressure and temperature variation. It is only when mold colonies grow as an interconnected group of hyphae called mycelium that mold becomes visible. Mycelium is far more widespread at low concentration levels than simple visual inspection would suggest (Prezant, Weekes, & Miller, 2008).

All molds secrete hydrolytic enzymes that break down starch, cellulose, and lignin into simpler substances that they can absorb. The ability of molds to decompose organic matter makes them invaluable components in the nutrient cycle. Many molds also secrete mycotoxins, however, which, along with the enzymes used to process organic matter, have evolved to inhibit the growth of other microorganisms (such as bacteria or insects) competing for the same nutrients. Some of these mycotoxins are neurotoxins, which gravely disrupt the nervous systems of competing organisms such as insects and also impact other organisms including humans. Some mycotoxins can be very dangerous when inhaled due to their effect on human respiratory (Hope & Simon, 2007) and neurological functions (Campbell, Thrasher, Gray, & Vojdani, 2004).

The impacts of mycotoxins on human health include allergic rhinitis, asthma, mucosal irritation, common cold symptoms, fatigue and weakness of concentration, general weakening of the immune system, and even death. Due to these dangers, mold is often treated as a hazardous material (Park & Cox-Ganser, 2011). Mold is dangerous to human health in several other ways. Mold spores are sufficiently small enough to be inhaled into the bronchial tubes, bypassing the mucosal barrier; consequently, some mold spores commonly yield allergic reactions including conjunctivitis, allergic coryza, inflammation of the respiratory tract, bronchial asthma, skin eczema, and "nettle rash" (Hardin, Kelman, & Saxon, 2003; Portnoy, Kwak, Dowling, VanOsdol, & Barnes, 2005).

Mold mycelium is also dangerous and is associated with mycosis and mycotoxicoses. Mycosis is the growth of a mold fungus on a human host, which can cause infectious diseases such as aspergillosis and penicilliosis (Jacob et al., 2002). Mycotoxicosis is anthropogenic intoxication due to the inhalation of the toxic by-products of mycelium metabolism, which can lead to delirium (Fung & Clark, 2004).

The adverse affects of mold (like most environmental illness) are age related and particularly pronounced in children (Ahluwalia & Matsui, 2011; Bearer, 1995; Jones, Recer, Hwang, & Lin, 2011; Koskinen, Husman, Meklin, & Nevalainen, 1999). This is due to a combination of their immature size, immune system vulnerabilities, confined exposure (they are kept inside), and misinterpretation of symptoms as sequential rhinoviruses (common colds). The public health risk of mold has been well documented for Europe (Bornehag et al., 2004) and for the U.S. (Institute of Medicine, 2004) in studies that have concluded that a direct association exists between mold in buildings and risk to their occupants and that this risk extends beyond the respiratory system (asthma, in particular) to other poor health outcomes. The economic and individual suffering associated with mold is simply staggering: Mudarri and Fisk (2007), for example, estimated the annual cost of asthma in homes attributable to mold to be $3.5 billion for the U.S.

Environmental Influences of Mold Growth

Mold growth is influenced by many factors. The decisive criterion for mold growth is sufficient moisture provided either by water liquid or vapor. Different molds thrive at different levels of relative humidity, i.e., the ratio of actual vapor density in an air-vapor mixture to the vapor density at saturation. Relative humidity between 70% and 80% provides adequate moisture for the growth of nearly all species of mold (Lstiburek & Carmody, 1996; Sedlbauer, 2000).

Temperature is another important growth criterion. Each mold has a specific temperature range in which it is able to grow. Generally, all species grow within the 0°C to 50°C range (Sedlbauer, 2000). Temperature also impacts the relative humidity at which mold is able to grow. As temperature increases, lower relative humidity levels become adequate for mold growth (Lstiburek & Carmody, 1996; Sedlbauer, 2000).

The substrate (medium) on which mold grows also influences growth rates. The nutrient contents of substrates vary widely: some substrates provide ideal nutrients (e.g., decaying fruit), some provide moderate nutrients (e.g., wood or wall paper), and some provide no nutrients (e.g., plastic).

The duration of favorable environmental conditions is also important. Some molds are able to grow quickly in favorable environmental conditions while others require lengthier periods (Sedlbauer, 2000). Other criteria of lesser importance also influence mold growth. These criteria include pH and salt content of the substrate, oxygen content of air, surface conditions of the substrate, and other biotic influences, such as the presence or absence of other organisms (Sedlbauer, 2000).

Mold and Buildings

Negative health impacts of mold result when humans are in close proximity to mold in an enclosed environment where concentrations of mycotoxins are able to increase. Thus, mold growth in buildings is particularly dangerous to human health. Mold spores typically enter buildings through windows and doors in air currents or by attachment to clothes and pets (Canada Mortgage and Housing Corporation [CMHC], 2005). Once spores are inside a building, spores germinate and mycelium grows provided favorable indoor environmental conditions exist.

The crucial condition—sufficient moisture—can be generated inside the home in various ways. Rainwater may enter through openings or cracks in the building envelope, faulty eaves troughs, defective plumbing, or on the clothes of residents and the fur of pets. Insufficient use of insulation, multipaned windows, or vapor barriers can result in condensation on interior envelope surfaces during the winter months. Inadequate use of ventilation and increased levels of indoor moisture generation due to resident activities (e.g., breathing, cooking, showering, etc.) increase humidity levels in indoor air. Increased humidity in indoor air further increases the condensation on interior envelope surfaces (Prezant et al., 2008).

Over 200 species of mold are known to occur in buildings and the majority are not harmful to humans. The most frequently occurring mold species causing harmful mycosis are *Absidia*, *Aspergillus*, *Basidiobolus ranarum*, *Cephalosporium*, *Cladosporium*, *Fusarium*, *Mortierella*, *Mucor*, *Penicillium*, *Rhizopus*, *Scopulariopsis*, and *Verticillium* (Sedlbauer, 2000). The most frequently occurring of these causing harmful mycotoxicoses (including via food contamination) are *Aspergillus*, *Penicillium*, and *Fusarium* (Felicio, Freitas, Rossi, & Gonçalez, 2011) and are associated with esophageal cancers (i.e., *Fusarium*; Sydenham et al., 1990) and respiratory distress (i.e., aspergillosis; Bennett, 2010). *Penicillium*, which while beneficial as an antibiotic, causes a highly allergic response, penicilliosis, in up to 10% of individuals (Bhattacharya, 2010).

Present Research on Environmental Conditions in Buildings and Mold

Mold growth and moisture balance in buildings are currently active research fields.

Several authors have identified the toxic mold species found within homes and the types of substrates on which they grow (Adan, 1994; Clarke et al., 1999; Nielsen, 2002; Pasanen et al., 2000; Sedlbauer, 2000). Some researchers have designed mold spore detection techniques and technologies (Moon, 2005; Schleibinger, Laussmann, Eis, & Ruden, 2005). Others have developed moisture generation and transfer models for the building envelope and interior space dependent on indoor and outdoor environmental conditions (Holm, Kuenzel, & Sedlbauer, 2003; Kumaran, 1999; Kunzel, Holm, Zirkelbach, & Karagiozis, 2005; Krus & Kiebl, 1998; Lu, 2003; TenWolde, 1988).

Researchers have also grown mold in a laboratory setting to correlate environmental conditions to the probabilities of mold growth (Clarke et al., 1999; Pasanen et al., 2000; Sedlbauer, 2000). The Fraunhofer Institute did the most comprehensive correlation for building physics in Germany (Kunzel et al., 2005). Based on a literature review of publications related to mold growth in buildings and limited samples of experimental data, researchers at the institute developed a model to predict spore germination and mycelium growth based on type of mold species, relative humidity, temperature, substrate composition, and time of exposure (Sedlbauer, 2000). Researchers at the institute also developed a moisture transfer model for the building envelope dependent on indoor and outdoor environmental conditions (Kunzel et al., 2005). The two models can be used together to predict mold growth in the building envelope in various climates.

The principal limitation of the current model is the lack of experimental data. Comprehensive experimental data defining the unique range of environmental conditions that enable growth of each mold species are not presently available and would require significant time and financial resources to obtain. In place of gaps in reliable data, researchers at the Fraunhofer Institute have used various approximations, aggregations, and extrapolations to produce a complete mold prediction model. Results from the models are thus approximate and can provide only an approximate indication of mold growth.

Between 2003 and 2008, the National Research Council of Canada (NRC) conducted research aimed at improving methods of mold prevention and control. The NRC recognized the lack of available data, stating that there was "no accepted metric for dampness related to mold growth, nor are there information for the effectiveness of modifying building design, construction methods, or regular building operations and maintenance in reducing dampness (National Research Council of Canada [NRC], 2008a)." NRC also noted "previous research has been based on steady-state conditions that do not include factors such as peak relative humidity, ventilation, fluctuating temperatures over day and night, and the effects of people breathing and moving about in buildings (NRC, 2008a)."

NRC (2008b) sought to improve mold prevention and control by developing the following:

1) reliable mold detection techniques, particularly for concealed spaces of buildings, such as ventilation ducts and cavities of the building envelope;
2) analytical and numerical tools to assess the likelihood of mold growth on building materials and components, such as laboratory test methods and numerical modeling software; and
3) reliable and cost-effective remediation methods to minimize the reoccurrence of mold growth in refurbished buildings.

NRC has yet to publish full conclusions from its research. Consequently, significant gaps still exist in the prediction, remediation, control, and prevention of mold growth in homes.

Mold in Homes on Reservations in Canada

Background

Though mold can grow in any home in Canada, it is especially problematic in the homes of indigenous people, who are referred to in Canada as First Nations peoples or First Nations. According to a survey conducted between 2002 and 2003 by the First Nations Centre and the National Aboriginal Health Organization, 44% of 10,616 respondents within reserve communities in Canada reported mold growth in their homes (First Nations Centre, 2006). Similar accounts come from interviews conducted within specific communities (Berghout et al., 2005). A newspaper article on the Ahousat First Nation located on the central coastal area of Vancouver Island, British Columbia, for example, indicates that 100 of 144 homes (69%) in the community contain mold, 45 of which have been condemned (Drews, 2008). The Kitamaat Band Council of the Haisla First Nation reports that 41 of 192 homes (21%) within the on-reserve community of Kitamaat contain mold (Mactavish et al., in press).

The scope of mold growth suggested by geographically diverse studies represents a widely recognized problem in Canada. A status report in 2006 from the auditor general of Canada further stated that "problems with mold exist in many on-reserve houses [yet] no federal organization has taken responsibility for assessing the full extent of mold contamination and developing a strategy or action plan for addressing the problem (Auditor General of Canada, 2006)." Specifically, no comprehensive field data exist describing the percentage of homes with mold, the degree of mold growth, the types of mold growing, the areas of the home most susceptible, the local climatic conditions, and the health status of the occupants of specific homes. Existing data have been obtained only through surveys and isolated interviews with specific communities.

Following the auditor general's status report, the First Nations indoor air quality committee was formed to develop a national strategy to address what it termed "the mold crisis." Its members include Indian and Northern Affairs Canada, Health Canada, and the Canada Mortgage and Housing Corporation in partnership with the Assembly of First Nations. The goal of the committee is to "develop sufficient awareness and capacity among First Nations home occupants, communities, and institutions so that they can prevent or remediate existing mould problems (Indian and Northern Affairs Canada [INAC], 2008)." No publications or reports have yet been publicly released by the committee.

Observational research such as that reported by Mactavish and co-authors (in press) suggests that homes on reserves are more susceptible to mold due to high moisture levels in the building envelope and interior space. These high levels are due to high instances of structural damage to the building envelope, high percentages of overcrowded homes, and the insufficient use of ventilation systems and other moisture-control strategies. Several historical socioeconomic and demographic factors have contributed to present housing conditions, yet this linkage is rarely recognized

in government and other institutional publications. Socioeconomic factors include disenfranchisement from traditional territory, high unemployment rates, inadequate capacity training, lack of home ownership, and insufficient federal funding for on-reserve housing and socioeconomic improvements. Rapid population increases on reserves with limited housing capacity have also played a role in overcrowded housing, with high levels of occupancy and use.

The Context of Disenfranchisement and Government Dependency

As a health problem in the housing on reserves in Canada, mold has grown out of a set of historical events that are relevant for understanding the current situation. Mold grows out of a political and economic environment, not just out of a poor choice of materials in given physical environments. Since 1860, many First Nations communities in Canada have been removed from their traditional territories and relocated to government-established reserves that are many times smaller than traditional territories. Alienated land was used for resource extraction, principally in mining, forestry, and hydroelectric generation, and rights to access resources on those lands were restricted (Waldram, 1993; Waldram, Herring, & Young, 2006). Consequently, many reserve communities became dependent on federal government funding for nearly all aspects of daily survival; importantly, these included shelter (Asch, 1984; Asch, 1997; Hopkinson, Stephenson, & Turner, 1996; Waldram et al., 2006).

Dependency is particularly acute in housing because territorial removal included loss of traditional homes built with local materials and techniques combined with the construction of new European-style colonial dwellings with attendant costs to the overall health and well-being of dislocated populations (Stephenson & Acheson, 2003). The inappropriate materials imported from outside the communities included untreated gypsum wallboard and "green" (poorly dried) wood, which are highly susceptible to mold growth. Community members had no knowledge of this new form of housing and lacked the economic power and skills to purchase, construct, or maintain homes of their own. Reserve communities became dependent on the federal government for the construction and maintenance of their homes. These homes were smaller than traditional homes and constructed to reflect the needs of suburban Canada rather than primary resource-based communities with extended family or clan-based familial organization.

Predictably, overcrowding became a major problem, leading to high infection rates of diseases such as tuberculosis (Clark, Riben, & Nowgesic, 2002). Thus, housing became triply alienated from First Nations: first, in their removal from traditional housing on traditional territory; second, in the construction of European- and North American–style housing using imported materials that serve as a productive media for mold growth and usually imported labor; and third, in the home itself as a threat to health and well-being due to overcrowding, which in turn has a serious impact on mold growth via high carbon dioxide output in damp conditions. Overcrowding has remained prevalent throughout the 20th and 21st centuries.

In 1962, housing shortages were reported at 6,048 units, or 24% of existing homes with rates of construction only 21% of that required (O'Connell, 1965). During that time, the average reserve home contained 7.4 inhabitants but only 3.1 bedrooms (O'Connell, 1965). Homes were consistently substandard, since the construction and maintenance of on-reserve housing was not regulated under the National Housing Act until 1973. In 1962, only 44% of on-reserve homes were equipped with electricity, 9% with a sewer or septic tank, 13% with potable water, and 9% with an indoor toilet (O'Connell, 1965).

Subsequent regulation of housing construction and maintenance did not significantly increase the quantity and quality of on-reserve housing. By 1981, 23% of on-reserve homes were in need of major repair, and 33.4% were overcrowded compared to 5% and 2.3%, respectively, for non-aboriginal homes (Clathworthy & Stevens, 1987). The term "major repair" incorporates a variety of housing deficiencies, including cracks in the building envelope, degradation or absence of thermal insulation, faulty eavesdrops, poor drainage, defective plumbing, and lack of adequate ventilation.

The term "overcrowding" is defined as an occupancy level exceeding more than one person per room. By 1996, on-reserve homes in need of major repair had increased to 36%, while overcrowding had decreased to 15% (Spurr, Melzer, & Enegland, 2001). According to most recent census data, reserve housing conditions have since worsened. In 2006, 44% of on-reserve homes were need of major repair and 26% were overcrowded, compared to 7% and 3%, respectively, for non-aboriginal Canadian homes (Statistics Canada, 2008). Demographically, overcrowding is exacerbated by the growth in First Nations population, increasing 29% between 1996 and 2006 at 3.5 times the growth rate of non-aboriginal Canadians (Statistics Canada, 2008). Reserve housing shortages in 2005 were estimated between 20,000 and 35,000 units and growing at 2,200 a year (Patterson, 2006).

The housing problem was made worse by the previously blocked return of many women to their communities of origin after the passage of Bill C-31, which reversed the sexual discrimination faced by First Nations women who had married and had children with any partner who was not a Status Indian. This meant that many families who required housing returned after June 1985. Although widely acknowledged as a potential problem, no significant increase in funding to support the population changes in First Nations communities was enacted (Guimond, Kerr, & Beaujot, 2004).

Since 1996, the federal government and affiliated organizations have introduced many on-reserve housing programs to improve on-reserve housing conditions. The programs were based on policy reforms intended to increase First Nations control over community-based housing programs, develop First Nations proficiency in housing and construction management, and allow more flexible home ownership options and increase access to private financing (INAC, 1996).

In 2005 the government of Canada intended to substantially increase the number of on-reserve homes to mitigate many social and health-related problems under an agreement known as the Kelowna Accord. The Kelowna Accord stated that on-reserve housing shortages would be reduced by 40% by 2010 and 80% by 2015 (Patterson, 2006). This commitment has never been honored, however, in the fiscal terms outlined in the original accord due to a change in government: a parliamentary shift to a conservative government led to the cancellation of the $5.1 billion plan in the very next year, jeopardizing many aspects of First Nations health (Webster, 2006).

The 2006 federal budget claimed that federal funding for First Nations increased 23% between 1999–2000 and 2004–2005 (Department of Finance, 2006). When inflation is taken into account, however, funding has dropped 3.5% (Assembly of First Nations [ASM], 2004). In particular, funding for core services such as education, economic and social development, capital facilities, and maintenance decreased 13% during this time (ASM, 2004). A 2002 report from the auditor general on Canada's major on-reserve funding institutions was highly critical of the requirement for on-reserve communities to complete up to 168 financial reports each year if they wished to access funding (Fraser, 2002).

Recent funding for new housing construction is particularly inadequate. In the three fiscal years since the demise of the Kelowna Accord, the federal government has committed only $300 million to on- and off-reserve First Nations housing improvements (Department of Finance, 2008). If such funding remains consistent, the federal government will have spent $500 million between 2006 and 2010, equaling less than half (42%) of that committed in the Kelowna Accord. Improvements to on-reserve housing are entirely dependent on federal funding due to high unemployment rates and lack of capacity training in on-reserve communities. Unemployment on reserves was 23.1% in 2006, compared to 5.2% for the non-aboriginal population (Statistics Canada, 2008). As a result, on-reserve community members have fewer financial resources to either construct their own homes or repair housing deficiencies, which play a significant role in the increased risk of mold developing in housing on reserves. In addition, overcrowding and poor maintenance are aspects of continuing poverty that contribute to the creation of environments in which mold flourishes.

Home Ownership and Mold Remediation

Most on-reserve band members do not own the homes they inhabit, and are thus less inclined to maintain and repair their homes. In 2001, 29% of reserve homes were owned by the home dweller, 13% were rented, and 59% were owned and operated by the local First Nations Government—the Band Council—and leased to band members (Jakubec & Enegland, 2004). Lack of home ownership provides little incentive for a resident to maintain a home using personal financial resources. Mold remediation for band-owned housing, in particular, is considered the responsibility of the Band Council (Drews, 2008). Given the severe limitations of Band Council funding, such remediation often does not occur. Councils are often placed in the position of having to choose between building new housing to alleviate crowding and repairing old housing, which has been poorly maintained and was poorly constructed in the first instance.

Band members who own their own homes do so precariously under a certificate of possession granted by the federal government (Alcantara, 2004). Under this certificate, any action taken by a homeowner on his or her own property must be approved by the federal government (Alcantara, 2004). Moreover, the land awarded can be taken back at any time if it is felt that the certificate is being abused (Alcantara, 2004).

The lack of full ownership and loss of power over land use can lead to decreased pride of home ownership and are disincentives to maintain the home. Further, the certificate of possession can discourage homeowners from investing in projects such as mold prevention and remediation. Under the certificate, lending institutions cannot seize on-reserve property due to provisions in the Indian Act (Alcantara, 2004). Thus, obtaining loans from financial institutions is particularly difficult for on-reserve homeowners, making the financing of mold remediation projects almost impossible. Often in these cases, homeowners enter into lease agreements with the Band Council to secure financing (Alcantara, 2004). As a result, homeowners lose the privilege of home ownership and, once again, lose the primary incentive to maintain their own home, because it is not fully theirs in the first place.

Contemporary Housing Awareness

Insufficient awareness of the operation and maintenance of Eurocentric-style housing can also increase the risk of mold growth in on-reserve homes. Energy-efficient housing designs now constructed on reserves feature nearly airtight building envelopes with air exchange provided almost entirely by mechanical ventilation systems. The failure to use these ventilation systems can result in high humidity levels within the home and higher risk of mold growth. In the Haisla First Nations community of Kitamaat, for example, some community members reportedly choose not to use these ventilation systems due to excessive noise (Mactavish et al., in press). In addition, some residents reportedly keep windows shut or cover up air outlet vents to prevent heat loss and lower expenses (Mactavish et al., in press). Both of these behaviors lead to increased moisture levels inside houses. More traditional homes were often heated by wood, which is freely available and dries out interiors. Older housing also included better circulation of air via the drafting of cold air into wood stoves.

Summary

Historical factors that are part of the legacy of colonialism have contributed to what First Nations leaders, health officials, and major newspaper editorialists have described as a mold-related housing crisis on reserves. This crisis features great health risks due to increases in exposure to molds that are widely suspected of causing serious health problems, especially in children and vulnerable elderly people (Peterson, 2009). First Nations people were steadily removed from their traditional homes and placed in European-style housing of which they had no knowledge and that were built with environmentally inappropriate materials. With little economic power and limited access to resources, First Nations people living on reserves became dependent on the federal government for all aspects of survival, including shelter. Failed commitments from the federal government to improve reserve housing and socioeconomic conditions have resulted in a legacy of widespread substandard housing and severe housing shortages that yield overcrowding, which in turn aggravates mold growth.

Persistent high unemployment rates have also left reserve residents with few personal finances to increase or maintain existing housing. Poor home maintenance is further exacerbated by the low homeowner rates perpetuated by paralyzing laws surrounding reserve home ownership, which include disincentives towards repair or remediation of housing deficiencies. Due to these factors, many on-reserve members live in homes that are structurally deficient, overcrowded, poorly ventilated, and inadequately maintained.

These housing conditions have led to high instances of mold growth and attendant illnesses. Inadequate homeowner education in mold remediation, control, and prevention techniques has allowed mold to flourish while human health deteriorates.

Conclusion

While poor housing and attendant problems including mold growth in homes are widely held to be a national crisis in Canada, remediation of these problems does not appear to be immanent. The mitigation of this crisis requires immediate and long-term activity in key research and policy areas as well as new construction.

First, the full scope of the health problems associated with mold in First Nations housing needs to be assessed; current data are piecemeal. To do this properly, along with conducting epidemiological surveys by region, complete experimental data on mold growth will ultimately be required in order to understand the unique environmental conditions (i.e., humidity, temperature, time of exposure, and substrate) that permit the germination of each specific toxic mold species affecting human health. This is a precondition of better construction and maintenance.

Second, field data on the extent of mold growth in homes on reserves in Canada do not exist but are essential for creating effective remediation policies and practices. Required field data include the percentage of homes with mold, the degree of mold growth, the types of mold growing, the areas of the home most susceptible, local climatic conditions, and the specific health status of home occupants.

Third, present government initiatives to educate homeowners in mold remediation; control and prevention techniques must be long lasting to be successful. Finally, and most importantly, given the historical legacy of government policies responsible for creating and aggravating this problem, the Canadian federal government should make a renewed and lasting commitment to improve the socioeconomic conditions and lack of suitable housing that have led to this crisis. Without such improvement, the housing crisis and the role that mold plays within it will surely persist and very likely worsen.

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INTERNATIONAL PERSPECTIVES

Asbestos in Public Hospitals: Are Employees at Risk?

Although most of the information presented in the Journal refers to situations within the United States, environmental health and protection know no boundaries. The Journal periodically runs International Perspectives to ensure that issues relevant to our international constituency, representing over 60 countries worldwide, are addressed. Our goal is to raise diverse issues of interest to all our readers, irrespective of origin.

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Abstract **Asbestos is an established human carcinogen. Asbestos-containing building materials (ACBM) are used in surfacing materials, thermal system insulation (TSI), and miscellaneous materials, and they have been used in buildings in Jamaica in the past. The objective of the study described here was to identify ACBM, its characteristics, and its determinants in Jamaican hospitals. A walk-through survey of all hospitals was undertaken and 152 bulk samples were collected from 26 public and private hospitals. The samples were analyzed using polarized light microscopy. Sixteen (61.5%) hospitals had ACBM used mainly as TSI. The ACBM in most cases was friable and in a poor condition indicative of fiber release and contained the fibers chrysotile, amosite, and crocidolite. The age of hospitals was not associated with the presence of ACBM. Results indicated potential risk of asbestos exposure in hospitals. The hospital authorities should formulate and implement an asbestos policy for hospitals and undertake proper management of asbestos in all hospitals.**

Introduction

Asbestos is a generic term for a group of six naturally occurring, fibrous silicate minerals (Agency for Toxic Substances and Disease Registry [ATSDR], 2001). These fibers belong to two mineral groups: serpentines and amphiboles. The serpentine group contains a single asbestiform variety: chrysotile, which comprises over 90% of the asbestos mined worldwide today (Craighead & Mossman, 1982). Five varieties of amphiboles are known: anthophyllite, amosite, tremolite, crocidolite, and actinolite (Virta, 2002). The structure, chemical composition, and persistence of chrysotile in biological systems differ from those of the amphiboles (Roggli, 1990). Amosite and crocidolite are the commercially valuable forms of amphibole asbestos. Asbestos-containing material (ACM) is any material that contains more than 1% of asbestos and is of two types: friable and bonded (Occupational Safety and Health Standard, Toxic and Hazardous Substances: Asbestos, 1988; U.S. Environmental Protection Agency [U.S. EPA], 2009a). Friable ACM can be crumbled, crushed, or reduced to powder by hand pressure when dry, while bonded (non-friable) ACM is typically bound up with cement, vinyl, asphalt, or some other type of hard binder. The U.S. Environmental Protection Agency (U.S. EPA) identifies three categories of asbestos-containing building materials (ACBM): surfacing materials, thermal system insulation (TSI), and miscellaneous materials (The Environmental Institute, 2004).

The International Agency for Research on Cancer has classified asbestos as a human carcinogen (Group 1) based on adequate evidence from animal and human studies (International Agency for Research on Cancer [IARC], 2009a, 2009b). U.S. EPA has also designated asbestos as "carcinogenic to humans." This descriptor indicates strong evidence of human carcinogenicity (U.S. EPA, 2005). Another U.S. organization, the American Conference of Government Industrial Hygienists, classifies asbestos as a "confirmed human carcinogen (group A1)" based on the weight of evidence from epidemiologic studies (American Conference of Government Industrial Hygienists, 2005). The classification of asbestos as a Group 1 human carcinogen was recently reaffirmed and "mineral substances such as talc and vermiculite that contain asbestos should also be considered carcinogenic to humans (Straif et al., 2009)." Approximately 100,000 deaths occur annually worldwide due to asbestos (International Labour Organization, 2006). Potential sources of occupational and environmental asbestos exposure are asbestos-containing products, asbestos removal, asbestos production, asbestos transport, and asbestos in public buildings (O'Reilly, McLaughlin, & Beckett, 2007). Exposure to asbestos may be direct or indirect (Golden, 1979).

The major diseases attributed to asbestos exposure can be placed into two categories: 1. fibrotic or restrictive, and 2. cancers. Fibrotic or restric-

TABLE **1**

Description of Hospital Type, Age, and Samples With ACBM

Hospital	Type	Age of Hospital	No. of Bulk Samples Collected	No. of Samples With ACBM	% of Samples With ACBM
U	Public	43	5	5	100.0
Y	Public	†	6	5	91.6
A	Private/public	53	18	16	88.8
I	Public	†	7	6	85.7
P	Public	†	5	4	80.0
L	Public	66	7	5	61.2
K	Public	52	6	3	50.0
R	Public	32	16	7	43.7
G	Public	†	7	3	42.8
T	Public	52	5	2	40.0
X	Public	61	5	2	40.0
J	Public	142	10	3	30.0
N	Public	220	8*	2	25.0
O	Public	114	8*	2	25.0
H	Public	52	10	2	20.0
E	Public	68	7	1	14.3
B	Private	90	4	0	0.0
C	Private	83	1	0	0.0
D	Private	47	2	0	0.0
F	Private	61	3	0	0.0
M	Public	43	3	0	0.0
S	Public	116	3	0	0.0
Q	Public	169	3	0	0.0
V	Public	81	7	0	0.0
W	Public	9	3	0	0.0
Z	Public	146	1	0	0.0

† Age not known.
* Both hospitals share the same boiler room from which samples were collected.

tive asbestos-related diseases include asbestosis, pleural plaque, diffuse pleural thickening, and rounded atelectasis. The cancers most strongly and consistently associated with asbestos are lung cancer and mesothelioma. Significant exposure to any type of asbestos may increase the risk of lung cancer, mesothelioma, asbestosis, and other nonmalignant lung and pleural disorders (IARC, 1998), although potency is considered to vary by the specific type of asbestos (Berman & Crump, 2008; Stayner, Kuempel, Gilbert, Hein, & Dement, 2008). Occupational exposure to asbestos could be responsible for 5%–20% of lung cancers and 80%–90% of pleural mesothelioma in men in industrialized countries. The risk of cancer is positively associated with cumulative exposure. It is assumed that there is no threshold below which no increased risk of respiratory cancer exists (ATSDR, 2001).

Hospital services in Jamaica are provided through specialist and general facilities. Hospitals in the public sector fall under the jurisdiction of the Jamaican Ministry of Health (JMOH) and are administered by four Regional Health Authorities. Hospitals are classified as type A, B, or C according to the level of service and the size of the population served. Type A hospitals are the most technologically advanced and serve as referral points for secondary and tertiary services. Some public hospitals provide specialist care and private hospitals are also available (Jamaica Ministry of Health, 2007).

Asbestos has been used in buildings in Jamaica in the past and two asbestos-cement product manufacturing plants operated there during the period of 1965–1985. Hospital records and postmortem reports have cited seven cases of deaths due to asbestos-related diseases (two cases of asbestosis and five cases of mesothelioma) on the island. Five deaths are also suspected to be caused by exposure to asbestos (Reid & Kahwa, 1995; University Hospital of the West Indies, 2007a, 2007b).

In 2004 JMOH asked the Sparkman Center for Global Health (SCGH) at the University of Alabama at Birmingham (UAB) to assist with training of employees to manage the asbestos problem in hospitals, following the identification of asbestos in some hospitals (Kahwa & Reid, 1994). The SCGH agreed to fund both the training and a study to identify the magnitude of the problem and to determine if employees were exposed to airborne asbestos across all major hospitals in the country (N = 30). We hypothesized that the presence of asbestos in hospital buildings was associated with the age of hospitals. Our objective was to identify ACBM, its characteristics, and its determinants in Jamaican hospitals. We also envisioned that the project could develop information that could be utilized as a basis for designing training and other appropriate interventions for asbestos control or abatement in the hospitals concerned.

Materials and Methods

Walk-Through Survey

A walk-through survey of all hospitals was undertaken to determine which hospitals had ACBM. Building records for hospitals were not available. Hospital buildings were inspected for surfacing materials, TSI, and miscellaneous materials. Detailed protocols for initial steps for the ACBM survey, survey procedures for sprayed or troweled-on surfacing materials, and survey procedures for pipe and boiler insulation were utilized (The Environmental Institute, 2004). The current condition of each instance of suspected ACBM found was recorded as "good," "minor damage or deterioration," or "poor" and the potential for future damage, disturbance, or erosion for both asbestos-surfacing material and pipe and boiler insulation was assessed as "low" or "high" as defined in the protocol.

We assessed the potential for fiber release in hospitals identified with suspected asbestos. To do this, an evaluation of the suspected ACBM's condition and physical characteristics was performed and the location noted. The evaluation focused on two parameters: current condition of ACBM and potential for future

disturbance, damage, or erosion of ACBM. If water or physical damage, deterioration, or delamination was evident, then fiber release was presumed to have occurred, was occurring, or was likely to occur. The appearance of the material and the presence of broken or crumbled material on a horizontal surface indicated fiber release (The Environmental Institute, 2004).

Collection and Testing of Samples

Bulk samples of insulation and other building materials were collected from 26 (87%) of the 30 hospitals using U.S. EPA procedures (Leidal, Busch, & Lynch, 1977). Bulk samples were collected from 21 public, four private, and one private/public hospital. No samples were collected from four hospitals as they were smaller and had more modern facilities and did not have boiler rooms and sterilizing facilities that required insulation with materials such as asbestos.

We collected 1–10 cubic centimeters (cc) of the suspected insulation/building material and packaged it for shipment to the laboratory using an approved protocol (The Environmental Institute, 2004).

A total of 152 bulk samples was collected. Each sample was labeled to indicate date of collection, hospital, type of sample, and location. The chain of custody form provided by the laboratory was completed for each sample. The samples were shipped to Safety Environmental Laboratories, Inc., in Birmingham, Alabama. This laboratory is accredited by the American Industrial Hygiene Association (AIHA) for analyzing bulk samples utilizing polarized light microscopy (PLM). The analysis procedure was that of the U.S. EPA 600/R-93/116 Method (U.S. EPA, 1993). This method identifies the type and percentage of asbestos fibers and other materials present in each sample. The range for the method is 1% to 100% asbestos and the estimated limit of detection (LOD) is <1% asbestos.

Other information recorded included age of hospital, location of boiler room (attached to hospital or detached), type of HVAC, number of beds, location of hospital (rural/urban), and type (A, B, or C). Each hospital was assigned a letter of the alphabet as a code.

The protocol for this study was approved by an Institutional Review Board at UAB, the Ethics Committees of the JMOH, and the University of the West Indies/University Hospital of the West Indies (UWI/UHWI).

TABLE **2**

Distribution of Hospitals by Type and Percentage of Fiber in Samples With ACBM

Hospital	Type of Fiber in ACBM					
	Samples With Chrysotile		Samples With Amosite		Samples With Crocidolite	
	No.	% of Fiber in Sample	No.	% of Fiber in Sample	No.	% of Fiber in Sample
A	2	25	14	15–30	–	–
E	1	5	–	–	–	–
G	3	40	–	–	–	–
H	2	60	–	–	–	–
I	1	30	6	25–40	–	–
J	3	25–50	–	–	2	10
K	–	–	3	40	–	–
L	3	15–50	2	25	–	–
N*	2	50	–	–	–	–
O*	2	50	–	–	–	–
P	–	–	4	20–30	–	–
R	3	20–40	7	20–75	–	–
T	–	–	2	20	–	–
U	–	–	5	75	–	–
X	1	10	2	20–40	1	5
Y	1	35	4	75	–	–

* Both hospitals shared the same boiler room in which ACBM was found.

Results

The median number of beds per hospital was 101 (range: 30 to 1,200). The date of construction could not be ascertained for four hospitals. For the 23 hospitals with information on year built the range was 1776 to 1997. The median age of the hospitals was 63.5 years (range: 9 to 220).

Sixteen (61.5%) hospitals had ACBM (Table 1). Overall, 67 or 44% of the samples tested positive for ACBM. The percentage of samples with ACBM per hospital ranged from 14.3 for Hospital E to 100 for Hospital U. The largest number of samples was taken from Hospital A, and 89% of the 18 samples contained ACBM. Hospital R was next in terms of number of samples (16), and 44% of the samples tested positive for ACBM. The age of 12 hospitals with ACBM was known. No association occurred between the age of the hospital and the ACBM found.

In the vast majority of cases, the asbestos found was used as TSI on boilers and pipes; in one case asbestos was used as TSI on the ceiling of a boiler room; while in another case asbestos was a part of the roof of an incinerator. More than 95% of the time the ACBM found was friable and in a poor condition indicative of fiber release. The ACBM found could not be quantified. No ACBM was found in areas occupied by patients or most employees. ACBM was found in areas occupied by maintenance workers and some laundry workers.

Three types of asbestos—chrysotile, amosite, and crocidolite—were found in the hospitals (Table 2). Chrysotile was the fiber type found at most hospitals. It was found in 12 or 75% of the hospitals with ACBM but only in 24 or 36% of the samples collected. Amosite was found in fewer hospitals than chrysotile but was present in most samples, 49 or 73%. Crocidolite was found in a few samples in a few hospitals. The percentage of chrysotile in the samples ranged from 5% to 60%; for amosite it was 15%–75%; and for crocidolite it was 5%–10% (Table 3). Some samples contained more than one fiber type. One sample taken at Hospital X contained all three types of asbestos.

Several other materials were found in the bulk samples. Thirteen (50%) hospitals had fiberglass in the samples collected, with the range across hospitals being 5%–100%, and at seven of the hospitals samples consisted entirely of fiberglass. Mineral wool was found in samples from eight hospitals and cellulose was found in 14 samples.

TABLE **3**

Summary Data on Each Type of Asbestos Fiber in Samples From 16 Hospitals

Type of Fiber	Hospitals		Samples		Range of % of Fiber in Samples
	No.	%	No.	%	
Total	16	100	67	100	–
Chrysotile	10	63	49	73	5–60
Amosite	12	75	24	36	15–75
Crocidolite	2	13	3	4	5–10

More than 50% of hospitals had calcium and carbonate minerals in samples analyzed. Binder, synthetic fibers, and other materials were also present in samples from some hospitals.

Discussion

Our study was the most comprehensive investigation for ACBM carried out at Jamaican hospitals to date. We were unable to quantify the amount of asbestos present in the hospitals or to estimate the amount that had disintegrated from boilers and steam transmission lines. The quantification of ACBM in the hospitals would serve to put the magnitude of the asbestos problem in perspective. The unavailability of a local laboratory for PLM analysis prevented the collection of more samples from some hospitals as the cost for overseas analysis proved prohibitive. The use of an accredited lab in this study, however, was positive. The unavailability of hospital building records could have led us to miss areas in some hospitals with asbestos as usually building records indicate the type of materials and the location where they were utilized during construction.

The results from the analysis of bulk samples indicated potential risk of asbestos exposure in Jamaican hospitals. More than half of the hospitals investigated were found to have one or more of the three principal asbestos fibers: chrysotile, amosite, and crocidolite. Chrysotile was the type most commonly found at the hospitals. This was not surprising given the fact this type of asbestos is found in more than 90% of ACBM found in buildings in the U.S. and elsewhere (ATSDR, 2001). ACBM has been found in other hospital buildings in the Caribbean and North America (Caplan, 1985; Crandall & Fleeger, 1989; Johnson, 1979) and in those cases investigations were done to determine the asbestos fiber concentration in the air.

In most hospitals where asbestos was found it was used as TSI for boilers and steam pipes, which have long become derelict and abandoned and serve no useful purpose. We recommend immediate removal and safe disposal of the ACBM from structures that have long become obsolete. In one case ACBM was found on boilers in an abandoned boiler house at one hospital and at another hospital an old boiler with ACBM was abandoned in the yard. These two situations have implications for community exposure if asbestos fibers were to become airborne.

At two of the largest hospitals, most of the ACBM was found in boiler rooms and on steam pipes that were functional. In these cases the asbestos, if not already disintegrated, was serving a useful purpose but given the general poor condition of the ACBM indicative of fiber release, the authorities should institute a management program to prevent potential future exposures. In these two hospitals suitable alternative insulation material should be procured for use in the boiler rooms and on steam pipes.

In 1986, the Occupational Safety and Health Administration (OSHA) established the current permissible exposure limit (PEL) for asbestos in the workplace of 0.1 fibers/cc of air. PELs are an allowable exposure level in workplace air that are averaged over an eight-hour shift of a 40-hour workweek. OSHA also set an excursion limit of 1.0 fiber/cc of air as average over a sampling period of 30 minutes (ATSDR, 2001; Occupational Safety and Health Standard, Toxic and Hazardous Substances: Asbestos, 1988). Pursuant to the Clean Air Act of 1970, U.S. EPA established the Asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP). It is intended to minimize the release of asbestos fibers during activities involving the handling of asbestos. It specifies work practices to be followed during renovation, demolition, and other abatement activities when friable asbestos is involved (U.S. EPA, 2009a; U.S. EPA, 2009b). The JMOH has adopted OSHA's PEL for asbestos. The National Environment and Planning Agency (NEPA), an agency of the government, developed a "Proposed Asbestos Management Policy for Jamaica (NEPA, 2002)." This document contains provisions similar to those set out in the NESHAP inclusive of prohibiting importation of ACM, improving inventory systems for ACM, a phased elimination of friable ACM, a code of practice for safe handling, transportation, and disposal of ACM, public awareness, and training. The policy stipulates a clearance level for asbestos fiber concentration in air of 0.01 fibers/cc and an action level of 0.1 fibers/cc. The provisions of this policy are being used to guide asbestos abatement programs in the country but have not been formally promulgated.

Conclusion

Air monitoring for asbestos fibers in all hospitals with deteriorating ACBM is recommended to determine if hospital workers are exposed to asbestos fibers and more importantly if the exposure exceeds the PEL for asbestos of 0.1 fibers/cc of air. The posting of appropriate warning signs would serve as a good reminder to prevent unauthorized or accidental entry into areas where asbestos is present. The hospital authorities should formulate and implement an asbestos policy for hospitals and undertake the requisite management of asbestos in all affected hospitals.

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United States Import Safety, Environmental Health, and Food Safety Regulation in China

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Abstract **China boasts a rapidly growing economy and is a leading food exporter. Since China has dominated world export markets in food, electronics, and toys, many safety concerns about Chinese exports have emerged. For example, many countries have had problems with Chinese food products and food-processing ingredients. Factors behind food safety and environmental health problems in China include poor industrial waste management, the use of counterfeit agricultural inputs, inadequate training of farmers on good farm management practices, and weak food safety laws and poor enforcement. In the face of rising import safety problems, the U.S. is now requiring certification of products and foreign importers, pursuing providing incentives to importers who uphold good safety practices, and considering publicizing the names of certified importers.**

Research Questions and Methods

Imports—including imports of food—comprise an important aspect of the U.S. economy; the country's manufacturing and processing industries are increasingly dependent on imports to meet the rising demand for goods among U.S. consumers. In particular, the volume of U.S. seafood and aquaculture imports has significantly increased as consumer demand continues to rise. According the National Oceanic and Atmospheric Administration, the volume of seafood imports in the U.S. has more than doubled during the past 10 years (National Oceanic and Atmospheric Administration, 2006). Part of this increase has consisted of Chinese seafood products. As of 2007, 100% of basa consumed in the U.S. was imported, and 80% of those imports came from China; meanwhile, approximately 2% of catfish consumed in the U.S. was imported, 99% of which was of Chinese origin (Bottari, 2007). The U.S. currently imports more aquaculture products than it exports. Several recent Food and Drug Administration (FDA) import alerts have raised concerns about the safety of globally traded Chinese seafood (Solomon, 2007). The acknowledgement of safety concerns regarding imports on which the U.S. is already dependent reveals a significant trade-policy dilemma. On the one hand, it is the obligation of the U.S. government's regulatory agencies and the nation's food importers, food processing facilities, and retailers to protect consumers from hazards that may be present in imported seafood products, including aquaculture products from China; on the other hand, sustaining and satisfying the U.S. food industry and American consumer demand requires a continuous supply of seafood imports, including those from China. This dilemma leads to the following fundamental questions:

- What are the sources of environmental health and food safety problems in the Chinese aquaculture industry?
- What steps have been taken by U.S. and Chinese authorities to protect consumers?

To answer these questions, we employed a systematic and multidisciplinary research approach. This involved an in-depth review of government documents (including, but not limited to, U.S. congressional hearings, import safety data, and laboratory test results), conference presentations by experts at the interface of food safety and environmental health, and a number of published studies. In addition, interviews were conducted with government officials from such agencies as FDA and Customs and Border Protection.

Analysis and Discussion: U.S. Import Safety and Chinese Aquaculture

International trade in food, plants, animals, and animal products can transmit infectious disease agents and toxic chemical contaminants across nation-state borders. Increased globalization of the food supply has led to the introduction of new foods, food handling practices, and dietary habits into different regions. Regional food safety problems have increasingly become globalized problems; food safety problems that were once confined to certain regions can now be felt thousands of miles away (Lang, 1999). This globalization has resulted in the emergence and reemergence of foodborne disease outbreaks and incidents of food contamination in different regions of the world. Effective and timely management of such food safety problems requires rapid international exchange of information. Global cooperation between

governments is crucial to the timely identification, prevention, or control of emerging food safety problems.

The U.S. has for a long time grappled with safety problems involving imported food, drugs, and raw materials for industries. Recent policy issues involving China include a March 15, 2007, nationwide recall involving several brands of pet food in the U.S. This recall was prompted after pet food caused several illnesses and deaths in cats and dogs. In this incident, contaminated raw material imports from China were used in the manufacture of animal feed. The raw materials were tainted with an industrial chemical—melamine—used in the manufacture of plastics (Associated Press, 2007; Food and Drug Administration [FDA], 2007a). In another incident in June 2007, 52 people in 17 states fell ill after eating a snack produced by an American company. The snack—Veggie Booty—was produced by using contaminated raw materials from China. The raw materials contained pathogenic *Salmonella* bacteria (Reuters, 2007). These are just a few of the problems that U.S. consumers, regulatory authorities, and companies have faced regarding the safety of imported Chinese food products and raw materials.

For decades, health officials have encouraged increased fish consumption due in part to the health benefits associated with omega-3 fatty acids found in seafood, and the U.S. has increasingly imported aquaculture products to meet rising demands for fish. As mentioned earlier, a large proportion of U.S. aquaculture imports come from China. China in particular, however, has been a source of aquaculture-related health concerns. In March 2007, FDA issued an import alert against Chinese aquaculture imports. This was due to the presence of excessive antimicrobial chemical contaminant residues—most of which are banned for use in food in the U.S. An import alert was issued against imports of catfish, dace, eel, shrimp, and basa (Weiss, 2007). An import alert is a publicized caution alerting regulatory authorities and inspectors to be on the lookout for shipments of goods deemed to be in violation of import regulations. Violations may be technical or safety related; they may involve improper labeling, excessive levels of microbial or chemical contaminants, contravention of endangered-species laws, violations of the country of origin's regulations, shipments containing animal or plant products from countries with outbreaks of infectious animal or plant diseases, and so forth. An import alert enables regulatory authorities to target and intercept violating import shipments at U.S. ports of entry before they enter the American market.

Regulatory authorities typically test for contaminants, which on the basis of risk analysis and experience they believe they will likely encounter in imported food or raw materials. Unfortunately, however, several safety problems encountered in the international trade in food and raw materials (e.g., melamine in wheat gluten from China used in pet food, antibiotics in aquaculture products from China, the United Kingdom's discovery of Sudan III dyes in chilies from India in 2003, etc.) involve contaminants that regulatory authorities and food testing laboratories *did not and arguably could not anticipate*. In such cases, hazards present in imported food and raw materials come to light after they have caused illnesses and in the worst cases, deaths. Consequently, management of food safety issues in international trade is often performed on a reactionary rather than a preemptive basis. This approach is concerning when one considers the growing magnitude of globally traded agricultural and food products including seafood.

In the midst of rapid growth in international trade, China has emerged as the largest food exporter in the world and the third-largest exporter of food to the U.S. The country dominates international food markets with exports of fruits, vegetables, and seafood. Chinese dominance in international trade in food has been clouded by increases in safety problems in food destined for both export markets as well as domestic consumption (Ellis & Turner, 2008). In the light of current increased global food trade between the U.S. and China and increased safety problems associated with products from China, our study explores (a) the sources of environmental health and food safety problems in the Chinese aquaculture industry and (b) steps taken by the U.S. and Chinese regulatory authorities to protect consumers from contaminants in aquaculture imports.

Sources of Environmental and Food Safety Problems in the Chinese Aquaculture Industry

China boasts a rapidly expanding economy that is heavily dependent on industrial and agricultural growth for its development; it has over 700 million small- and large-scale farmers spread across 300 million hectares of farmland (Dong & Jensen, 2007). According to the 2009 *International Energy Outlook Report*, China currently stands as the largest food exporter in the world, and the country attracts large direct foreign investment through transnational corporations (U.S. Energy Information Administration, 2009). China was the world's largest producer of aquaculture products in 2004, producing 91 billion pounds of seafood, or 70% of the world's output in seafood (Ellis & Turner, 2008). In 2007, China's output in seafood declined to 72 billion pounds due in part to increased rejection of its seafood exports by various countries; officials documented excessive levels of chemical contaminants in Chinese products.

China's development model requires heavy energy and natural resource use, both of which contribute to environmental degradation. More than 90% of China's urban-area rivers are polluted (Jiang, 2009). Heavy use of coal as a source of energy in China's processing industries and power plants has caused marked pollution of air, land, and water bodies. This affects the aquaculture industry, which is heavily dependent on inland waters for fish farms. In 2005, the Netherlands-based Robobank International detailed some of the environmental pressures on Chinese fish farms. The report noted that "China's serious water pollution issues resulting from industrial and urban sewage, inadequate quality control systems, use of illegal chemicals to fight fish diseases, and poor regulatory enforcement (Shapley, 2007)" as some of the major problems facing the Chinese aquaculture industry. The issue of environmental management was also echoed by Ding Xiaoming, the director of China's Aquaculture and Fisheries Bureau. Speaking to journalists at an interview, he acknowledged that "[w]ater quality is a top issue facing Chinese aquaculture," and that "without good water quality, Chinese aquaculture cannot develop (Barboza, 2008)." Poor environmental waste

management is one source of problems in the Chinese aquaculture industry; poor sewage and chemical waste disposal results in the contamination of feeding grounds for fish. Beveridge and co-authors explored the relationships between demands for environmental resources and their impacts on the environment. Aquaculture is carried out in ecologically open regions and is highly dependent on resources from the environment; increases in demand for natural resources can negatively impact the environment (Beveridge, Phillips, & Macintosh, 1997). Inland aquaculture uses local surface or ground water, and the resulting waste—food remains and fecal matter—is confined to the ponds (except during harvesting). This accumulation of waste degrades water quality in fish ponds, resulting in the rapid growth of bacteria and other pathogenic microorganisms. These, in turn, cause disease in fish. Farmers often turn to antibiotics, antifungal agents, and other veterinary drugs, which they apply to fish ponds to control disease.

The safety of Chinese aquaculture products is further compromised by counterfeiting and use of unapproved or banned chemicals; these practices have spread across every sector of the Chinese economy. According to Xinhua, the Chinese state news agency, China uses about 1.2 million tons of pesticides on approximately 300 million hectares of farmland (Li, 2006). According to studies from the Chinese Academy of Sciences, 11 coastal cities in the Pearl River Delta are heavily contaminated with pesticides such as DDT, which was banned by China in 1983 (Guo, Yu, & Zeng, 2009). Statistics from official Chinese agencies show that the country produces about 300 types of pesticides and about 800 additional pesticide mixtures. Alarmingly, an estimated 20% to 40% of all pesticides and chemicals produced in China are counterfeits. This is troublesome for global health when one considers that "[i]n 2005, China produced 1,039,000 tons of pesticides and exported 428,000 tons (Yang, 2007)." According to Xinhua, the pesticide system is so complicated that "even agricultural experts hardly are able to identify the actual product (Xinhua News Agency, 2007)."

In the early 1980s, Chinese agricultural officials and local governments began to advocate the use of chemical fertilizers and pesticides to improve yields; the officials received incentives for promoting use of fertilizers and pesticides. Many Chinese farmers often use excessive pesticides to increase their farm output partly because they are not educated on proper application procedures, and partly because of the questionable authenticity of the chemicals and fertilizers. In other cases, unsuspecting farmers buy counterfeit fish medications and use them on fish farms. Counterfeit medication may contain anything from toxic chemicals to carcinogenic substances; some lack the active ingredients necessary for treating fish, leading to increased use of different chemicals. When used in fish farms, the chemicals contaminate the fish feeding environment, accumulate in fish, enter the food chain, and are eventually consumed by humans. Approximately 7% of China's arable farmland is heavily polluted because of excessive use of chemicals and fertilizers. Furthermore, aquaculture operations face significant threats from the runoff of agricultural chemicals and fertilizers used on farms, as most aquaculture farms use inland rivers as their source of water. Some factories dump contaminated effluent directly into waterways used for crop irrigation and fish farming (Zamiska & Spencer, 2007).

A 2004 China marine environment report provides insight into the extent of environmental pollution in China's rivers. According to the report, about 2,480,000 tons of pesticides flow into China's Zhu River each year. This has seriously polluted rivers and coastal waters in the province of Guangdong, resulting in large deposits of oil and heavy metals like lead, arsenic, mercury, and copper (Yang, 2007).

Many agricultural chemicals sold and used in farms are poisonous. An estimated 30% of the total pesticides consumed with food in China are highly toxic, and about 53,300 to 123,000 Chinese citizens are poisoned annually by pesticides (Organic Consumers Association, 2003). The country's ability to protect the safety and quality of its food production has continuously been held back by a "weak legal, political, and regulatory infrastructure," a strong protectionist approach favoring local industries, weak enforcement of existing food safety laws, a "lack of product liability laws," and lax monitoring of food products due to the large numbers of industries and farms involved in the processing and trade of food products. China's judicial system also lacks independence, making it difficult to protect "whistleblowers (Ellis & Turner, 2008)."

Health Protection Steps Taken by Regulatory Authorities in the U.S. and China

The U.S. boasts a multiagency (and, admittedly, complicated) network of agencies responsible for food policy, including food safety and trade policy. The U.S. Department of Agriculture (USDA) is the federal executive department responsible for developing and executing policies on farming, agriculture, and food; it aims to promote agricultural production, commerce, the safety of meat and poultry products, protection of natural resources, and the end of hunger in the U.S. and abroad (U.S. Department of Agriculture, 2004).

FDA is responsible for scrutinizing the safety of most food and medical products consumed in the U.S. FDA works with state and local regulatory agencies to carry out in-plant inspections that focus on product safety, food plant hygiene, economic fraud, and so forth to ensure regulatory compliance. FDA also maintains a database of foods being imported. From this database, it selects those that are to be sampled for laboratory analysis. The selection of samples for analysis is based on an evaluation of the hazards associated with the product and their likelihood (or risk) of occurrence. Analyses include, but are not limited to, checks for hazards such as pathogens, residues of banned veterinary drugs, chemicals, pesticides, toxins, and unapproved food additives (FDA, 2007b).

Courtesy of new legislation approved in 2002—The Public Health Security and Bioterrorism Preparedness and Response Act (Bioterrorism Act)—FDA is authorized to detain suspect imported food shipments at U.S. ports of entry until they are tested and cleared for consumption. The agency can also refuse the entry of any contaminated food or drugs into the country. FDA carries out periodic inspection of food processing facilities in the U.S. to ensure that they comply with regulations; however, this is not always the case with foreign food processing facilities whose products are also sold in this country.

FDA does not have jurisdiction over foreign processing facilities; its actions are limited to ensuring that nonconforming food products or drugs imported from other countries do not gain entry into the U.S. market. The FDA's activities regarding regulation of imports, including seafood imports, have primarily been limited to the ports of entry. To be sure, visits to foreign processing facilities (during FDA foreign inspections) are conducted, but foreign facilities that process food products destined for the U.S. market may, at their discretion, refuse to allow FDA personnel to inspect their facilities. FDA's inspection of foreign facilities is not limited to only jurisdictional issues; the agency also lacks sufficient funds and manpower to carry out frequent inspection of foreign agricultural and food operations. Of all food imports in the U.S., FDA inspects about 1.93% at the ports of entry; about 2% of these undergo further sampling and laboratory analysis (Bottari, 2007). While FDA often carries out biennial inspection of domestic food and drug establishments, such routine inspections of foreign food and drug establishments would be difficult due to the agency's limited resources. With its existing human resources, it would take the FDA 13 years to carry out a one-time inspection of all foreign food and drug establishments. For the 2007 fiscal year, the U.S. government allocated $10 million for foreign inspection services, while in the 2008 fiscal year $11 million was allocated. These funds are far below what is needed to carry out sufficient inspection of foreign food and drug establishments, as one analysis estimates that inspection of foreign establishments would cost close to $70 million per year (Crosse, 2008).

The government of the People's Republic of China monitors Chinese food safety trends in two major ways—through the Nationwide Food Contamination Monitoring Network (NFCMN), and the *Total Dietary Study*, which is similar to the U.S. *National Health and Nutrition Examination Survey* (NHANES). The NFCMN operates in 17 provinces and is mainly concerned with monitoring the levels of contaminants in food—with the aim of early detection for emergency response (Ellis & Turner, 2007). Chinese food exports have occasionally been found to contain unapproved chemicals or approved chemicals at concentrations above the maximum residue limits set by importing countries. A large percentage of Chinese aquaculture exports to the U.S., the European Union, and Japan were rejected in 2007 due to excessive levels of unapproved antimicrobial residues. An import alert issued by FDA in 2007 on Chinese aquaculture and seafood resulted.

The Chinese government has, according to some, been swift and firm in its action against farmers suspected of using unapproved drugs. In its efforts to secure the safety of the nation's food, the government faces difficulties in constantly inspecting small-scale Chinese farmers. This is due to the large numbers and wide geographical distribution of fish farms, as well as the ongoing problems of corruption and deceit.

During an effort to reign in the aquaculture industry, Chinese government blacklisted seafood processors and revoked licenses of companies found to have exported food tainted with illegal drugs or banned substances (Barboza, 2008). Chinese authorities also closed down shoddy aquaculture operations and tightened regulations against the use of banned antibiotics in aquaculture. The Chinese government has also begun to pursue policies that encourage consolidation and standardization of farms (Ellis & Turner, 2007), and the government has adopted new policies including, but not limited, to the following:

- establishment of mechanisms to enable the traceability of products through keeping of farm records and encouraging the use of third party certifiers;
- a ban on the use of toxic and unapproved chemicals in food;
- the blacklisting of seafood processors and revocation of licenses of companies that export food tainted with illegal drugs or banned substances;
- establishment of the testing of end products for residues of unapproved chemicals and drugs; and
- newly drafted food laws: the Food Hygiene Law and the Food Safety Law, drafted by the Ministry of Health; and the Law of Quality and Safety for Agricultural Products, drafted by the Ministry of Agriculture.

The food safety law submitted to the People's Republic of China's legislative body in 2007 clarified specific responsibilities of government bureaus at all levels. The aim was to ensure no overlap in responsibility of different bureaus that deal with food safety issues while also fostering a culture of accountability. The new laws specified that the responsibility of food safety issues rested with the government's Ministry of Health, and mandated higher fines for violators as well as penalties for officials who fail to enforce the laws. The laws permitted publication, via the Internet, of important food safety issues, about which the public-at-large and interested parties could provide feedback.

While China has been busy repairing its image (compromised by repeated and embarrassing instances in which Chinese contaminated products have entered international markets), the U.S. has continued to adopt additional strategies to protect consumers from such products. In July 2007, President George W. Bush issued an executive order establishing an interagency working group on import safety. The group was charged with the task of reviewing import safety problems and making recommendations for actions to address them. Speaking at a press conference on November 6, 2007, after receiving recommendations from the group, President Bush referenced 14 recommendations including the establishment of new incentives for importers that adhere to robust food safety practices and demonstrate good track records, a reinvigoration of training of inspectors in foreign countries, as well as increases in penalties for violation of U.S. import laws and regulations (Interagency Working Group on Import Safety, 2007). In the report, FDA unveiled a plan addressing both imported and domestically produced food. The plan aimed at increasing the capacity of FDA to coordinate with other federal agencies, to protect the U.S. food supply chain, prevent safety problems from arising in the first place, provide for effective responses to emerging food safety problems, and facilitate communication with the industry and the public.

The plan presented a 50-step road map for improved consumer protection. Recognizing the formidable challenge presented by high volumes of imports, the plan proposed a risk-based strategy that allocates import safety resources according to hazards (Interagency Working Group on Import Safety, 2007). It also recommended replacement of "snapshot" safety inspections at the borders with new inspection models that identify and target imports posing the greatest

risks and directing resources to these areas. The proposed approach in managing import safety will, it is hoped, prevent contaminated products from reaching consumers. Below are summaries of recommendations from the interagency working group (Interagency Working Group on Import Safety, 2007):

- authorize FDA to require producers of high-risk foods from certain countries to certify that their products conform to regulations;
- introduce a voluntary certification for foreign manufacturers, to help U.S. inspectors expeditiously clear for importation products from certified importers;
- provide incentives to importers who uphold higher safety practices for high-risk products;
- establish information sharing agreements with foreign governments, to facilitate the timely exchange of import- and recall-related data;
- publicize names of certified producers and importers in order to increase transparency, and enlighten consumers and distributors so they are able to make informed decisions on the safety of products; and
- require FDA to recall adulterated or contaminated products from the market.

The report stressed the value of increasing the presence of U.S. inspectors in foreign countries, enhancing standards of inspection, and strengthening penalties for violators. U.S. inspectors stationed overseas would work with foreign governments to train and enhance capacity of foreign inspection agencies. This step would ensure conformity to U.S. safety standards and reduce inspection workloads at ports of entry. The report recommended that import safety and inspection agencies be given the capacity to enhance their standards by taking into consideration industry best practices; this would leverage the knowledge and understanding of those who best know how the products are made.

The interagency working group presented President Bush with a strategic framework detailing immediate steps to be taken by federal agencies to speed up their participation in a computerized "single window system" for electronically reporting imports to facilitate the exchange of information among and between U.S. governmental agencies and those of exporting countries. The group's action plan also recommended that FDA be given the authority to recall adulterated or contaminated products in cases where the affected food posed a significant threat to life; such authority would be especially valuable in cases where implicated firms refuse to carry out voluntary product recalls (Interagency Working Group on Import Safety, 2007). Historically, food companies have been encouraged to carry out voluntary product recalls, and FDA has not possessed legal powers to withdraw defective products from the market.

TABLE **1**

Summary of the Factors Contributing to Chinese Environmental and Food Safety Problems

- Poor environmental and waste management practices by the wider industrial sector
- Improper aquaculture farm management practices
- Excessive application of agricultural chemicals and fertilizers leading to contamination of water bodies, a source of water for aquaculture operations
- Counterfeiting operations resulting in the substitution of toxic chemicals and/or substances without active ingredients for genuine aquaculture chemicals, compounded by the inability of farmers to distinguish fake chemicals and farm inputs from genuine ones
- Lack of education regarding proper chemical application procedures on aquaculture farms
- Lack of product liability laws
- Laxity of government and food safety regulators to develop and enforce food safety regulations and to monitor regulatory compliance
- Weak civil society and judiciary systems, making it difficult to pursue and prosecute violators

Conclusion

Our study identified several factors contributing to environmental and food safety problems in China's aquaculture industry. Table 1 is a summary of factors contributing to Chinese environmental and food safety problems. Although FDA and China have indicated concerns about contaminated food exports, substandard Chinese products continue to reach U.S. markets (Acheson, 2007). Meanwhile, the U.S. has pursued policies to protect itself from streams of contaminated imports that have been showing up at its borders. The U.S. is pursuing a new inspection approach that involves "pushing the borders back" and putting in systems to prevent contaminated shipments from reaching U.S. ports of entry in the first place. This inspection approach involves working with other countries' (including China's) governments to ensure that food products exported from those countries are inspected and certified before being shipped to the U.S. This inspection approach differs from traditional approaches in which inspection, sampling, and testing of products occurs only at ports of entry.

In its effort to effectively manage inspection of imported products, in January 2009 the U.S. government invigorated the process of deploying FDA inspectors to foreign countries to provide training of foreign inspectors and to assist with inspection of products destined for the U.S. (American Veterinary Medical Association, 2009). FDA was also authorized to require producers of high-risk foods in certain countries, under agreement with those countries, to certify and clear products for export to the U.S.

The U.S. is currently involved in a larger process of certifying foreign food manufacturers; this certification process allows importers who comply with import regulations to be granted expedited clearance at U.S. ports of entry, while importers in continuous violation of food safety regulations receive more scrutiny from the FDA and customs officials before their products are allowed into the U.S.

The U.S. government is also considering information sharing agreements with foreign governments and within its own agencies. It is hoped that this will facilitate exchange of a range of information, including recall data. The information would enable U.S. Customs and Border Protection officials and other governmental agencies to obtain data on product safety, import transactions, and so forth. This step would enable them to make timely

decisions on whether to accept imports, reject imports, recall unsafe products, or advise consumers on certain products.

The U.S. government is also considering providing incentives to importers who uphold higher safety practices for high-risk products. The U.S. government intends to publicize the names of certified producers and importers so as to increase transparency and consumer awareness.

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Potential Health Hazards for Students Exposed to Formaldehyde in the Gross Anatomy Laboratory

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Abstract **Formaldehyde, which has been a well-established preservative for cadavers in the anatomy laboratory for years, has an odor that many anatomy students find unpleasant. Anatomy faculty and students, embalmers in funeral homes, histopathology laboratory workers, and other biological researchers are continually exposed to the toxic vapors of formaldehyde. The immediate effects of that agent are nausea, headache, and ocular irritation that causes tear overflow and a burning sensation in the throat. Long-term exposure to formaldehyde can cause contact dermatitis, congenital defects, and cancer. This article discusses the adverse effects of continual exposure to formaldehyde and formalin and suggests various measures that can eliminate or minimize that danger to staff and students in gross anatomy laboratories.**

Introduction

Formalin, an aqueous solution of formaldehyde, is the chemical most commonly used for embalming. In 1867, the German chemist August Wilhelm von Hofmann identified formaldehyde, which is a colorless, flammable gas that is quite soluble in water. Formaldehyde is colorless at room temperature and has an irritating, pungent smell. It is commercially obtainable as formalin, which contains 37% by weight or 40% by volume of formaldehyde gas in water. In the body, formaldehyde quickly metabolizes to formic acid. The measurement of formate (formic acid minus 1 hydrogen ion) levels indicates the severity of formaldehyde intoxication. Formaldehyde is used extensively in the chemical, adhesive, paint, plastic, construction, textile, paper, and cosmetic industries; in the manufacture of pressed wood products (urea resins in plywood wall paneling, particle board, and fiber board); in fertilizers; in permanent press products and other textiles; in paper; and in glue (Bernstein et al., 1984). It is also formed during the burning of organic materials and is found in tobacco smoke (U.S. Environmental Protection Agency [U.S. EPA], 2011). The concentration of formaldehyde in the air is often expressed in terms of parts per million (ppm) (1 ppm = 1.248 mg/m^3).

A cadaver is embalmed via the infusion of chemical substances that include formalin (which contains formaldehyde), alcohol, glycerin, carbolic acid, and dye. Those substances have specific roles (e.g., preservation, denaturalization, solidification of tissue protein disinfection, and maintenance of the integrity of the anatomic relation), and they are usually infused via the femoral arteries or the internal carotid arteries (Coleman & Kogan, 1998). Thus anatomists, technicians in biological science laboratories, and anatomy students during their dissection course are continually exposed to formaldehyde. The level of exposure to that agent depends on the duration of time spent in the gross anatomy laboratory, the working conditions there, and the type of embalming performed (Pabst, 1987). In many cases, the level of exposure to formalin (and hence to formaldehyde) is sufficient to irritate the eyes and upper respiratory tract. Formaldehyde can also cause contact dermatitis, and it can produce acute toxic effects (Flyvholm & Menné, 1992).

The threshold limit value for formaldehyde is 0.3 ppm, which must never be exceeded (American Conference of Governmental Industrial Hygienists, 2001). The legal airborne permissible exposure limits are 0.75 ppm averaged over an eight-hour work shift and 2 ppm not to be exceeded during any 15-minute work period (Formaldehyde, Occupational Safety and Health Standards, 1998).

The recommended airborne exposure limits are 0.016 ppm averaged over a 10-hour work shift and 0.1 ppm not to be exceeded during any 15-minute work period (Agency for Toxic Substances and Disease Registry [ATSDR], 1999). The toxic effects of formaldehyde exposure can be classified as follows: irritation of mucous membrane, contact dermatitis, teratogenicity, and carcinogenicity (National Institute for Occupational Safety and Health [NIOSH], 2009).

Excessive formaldehyde vapor in the working area can be caused by a work environment that facilitates the spillage of formalin; poor condition of cadavers, which causes embalming fluid to leak; a high formaldehyde concentration in the air (>0.50 ppm) or in cadaveric tissues (0.22 ppm); poor ventilation in the dissection rooms; lack of strict and appropriate guidelines for handling embalmed cadavers and prosected specimens; or ignorance of consequences of formalin exposure (Balmes, 2004). In this article, common adverse effects caused by

continual exposure to formaldehyde are described, and methods of reducing the likelihood of that exposure are presented.

Discussion

During gross anatomy dissection, exposure to formaldehyde vapors and contact with formalin can cause adverse effects. Dissection and prosection are, however, essential parts of an education in anatomy. The acute effects of exposure can be caused by inhalation of formaldehyde vapors, which irritate the respiratory tract and eyes and cause lacrimation, burning of the nose and throat, dyspnea, and headache and can result in pulmonary edema and pneumonitis (Kurose, Kodera, Aoyama, & Kawamata, 2004). Some individuals are highly susceptible to the adverse effects caused by formaldehyde, but others have no reaction to the same levels of exposure (Mizuki & Tsuda, 2001). The most common adverse effects of exposure to formaldehyde are described below.

Skin Disorders

Formaldehyde is absorbed through intact skin and can cause severe irritation or allergic dermatitis. Formalin can cause white discoloration of the skin as well as burning, drying, cracking, blistering, and scaling of the skin. These skin disorders can occur after contact with formaldehyde at levels well below those of many formaldehyde workers. Other signs of exposure to formaldehyde include erythema, edema, and hives (Cotran, Kumar, & Collins, 1999). Exposure to liquid formalin or formaldehyde vapor can provoke skin reactions in sensitized individuals, even when airborne concentrations of formaldehyde are below 1 ppm (Charpin, Dutau, & Falzon, 2000). Exposure to formaldehyde gas can cause major allergic symptoms and exacerbate chemical sensitivities (Takahashi et al., 2007). The modification of tissue proteins by formaldehyde causes local toxicity and initiates allergic reactions, and repeated contact with formaldehyde can produce eczematous dermatitis.

Dermatitis can also be caused by contact with formaldehyde-treated clothing (Wartew, 1983). Formaldehyde resins are used in the textile industry to make clothing that is wrinkle resistant (e.g., permanent-press clothing), and those resins can release significant amounts of formaldehyde and cause contact dermatitis. Many preservatives used in cosmetics, pharmaceuticals, and industrial biocides also release formaldehyde. Students who have been diagnosed as having atopic dermatitis and allergic rhinitis are susceptible to the effects of formaldehyde exposure and can exhibit mucocutaneous symptoms caused by impaired barrier function and the remodeling of the skin and mucosa (Wantke et al., 2000).

Congenital Malformations

Formaldehyde is a proven teratogen in rats and mice (Hansen, Contreras, & Harris, 2005), in which it crosses the placental barrier and can affect the embryo (Thrasher & Kilburn, 2001). Participation in cadaver dissection is compulsory for students in most medical schools worldwide and for those in most physical therapy, occupational therapy, chiropractic, osteopathic, dental, and veterinary schools. Anatomy students who are pregnant should consult an obstetrician before attending the first gross anatomy laboratory and must take precautions to ensure minimal exposure to formaldehyde. The teratogenic effect of formaldehyde in humans is questionable owing to inconclusive, ambiguous study results (Taskinen et al., 1999), but the risk of congenital anomalies appears to be greater in women who experience symptoms from organic solvent exposure (Khattak et al., 1999).

Ocular Irritation

Formaldehyde is corrosive to the eyes. Formaldehyde solutions that splash into the eye can cause injuries ranging from brief discomfort to corneal clouding and loss of vision and may be trapped behind contact lenses, which usually discolor and solidify when exposed to formalin. Some individuals with daily-wear disposable lenses do not experience problems (Yang, Zhang, Chen, Chen, & Wang, 2001). Most laboratories suggest that students not wear contact lenses during a gross anatomy session because even if safety goggles are worn, corrosive vapors can accumulate under contact lenses and cause serious injuries or blindness.

Before anatomy coursework begins, instructors and emergency care providers should be notified of any students who will wear contact lenses during gross anatomy laboratory sessions. Contact lenses can be difficult to remove after a chemical splash to the eye. If ocular exposure to corrosive agents occurs during a laboratory session, the injured eye(s) should be held open and immediately irrigated with a gentle stream of large volumes of clean water. This may dislodge contact lenses, and trained staff can later remove lenses that have remained in place (NIOSH, 2005).

Cancer Risk

Laboratory studies suggest that exposure to formaldehyde may cause nasal cancer in rats. In 1987, the U.S. Environmental Protection Agency (U.S. EPA) classified formaldehyde as a possible human carcinogen under conditions of extraordinarily high or prolonged exposure (Luce et al., 1993). Since that time, some studies of industrial workers have suggested that formaldehyde exposure is associated with nasal sinus cancer, nasopharyngeal cancer, and possibly leukemia (Pinkerton, Hein, & Stayner, 2004). In 1995, the International Agency for Research on Cancer concluded that formaldehyde is a likely human carcinogen. In June 2004, after evaluating all accessible data, the International Agency for Research on Cancer reclassified formaldehyde as a recognized human carcinogen (International Agency for Research on Cancer, 2006).

Several National Cancer Institute surveys have revealed that professionals (such as anatomists and embalmers) who are likely to be exposed to formaldehyde are at greater risk for leukemia and brain cancer than are individuals in the general population (Hauptmann, Lubin, Stewart, Hayes, & Blair, 2003). A National Cancer Institute case-control study of funeral home workers exposed to formaldehyde also suggested an association between increasing formaldehyde exposure and mortality from myeloid leukemia (Beane Freeman et al., 2009).

A study by Hauptmann and co-authors compared funeral home workers who died from hematopoietic, lymphatic cancer and brain tumors with funeral home workers who died from other causes between 1960 and 1986. The funeral home workers who had performed the most embalming and those with the highest estimated formaldehyde exposure had the greatest risk of myeloid leukemia. Excessive formaldehyde exposure was not linked to other cancers of the hematopoietic and lymphatic system or to brain cancer (Hauptmann, Lubin, Stewart, Hayes, & Blair, 2004).

Ingestion-Related Gastrointestinal Effects

Formaldehyde ingestion by anatomy students or instructors is unlikely, although formalin (which is poured onto a dissected specimen to prevent drying and tissue destruction) is ubiquitous in the gross anatomy laboratory. Formalin is irritating, corrosive, and toxic. Ingestion of that substance is unusual because of its unpleasant odor and irritant effect, but such exposure has been documented in accidental incidents and suicide attempts (Pandey, Agarwal, Baronia, & Singh, 2000). The ingestion of formaldehyde can cause death even in doses as little as 30 mL of a 37% solution. Alimentary toxicity after ingestion is most severe in the stomach and causes nausea, vomiting, and severe abdominal pain. Gastrointestinal hemorrhage and gastric outlet obstruction are late complications of formaldehyde ingestion (Hawley & Harsch, 1999). Extensive damage to other organs including the liver, kidneys, spleen, pancreas, and brain as well as the central nervous system can occur from the ingestion of formaldehyde (Köppel, Baudisch, Schneider, & Ibe, 1990).

Inhalation-Related Upper Airway Irritation and Bronchial Asthma

Formaldehyde irritates the upper airway. The exposure level of formaldehyde that is instantly hazardous to life and health is 100 ppm. Exposure above 50 ppm can produce severe pulmonary reactions (pulmonary edema, pneumonia, bronchospasm) that can cause death within minutes. Concentrations greater than 5 ppm promptly cause lower respiratory tract irritation characterized by cough, chest tightness, and wheezing (Monticello, Morgan, Everitt, & Popp, 1989).

Whether formaldehyde gas is a pulmonary sensitizer that can cause work-related asthma in a previously healthy individual remains controversial (Martin, Nemitz, Hendley, Fisk, & Wells, 1995). Formaldehyde can cause symptoms of bronchial asthma in humans (Harving, Korsgaard, Dahl, Pedersen, & Mølhave, 1986). Upper airway soreness, which is the most common respiratory effect reported by workers exposed to formaldehyde, can develop after exposure to a wide range of concentrations (usually above 1 ppm) of formaldehyde. Previously sensitized persons can develop severe constriction of the bronchi at very low concentrations (e.g., 0.3 ppm) (ATSDR, 2008). Symptoms of upper airway irritation caused by formaldehyde exposure include a dry or sore throat, nasal itching and burning, and nasal congestion. Tolerance to formaldehyde exposure can develop within one to two hours and can enable workers in an environment of steadily increasing formaldehyde concentrations to be oblivious to their increasingly hazardous exposure (Burge, Harries, Lam, O'Brien, & Patchett, 1985).

Recommendations for Minimizing Formaldehyde Exposure

1. Students and instructors should be aware of the potential health hazards of formaldehyde exposure.
2. The gross anatomy laboratory should have a standard ventilation system. According to the American Conference of Governmental Industrial Hygienists (2001), the ventilation rate should exceed 15 room changes per hour.
3. Negative-pressure ventilation and monitoring systems should be installed to further reduce exposure to formaldehyde vapor.
4. Cadaver bags should be opened, and vapors should be allowed to escape.
5. Protective garments and equipment (a laboratory coat, protective goggles, and gloves) should be worn or used to prevent direct skin contact with formaldehyde.
6. Contact lenses should not be worn in the gross anatomy laboratory.
7. The bucket at the end of the cadaver table should be emptied frequently.
8. Excess fluid should be removed from the cadaver bag with a sponge or by tilting the table to drain it.
9. Nitrile gloves or 2 pairs of latex gloves should be worn during cadaver dissection and demonstration. Students who are allergic to latex gloves should wear plastic gloves.
10. Pregnant students should minimize their exposure to formalin. Models and three-dimensional figures can often be used for the study of anatomy, or anatomy courses can be taken after the baby has been born. At the beginning of the course, students should be asked to report pregnancy and to inform their teachers if they become pregnant during the course. Pregnant students should explain the likelihood of their exposure to formalin and formaldehyde to their obstetrician. They should be fitted with a mask approved for preventing formaldehyde exposure. They should be advised to dissect and study the cadaver for periods no longer than an hour at a time, and to take 15-minute breaks between dissection sessions.
11. Asthmatic students should use a full-face or half-face respirator during dissection.

Conclusion

Regardless of its toxic effects, formaldehyde remains a popular choice of tissue fixative because of its effectiveness, low cost, and consistent results. Because of the toxic effects of that agent, however, identifying a cost-effective, environmentally friendly alternative is essential and far preferable to decreasing hours spent learning or working in the gross anatomy laboratory.

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NEHA RADON RESISTANT NEW CONSTRUCTION (RRNC) TRAINING OPPORTUNITY

What?

The National Environmental Health Association (NEHA) is sponsoring a 2½ day (all expenses paid) training in Washington, DC. The training is designed to enhance your efforts to implement radon-resistant new construction (RRNC). You will work with U.S. EPA staff, NEHA field partners who have successfully implemented RRNC in their communities, local code officials and builders, other national affiliate partners, and nationally-recognized instructors. You will see specific examples of how to develop an effective, results-oriented program. And, you will develop your own comprehensive strategy to guide you in your efforts in promoting RRNC as part of your radon risk reduction strategy. The training will include an extensive overview of RRNC techniques and presentations on radon health effects, including recent research.

Why?

By the end of this training you will be knowledgeable in the technical components of RRNC and your state and local building code process. You will also acquire new skills to create consumer demand, build local coalitions, and work with other nonprofit affiliates and organizations such as Habitat for Humanity and other homebuilder associations. You will use this knowledge and these skills to develop a community action plan that contains specific and measurable goals for your program.

Who Should Apply?

Those with a genuine interest in expanding their knowledge and commitment to obtaining and encouraging radon-resistant techniques in new residential construction (particularly in those areas with high radon risk potential). We are strongly encouraging joint applications that involve a public/environmental health professional paired with a building code official, zoning or planning department official, or an interested builder or representative of a homebuilders association from the same community. These individuals should be prepared to serve as resources for residential construction activities in their area for a minimum of one year.

When?

March 6–8, 2012. Tuesday, March 6, will be a travel day; please arrive by 4:00 p.m. for a short evening session and reception. The class will then meet all day on the 7th and 8th. Return home will be Thursday, March 8.

How to Apply

Applications must be received by the close of business on Friday, February 10. Participants will be notified by Wednesday, February 15, if selected.

Applications must include:

- Name, position title, full mailing address, phone, fax, and e-mail address.
- Brief description of your current or planned radon activities (include any organizations you are or will be working with).
- A description of the area to be served and the radon zone classification, if known, and approximate number of new residential construction building permits in the past year.
- Any previous radon or RRNC training you have received.
- A brief statement indicating that you have the support of your management to undertake this program.

Electronic applications should be e-mailed to:
Susan Peterson at speterson@neha.org

For questions:
Contact Susan Peterson at
(847) 563-8242 or
speterson@neha.org

SPECIAL REPORT

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The 2011 Japanese Earthquake: An Overview of Environmental Health Impacts

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Abstract **A magnitude 9.0 earthquake rupturing the Earth's crust nearly 130 km off the east coast of Japan on March 11, 2011, triggered a tsunami that reached the Japanese coast approximately 30 minutes later. The combined effects of the earthquake and tsunami (known as the Tohoku event) devastated the area of northeast Japan, resulting in widespread infrastructure destruction, loss of life, and environmental contamination. Perhaps the longest-lasting impact of the Tohoku event will result from the damage to the nuclear power plants along the coast and the subsequent release of radioactive elements into the environment. This article describes the environmental impacts of the disaster and highlights the interconnectedness among the core areas of environmental health including air quality, water quality, weather/climate change, food safety, healthy housing, waste/sanitation, infectious disease/vector control, radiation, injury prevention, emergency preparedness, and toxicology. The purpose of this article is to provide an overview of the spectrum of the natural disaster and its environmental health impact to the human population. Future scientific analysis may confirm or challenge the information presented here.**

Introduction

On March 11, 2011, at 2:46:23 p.m., a magnitude (M) 9.0 earthquake occurred approximately 130 km off the east coast of Japan (U.S. Geological Survey [USGS], 2011). The earthquake, known as the Tohoku event, was the fourth-largest recorded since the advent of modern seismometry more than 100 years ago. The energy release was equivalent to an M 9.4 event including the subsequent faulting in the following 25 minutes (Ishii, 2011). Along with severe shaking of the island nation, the earthquake triggered a tsunami affecting the entire Pacific rim. The northeast coast of Japan, the region closest to the epicenter and facing the tsunami propagation direction, suffered the most devastating effects with a wall of water exceeding a height of 10 m in places. In areas of subdued topography, the tsunami raced several kilometers inland before receding, as evidenced by the moderate resolution imaging spectroradiometer (MODIS) satellite images (National Aeronautics and Space Administration, 2011) (Figure 1).

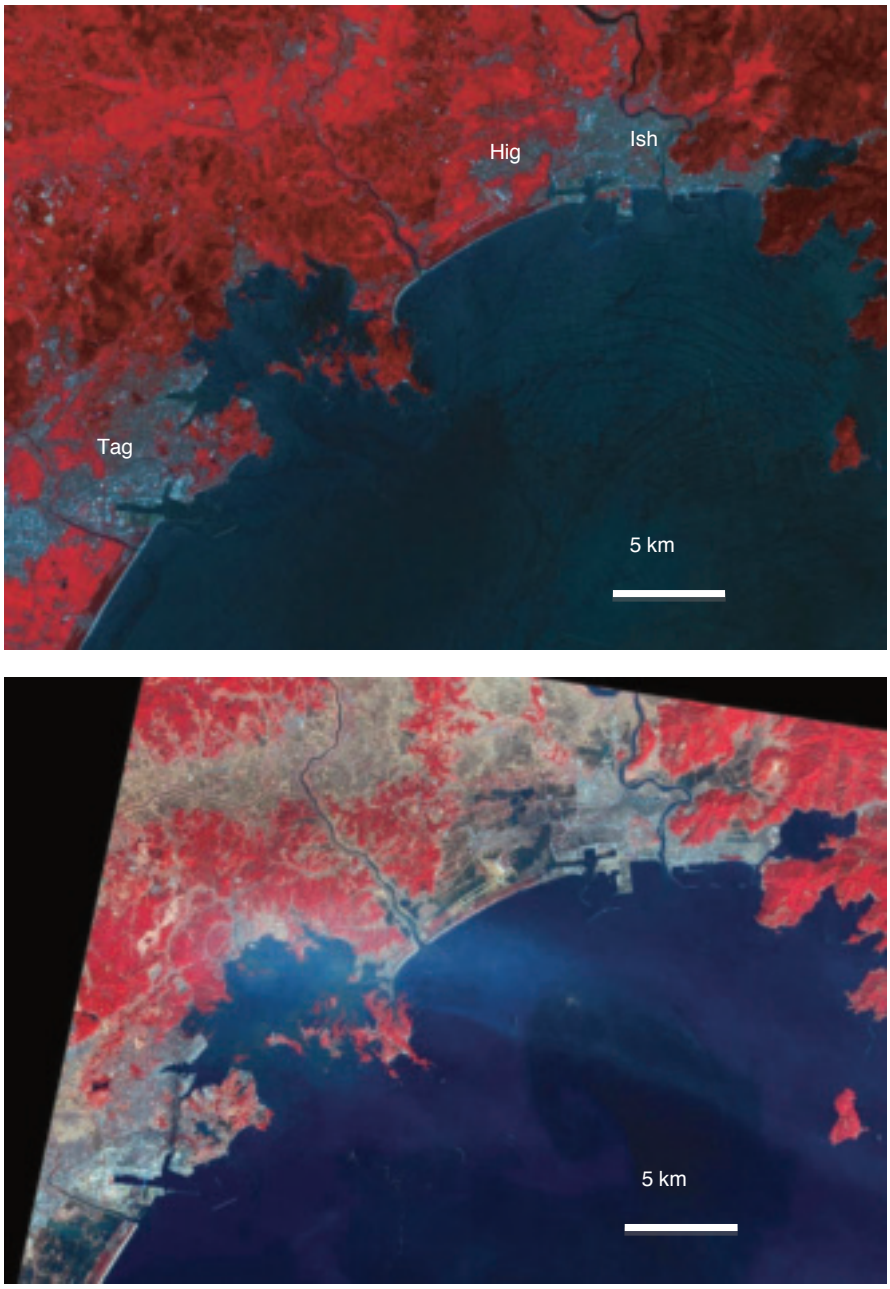
The impact of the tsunami is readily apparent from the extent of deposited silts and sands that reached several kilometers inland, over almost all the populated regions in the images. Standing water and extensive sediments are seen throughout both cities in the bottom image (Figure 1). Many hundreds of aftershocks, ranging into the mid 7s in magnitude, have occurred and will continue to occur over the better part of the coming year, underscoring the instability of the situation. The purpose of this article is to provide an overview of the spectrum of the natural disaster and its environmental health impact to the human population.

As the Earth is a dynamic planet, the health and well-being of human society have always been susceptible to impacts from natural events. Earthquakes in particular have a long history of significantly impacting societies through direct effects of building collapse and infrastructure damage due to ground shaking and subsequent disasters such as fires and tsunamis. Earthquakes occur wherever stresses build up in the Earth's crust beyond its elastic breaking point (Stein & Wysession, 2003). Stresses build relatively quickly (thereby inducing earthquakes) at tectonic boundaries where two or more plates come in contact with one another. For example, the San Andreas fault in California delineates where the Pacific and North American plates slide against one another. In addition to sliding against each other, a plate also may be pushed beneath its neighbor in a process known as subduction (Figure 2). Many populous regions including much of China, Japan, the Mediterranean, the Caribbean, Indonesia, South America, and western North America including the San Andreas fault in California are near plate boundaries (DeMets, Gordon, & Argus, 2010) and thus prone to significant seismic risk.

Because this article is meant to illuminate a recent event, fewer scientific sources could be used as references than we would normally

FIGURE **1**

Moderate Resolution Imaging Spectroradiometer (MODIS) Satellite Images of Ishinomaki, Higashimatsushima, and Tagajo



False color satellite images. Top image taken several days before the earthquake and tsunami. Bottom image taken four days afterwards. Red color shows vegetation. Dark blue is water. Buildings, pavement, and other artificial structures are white to light bluish hues depending on the reflectivity of the surface. Silts and sands are brown and brownish-gray. Images courtesy of NASA/GSFC, MODIS rapid response.

prefer. Moving forward, more in-depth scientific analyses of the environmental health significance and impact of the Tohoku event will undoubtedly occur. Many of these future analyses and findings are likely to confirm or challenge the information presented here.

Geological Setting of Earthquake and Tsunami

The country of Japan sits at the junction of several converging tectonic plates (Figure 3). Notably, the Pacific plate subducts below (is pushed underneath) northern Honshu along the Japan trench at a rate of 93 mm/yr., while the Philippine plate subducts beneath southern Honshu along the Nankai trough at a rate of 58 mm/yr. (DeMets et al., 2010). As the plates subduct they tend to lock with the overriding plate, thereby building up tectonic strain. When the strain becomes larger than the strength of the locked fault surface, the fault causes an earthquake. The magnitude of the event depends on both the area of the strain and the amount of slip along the interface. The M 9.0 Tohoku event occurred along the Pacific plate. The fault rupture area was nearly 400 km long and 150 km wide (Ishii, 2011; USGS, 2011) with slip as great as 32 m (Geospatial Information Authority of Japan, 2011). A portion of the northeastern Honshu permanently shifted more than 4 m eastward and dropped three-quarters of a meter downwards (Geospatial Information Authority of Japan, 2011).

The Tohoku earthquake was felt around the world, and three traces of a seismogram recorded at Southern Illinois University in Carbondale, Illinois, show ground movement in three perpendicular directions (Figure 4). Four distinct arrivals can be observed: Direct P and S along with Love and Rayleigh surface waves. The spacing in time arises from the waves traveling at different speeds. All waves hit Japan within a minute. The extended-duration, large-amplitude shaking arose from the surface waves (Figure 4).

Because shallow subduction occurs along deep ocean trenches and entails a significant amount of vertical motion, a resulting earthquake can transmit energy efficiently into the water column above, leading to a tsunami. In the open ocean, a tsunami travels at a speed of roughly 800 km/hr. with an amplitude of less than a meter. As the wave enters shallow water, however, the increased drag on the seafloor slows the wave and amplifies crest height, potentially reaching tens of meters in height (Stein & Wysession, 2003).

Infrastructural and Environmental Impact

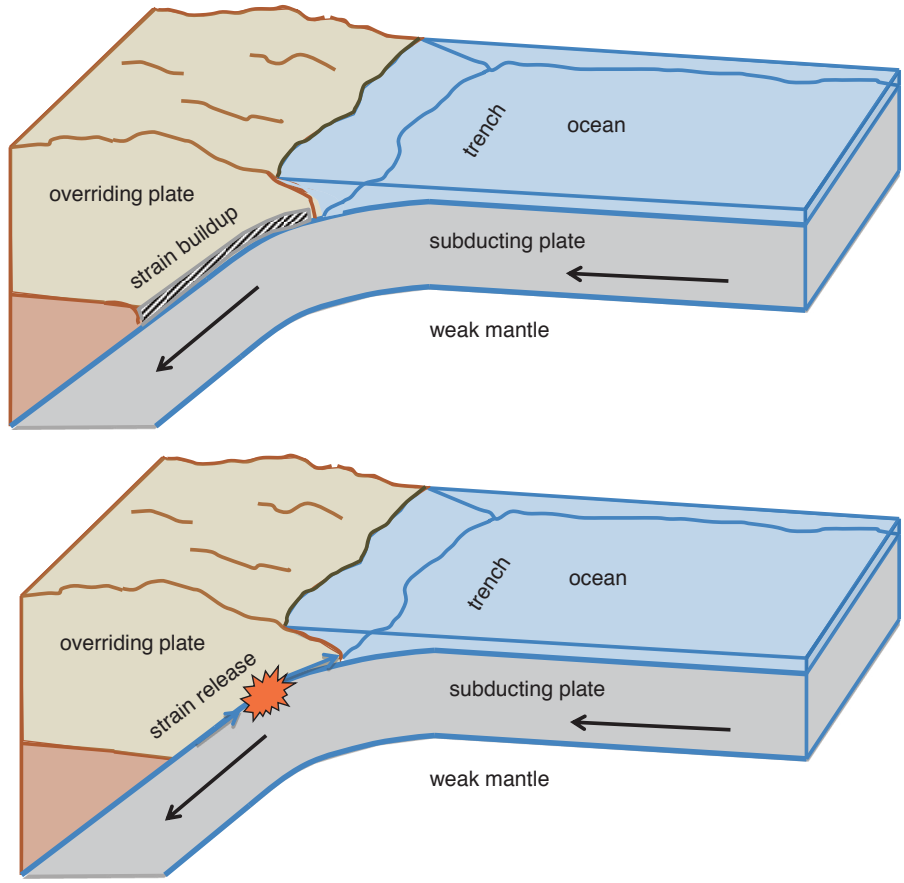
The country of Japan has a long history of deadly earthquakes and their effects (e.g., tsunamis and fires) and has spent considerable resources over the last several decades in advancing engineering and safety given the earthquake danger. In the face of the Tohoku event, notable successes are visible in these efforts, such as tsunami warnings and infrastructure that did not lend itself to widespread fires. Without either protection in place, the numbers of deaths and degree of damage would undoubtedly have been far higher, such as the 1923 M 7.9 Kanto earthquake that killed well over 100,000 people and left much of Tokyo in ashes and ruin (De Boer & Sanders, 2005).

Despite these advances, extensive damage occurred to infrastructure from the Tohoku event, with impacts to human health both immediately and into the foreseeable future. As of May 12, 2011, the death toll stood at 14,998 with an additional 9,761 people still missing (Japan National Police Agency, 2011). The number of homeless is estimated in the hundreds of thousands (Showstack, 2011), with over 163,000 people living in temporary shelters as a result of evacuations following the disasters (Reuters, 2011a). More than 46,000 buildings were damaged or destroyed (Reuters, 2011a).

Damage to roads and railroad lines disrupted relief efforts; shelters lacked adequate food and water for several days (Magnier & Demick, 2011; National Public Radio, 2011). Three weeks after the earthquake, high-speed rail service had been restored to all but two lines (Fountain, 2011) but train service continued to be affected by rolling electrical blackouts (White, 2011). Airports were closed immediately following the quake although all but the airport in Sendai reopened within a few days. The Sendai airport was impacted by the tsunami and after four weeks was able to partially reopen to commercial traffic (Fackler, 2011). In addition, all major ports were closed right after earthquake; 15 ports in the immediate disaster area remained closed while the rest of the nation's ports reopened within several days (Manila Bulletin Publishing Corporation, 2011). As of May 6, 2011, the remaining ports were provisionally functional although some were still limited to emergency aid transports (Inchcape Shipping Services, 2011).

FIGURE **2**

Diagram of a Subduction Zone



When the stress in the deformed plate becomes larger than the strength of the fault, the fault breaks, releasing the strain in the form of an earthquake. The upper side of the fault moves upwards, displacing water above, potentially triggering a tsunami.

Communication largely remained intact; phone and Internet services were only briefly interrupted. Within hours, people in affected areas were able to use technology to communicate with people in unaffected areas (Vijayan, 2011).

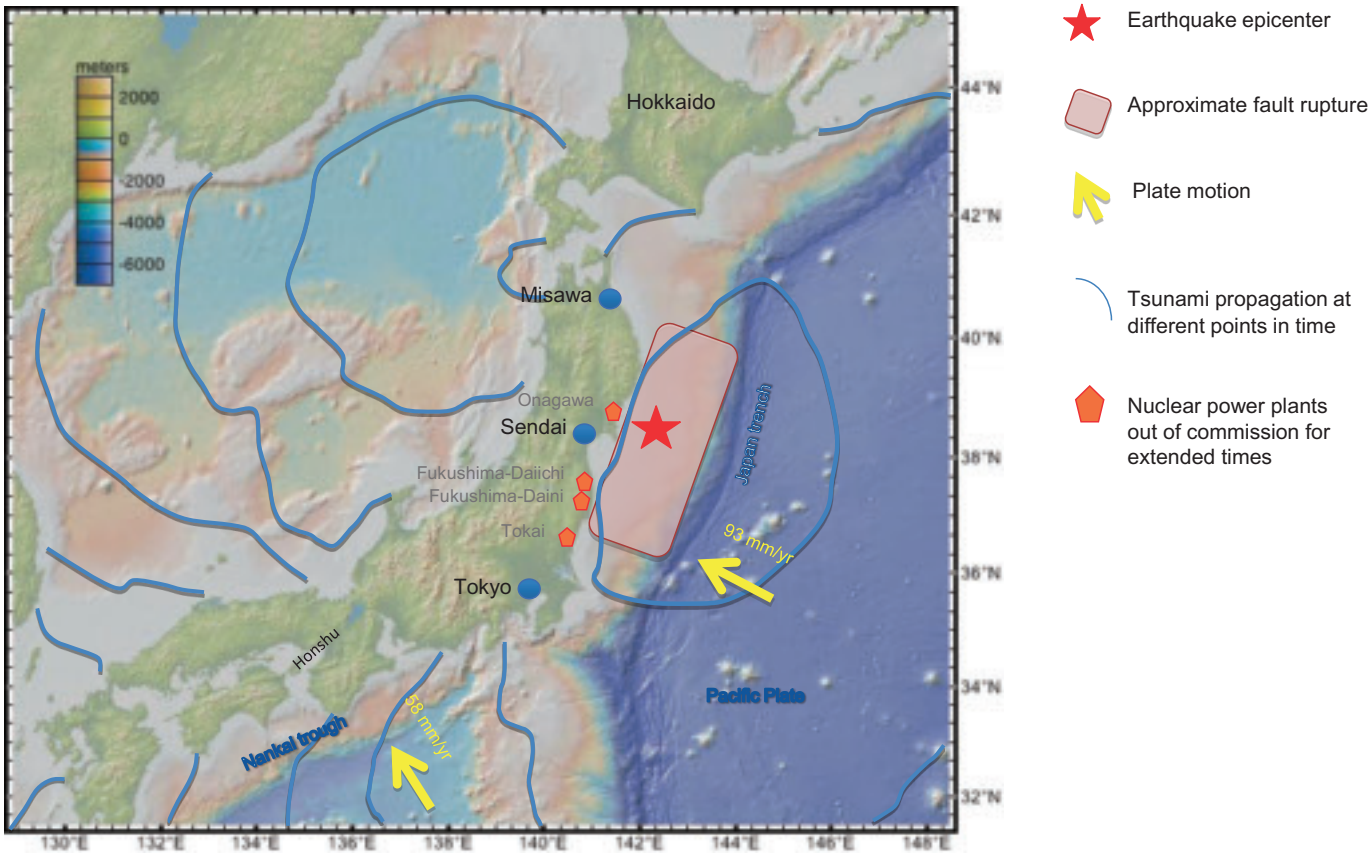
The earthquake and tsunami also affected water service. One irrigation dam failed as a result of the earthquake, and six more had shallow cracks on their crests (Chinese National Committee on Large Dams, 2011). The Japanese Ministry of Land, Infrastructure, Transport and Tourism reported that about 50 sewage treatment plants had been damaged. No count has been given of the number of drinking water systems affected (Jaffe, 2011), although some estimates of the number of people that may have been without drinking water run as high as one million (Showstack, 2011).

Electrical service was interrupted, and electrical shortages including rolling blackouts were still occurring more than three weeks after the earthquake. Electrical shortages were exacerbated by the fact that Japan does not have a unified national electrical power grid and uses 50-hertz and 60-hertz systems that are incompatible (Williams, 2011). Electrical production was also disrupted due to damage to numerous nuclear reactors.

A new concern not encountered in previous events in Japan or elsewhere following an earthquake is severe damage to nuclear power plants that could result in deleterious

FIGURE **3**

Tectonic Map of Japan



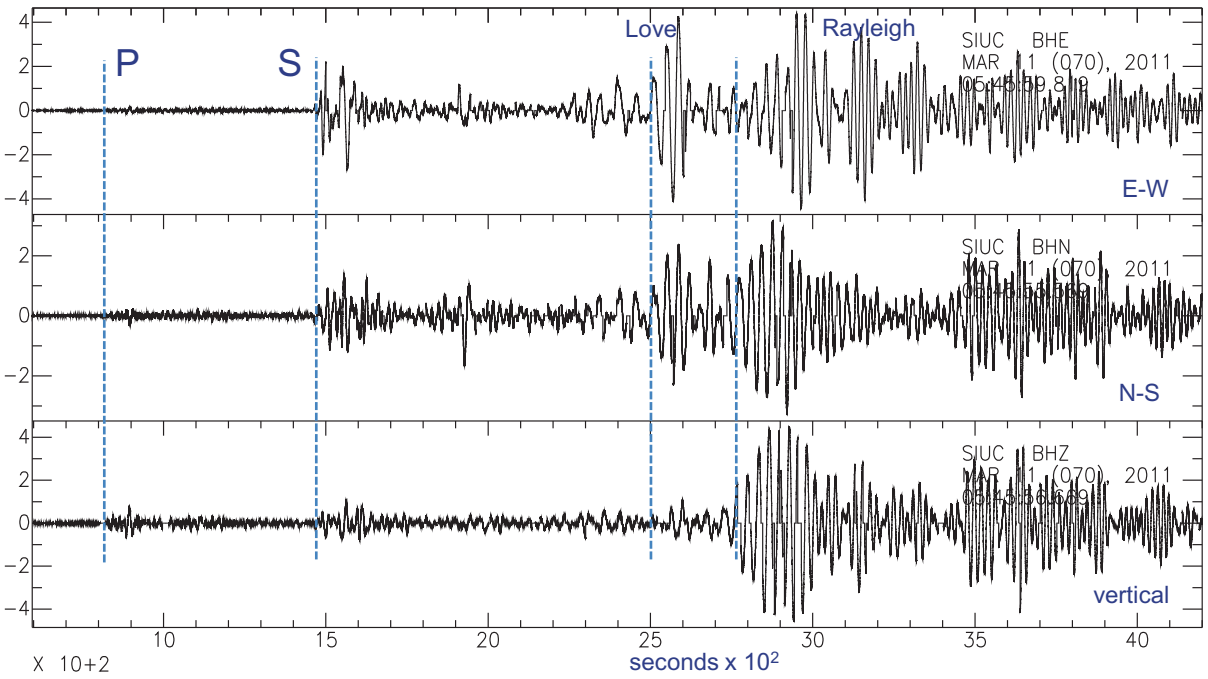
Tectonic setting of the March 11, 2011, Tohoku earthquake. The entire Japanese coast was impacted by the tsunami; however, northern Honshu suffered an especially large direct tsunami impact.

health effects from the release of radiation into the atmosphere, hydrologic cycle, or soils. Fifteen nuclear power plants underwent emergency procedures during the earthquake, with four remaining closed for an extended period of time (Reuters, 2011b). All plants withstood the initial shaking and were able to successfully insert control rods into the core to halt uranium fission. Problems at two of the power plants soon developed, however. The most worrisome problem was that reactors at the Fukushima-Daiichi power plant were impacted by the tsunami. When the 14-meter waves topped a sea wall designed to withstand only a 5.7 m tsunami, the entire plant was flooded (Cyranoski, 2011). The flooding irreparably damaged the diesel backup generators that supply coolant (fresh water) during emergencies. Without a continual supply of fresh coolant, the decay of nonuranium products that have built up in the system will boil off the coolant water and eventually heat the fuel pellets past their melting point, causing a meltdown. Coolant is always needed in nuclear reactors because fission occurs spontaneously even when control rods are inserted and the reactor is shut off, causing heat to build up in the cladding, fuel, and the reactor core. If uncontrolled, the heat can lead to explosions (Shults & Faw, 2008). Following explosions at the plant, an area of 20 km surrounding the plant was placed under mandatory evacuation, and an additional area up to 30 km surrounding the plant was designated a voluntary evacuation area; these evacuation areas are much smaller than the United States' recommended 80 km evacuation zone (BBC News, 2011a).

The International Atomic Energy Agency (IAEA) has established a measurement tool, the International Nuclear and Radiological Event Scale (INES), to rank the safety significance of release of radioisotopes from various incidents. The scale ranges from 0 (no safety impact) to 7 (highly dangerous). The level 7 criteria indicate "widespread health and environmental effects [and] external release of a significant fraction of reactor core inventory (International Atomic Energy Agency [IAEA], 2008)." Event ratings at the Fukushima-Daiichi plant originally were computed for individual reactors, rating them as 5, but on April 12, 2011, the disaster was upgraded to 7 because the accidents were considered as

FIGURE **4**

Seismogram Recorded at Southern Illinois University, Carbondale, Illinois



Three seismogram traces show ground shaking in east-west (top), north-south (middle), and vertical (bottom) directions. Major seismic arrivals carrying the bulk of the energy are easily observed (dashed).

a single event (IAEA, 2011a). The same rating of 7 was given to the nuclear disaster at Chernobyl, Russia, in 1986. Reasons for the upgrade include the fact that the Japanese Nuclear and Industrial Safety Agency and the Japan Nuclear Safety Organization indicated the following:

> The value representing radiation impact, which is converted to the amount equivalent to Iodine-131, exceeds several tens of thousands of tera-becquerels (of the order of magnitude as 10^{16} Bq)…[and]…this results in the value corresponding to Level 7 of INES rating (Ministry of Economy, Trade, and Industry, 2011).

Although the Fukushima accident has the same rating as the Chernobyl accident, "the amount of discharged radioactive materials is approximately 10% of the Chernobyl accident (Ministry of Economy, Trade, and Industry, 2011)."

Evidence indicates that damaged fuel rods, either spent rods in cooling ponds or rods in the core of one or more of the reactors, have been the source of environmental contamination by radioactive isotopes of iodine and cesium. Radioactive material was released into the air and water, with about 11,500 tons of radioactive water released into the ocean on April 4, 2011 (IAEA, 2011b), raising global concerns about possible contamination of fish and other sea life.

Environmental Health Impacts

The Tohoku disaster has relevance in each of the 11 core areas of environmental health identified by Ratnapradipa and co-authors (2011): air quality, water quality, weather/climate change, food safety, healthy housing, waste/sanitation, infectious disease/vector control, radiation, injury prevention, emergency preparedness, and toxicology. This disaster highlights how many of these core areas overlap and interconnect.

Air Quality

Although widespread fires did not occur following the earthquake, localized areas burned for days, such as the fishing village of Kesennuma (Russian Television, 2011). Because no widespread fires followed the earthquake, the impact on air quality was largely limited to particulate from rubble immediately following the earthquake and radioactive fallout from the explosions and emissions at the nuclear reactors.

Water Quality

As previously stated, sewage treatment facilities were damaged by the earthquake and tsunami, and hundreds of thousands of people were immediately without adequate safe drinking water. Damage and destruction of

water treatment and sewage systems increase the likelihood of outbreaks of cholera and typhoid, although outbreaks are less likely to occur in developed countries. Outbreaks of gastrointestinal illnesses are more likely among crowded survivors in temporary shelters. The National Travel Health Network and Centre of Britain's April 7, 2011, clinical update advised people traveling to Japan that the "…flooding, stagnant water, and contamination of water supply are conducive to development of diseases such as salmonellosis, *Campylobacter* infection, shigellosis, hepatitis A and E, and intestinal parasites including *Giardia* and *Cryptosporidium* (National Travel Health Network and Centre, 2011)." In addition, traces of radioactivity were detected in drinking water in several prefectures, including Tokyo (Hur, 2011; IAEA, 2011c).

Weather/Climate Change

The unusually cold weather at the time of the earthquake brought heavy snows to some affected areas and added to the difficulties faced by survivors, as many were homeless or in emergency shelters immediately following the Tohoku event. Without electricity, many were without heat.

Food Safety

Food shortages in affected areas were a great concern immediately following the disaster. Failure of electrical service resulted in large amounts of rotting food in warehouses (Makinen, 2011), and damage to transportation routes meant that food delivery was difficult immediately following the disaster. The largest continuing food safety concerns relate to radiological contamination of both land and sea. Radiation levels exceeding legal limits were found in milk and certain vegetables (notably leafy greens such as spinach) in areas as far away as 120 km from the Fukushima plant (Hur, 2011; IAEA, 2011d; Olsen & McDonald, 2011).

Fish consumption in Japan is expected to drop for the next several months due to a combination of factors. Prior to these disasters, Japan was second only to China in per capita consumption of fish (Zabarenko, 2011). Japan's fishing industry was heavily impacted by the tsunami. Several fishing villages were destroyed, thousands of coastal fishing vessels were lost, and shellfish and aquaculture sites and processing plants were destroyed (Ydstie, 2011), decreasing physical capacity to produce, harvest, and process seafood. In addition, human bodies were washed out to sea and unrecovered, which may have a psychological impact on fish consumption. Potential radioactive contamination of sea water is also a concern, given the contamination of seafood. Monitoring of fish indicated that elevated levels were being recorded in sand lance as early as April 4, 2011 (IAEA, 2011e). Not only did radioactive wastewater leak directly from the damaged reactor to the sea for several days (Brumfiel, 2011), but the immediate imperative to move coolant through the reactor resulted in deliberate dumping of 10,000 tons of radioactive wastewater into the ocean (Butler, 2011). The prevailing wind direction also carried airborne radioactive contamination out to sea. The contaminated seawater dumped into the ocean may lead to radioactive bioaccumulation in fish and shrimp, which if eaten by local residents, may lead to increased human radiation exposure (Friis, 2007).

Healthy Housing

The tsunami completely engulfed large areas of coastline. Some villages were completely destroyed and many homes were damaged. Homes that withstood the tsunami waves will be faced with issues typical of flooding, including structural damage, mold and mildew growth, removal of contaminated mud and dirt, and seawater-specific issues such as groundwater well contamination. In addition, many homes that were undamaged by the earthquake and tsunami are within the radiological evacuation zone and are therefore uninhabitable at present. It may be necessary to pass emergency laws allowing demolition crews to knock down homes and structures thought to be too damaged to repair, without first contacting the property owner (Makinen, 2011). Estimates for rebuilding have been as much as $310 billion (BBC News, 2011b).

Waste/Sanitation

The Japanese traditionally cremate their dead, but with damage to crematoria, impassible roads, and electrical outages, the cremation of more than 12,000 bodies, perhaps even twice that number, cannot occur immediately. Instead, human remains have been temporarily placed in mass graves, with the intention to eventually exhume and cremate them. This may take up to several years (Russian Television, 2011).

Disposal of the debris from the earthquake and the tsunami is very problematic. Much of it is contaminated with mud and dirt, which may carry harmful bacteria or be tainted with PCBs or asbestos. As the piles of debris begin to dry, asbestos may become airborne (Makinen, 2011). Decaying waste may also lead to increases in insects and other pests, further threatening human health. Another concern is that the debris may ferment and ignite (Makinen, 2011). The sheer amount of waste resulting from the disaster, estimated at over 80 million tons, is a logistical problem that extends beyond the zones directly impacted due to the limited space for landfills (Makinen, 2011). Waste in Tokyo began to accumulate because incinerators were affected by the power supply problems (Makinen, 2011).

Infectious Disease/Vector Control

With evacuees concentrated in schools and other relief shelters, epidemics such as influenza pose a real threat. Rotting food in warehouses, mass graves, and decaying debris all increase the likelihood of insect and other pest infestations, which may serve as vectors for human disease.

Radiation

Emergency personnel working to restore safety functions to the damaged nuclear reactors have had direct exposure to radiation. In response to the Fukushima disaster, the Japanese Health Ministry raised the legal limit of emergency radiation exposure for workers from 100 to 250 millisieverts (mSv) (Pinoy Global Online News, 2011). Two workers were exposed in excess of 200 mSv, with one receiving 240.8 mSv of radiation (Pinoy Global Online News, 2011). That dose is slightly below the 250–1000 mSv acute radiation sickness exposure level, in which some people suffer from nausea, loss of appetite, and bone marrow, spleen, and lymph damage (Sherer, Visconti, & Ritenour, 2006). It is important to note that exposure received by this individual was in minutes rather than years, which means that the human body has less time to repair acute cellular damage than

when it receives chronic exposure (over a period of years) (Sherer et al., 2006). Acute exposure to high doses of radiation may diminish effective cellular repair mechanisms and may exacerbate somatic (in the person) and genetic (in their biological offspring) radiation effects (Sherer et al., 2006).

From a human health perspective, Iodine-131 is problematic because it is readily absorbed by the thyroid gland, which can lead to diminished function and tumor development (Arena, 1971; Eaton & Klaassen, 1996; Sherer et al., 2006). Cesium-137 is easily absorbed by the skeletal system, and with a half-life of 30 years, this isotope results in long-term, unwanted chronic exposure, which may lead to bone necrosis and cancer (Arena, 1971).

Injury Prevention

Although drowning due to the tsunami is responsible for most of the fatalities (Healy, 2011), many also died from physical trauma including head wounds and crushing wounds resulting from the earthquake and the tsunami. Building codes designed to withstand earthquakes undoubtedly prevented many more injuries and death from building collapse. For comparison, although the January 12, 2010, M 7.0 earthquake in Haiti was 1,000 times smaller than the Tohoku quake, over 230,000 people died in the Haiti quake, primarily from building collapse (Bilham, 2010).

Emergency Preparedness

Japan has done much as a nation to prepare for earthquakes and tsunamis with tsunami warning systems and building codes to promote safety during seismic events. Japan was seemingly unprepared, however, for the damage to nuclear reactors and the failure of emergency backup systems. This nuclear disaster largely overshadowed responses to address the immediate needs of individuals in the earthquake and tsunami areas, many of whom were still without adequate food, water, and shelter several days after the event.

Toxicology

As with many severe flooding situations, harmful substances released directly into the environment can cause large-scale contamination of water and land. Contaminants such as fuel products and pesticides are likely present in areas inundated by the tsunami flood waters (Centers for Disease Control and Prevention, 2005). The cardinal rules of toxicology involve the relationship between dose and response. If no exposure occurs, then dose is irrelevant, but if exposure does occur, dose is paramount in determining possible health effects and treatment for the exposed population (Eaton & Klaassen, 1996). Because population exposure has occurred in the Tohoku event, the problem regarding effective treatment and long-term population monitoring hinges on determining exact individual doses for everyone exposed to toxic substances and radiation both from the Tohoku event and the Fukushima-Daiichi nuclear power plant accident.

Vulnerable Populations

As with any environmental health concern, certain populations are more at risk for negative health consequences from environmental exposures than others. Radiological and toxicological exposures are assessed in terms of both the volume and duration of the exposure. Emergency workers are at risk for acute, high-volume doses, while those living in and around the evacuation zones are at risk for low-to-moderate volume over a prolonged period of time. Physical characteristics such as age are also risk factors. Pregnant women and infants are at higher risk than the general population due to the potentially negative developmental impact of higher concentrations entering smaller bodies. Likewise, the younger population is more at risk for chronic low-dose radiation exposure than the elderly.

Conclusion

The combined effects of the earthquake and tsunami that devastated the area of northeast Japan resulted in widespread infrastructure destruction, loss of life, and environmental contamination. Perhaps the longest-lasting impact of the Tohoku event will result from the damage to the nuclear power plants along the coast and the subsequent release of radioactive elements into the environment. The impacts were both immediate and local as they related to loss of life, injuries sustained during the disaster, displacement due to building damage, and food and water shortages. In addition, the disaster will continue to have long-term environmental impacts that extend beyond the immediate destruction zones, particularly as they relate to radiological and toxicological contamination. Environmental health professionals will have much to learn from the study of and response to this disaster.

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DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES BRANCH

Environmental Health Internship Essentials

Alex Choo
Jacob Gerke
Victoria Sellers
Maha Syed

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.

CDC's Summer Program in Environmental Health is a 10-week internship for students majoring in environmental health.

The Centers for Disease Control and Prevention (CDC) Summer Program in Environmental Health (SUPEH) provides students in academic programs accredited by the National Environmental Health Science and Protection Accreditation Council (EHAC) an opportunity to experience environmental health practice at the local, state, and federal levels. The internship exposes students to the aspects of the environmental health profession, from hands-on activities in the field to environmental health management in the office. Typically, the internship is the student's first glimpse into the real-world application of environmental health science.

As interns, we recognized early on that environmental health practitioners must possess a wide range of competencies to be effective at promoting and improving environmental health. Based on observations during our internship, we recognized a need to continually develop not only technical skills and abilities but also competencies as well-rounded professionals. Those competencies fall under the three categories identified by the Environmental Health Core Competency Project: assessment, management, and communication (American Public Health Association and National Center for Environmental Health, Centers for Disease Control and Prevention, 2001). This column gives our unique perspectives as four environmental health interns who experienced, for the first time, general environmental health practice through the eyes of practitioners.

Technical

Academic environmental health curriculums provide instruction in the broad technical areas of the field, such as food protection and water quality. Understanding the various areas of the science helped us to think critically and analyze complex situations, as we realized practitioners do not always encounter "textbook" cases. We found this to be especially true when we conducted facility inspections during which interrelated environmental factors were found. All of the broad topics we learned from our course work could be applied in one facility on an inspection. When attempting to solve health problems, environmental health professionals must take a systems-based approach, consider the environment as a whole, and understand the relationship and connections between contributing factors.

Assessment

Practically every field activity was an exercise in assessment and a reminder about

Alex Choo (left), Maha Syed, and Victoria Sellers (right) prepare for a community-based vector control activity.

Jacob Gerke directs an environmental health emergency response exercise.

the complexity of environmental health problems. During inspections, we used the combination of visual observations and sampling to inform stakeholders about potential health risks. Completing our projects required analysis of data collected from investigations, inspections, and interviews with subject-matter experts to make a correct assessment. The experience taught us that environmental health professionals generate a significant amount of data and consideration must be given to how the data can be used to ensure that accurate information is conveyed to the public.

Management

Early in the internship, we developed an appreciation for the fact that environmental health professionals not only work in the field but also have responsibilities in the office. We received an introduction to the work that happens somewhat "behind the scenes." While we were not involved with budgeting and supervising, we did have an opportunity to learn about aspects of other management activities. We realized the importance of accurate reporting, recording, and documenting work. Project assignments required us to solve problems, meet deadlines, and collaborate with coworkers. The assignments also provided insight into other important aspects such as managing relationships with coworkers and being organized and proactive.

Communication

Whether written or spoken, in the field or office, communication was a common theme with every internship activity. During field experiences, we learned that clearly explaining results and findings to ensure risks are understood is critical. This lesson was reinforced by the potential for serious health consequences if inspection or investigation results were misinterpreted. We were able to practice public speaking by providing training, giving presentations, and attending seminars and workshops. In addition to verbal expression, we discovered the importance of forming effective health messages in writing. The take-home message was that environmental health professionals must effectively relay the results of their activities to best benefit the public and preserve health.

A Great Opportunity

The SUPEH program provided opportunities for us to get out in the field, work with practitioners, and learn about environmental health practice in a comprehensive fashion. We worked closely with our supervisors, mentors, and peers, developing lasting relationships and gaining vital skills that we will benefit from in the future as environmental health professionals. The goal of an internship is to provide students with experience through a comprehensive introduction to a professional career. We witnessed firsthand how a challenging, well-rounded internship can have a significant impact on future environmental health practitioners in terms of professional growth and future career goals. We encourage environmental health interns and supervisors to seek or provide internships that allow the student the benefit of experiencing all that an environmental health professional encounters.

More information about SUPEH is available at www.cdc.gov/nceh/ehs/supeh/. CDC also offers other environmental health internship opportunities, such as the Collegiate Leaders in Environmental Health, for students majoring in environmental studies, engineering, chemistry, biology, ecology, or related fields. Learn more at www.cdc.gov/nceh/ehs/Workforce_Development/internship.htm.

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DIRECT FROM NCSL

State Legislative Update: Final Count for 2011

Doug Farquhar, JD

Editor's Note: The NEHA Government Affairs program has a long and productive association with the National Conference of State Legislatures (NCSL). The organizations have worked together on any number of legislative and policy areas that directly impact the environmental health profession. One of the keys to the successes of the NEHA/NCSL collaboration has been the recognition of the fact that often some of the most significant legislative and policy initiatives related to environmental health occur in state legislatures. The states have, in a very real sense, been the innovators in developing new programs and practices. They serve as laboratories to test new programmatic approaches to some of our most pressing environmental health problems, and those successful state programs have often been the framework for subsequent national policy.

In recognition of this fact, we have asked Doug Farquhar from NCSL to provide an overview of state environmental public health legislative activity. The column highlights some of the legislative work being done in topic areas that are of the most pressing public concern. It provides summary information in the areas of children's environmental health; indoor air quality; and exposure hazards related to lead, mercury, asbestos, and pesticides. Additionally, some of the newer legislative activities concerning radon and biomonitoring are presented.

Doug Farquhar, program director for NCSL's Environmental Health Program, has worked with NCSL since 1990. Mr. Farquhar directs program development, management, and research for the Environmental Health Program. These projects encompass consultation and policy analysis of state and federal policies and statutes, regulations, and programs regarding environmental health and related topics for state legislatures and administrative programs.

The 2011 legislative cycle was even more challenging than in previous years. The new Republican majorities reduced taxes in many states, which are facing huge budget shortfalls because the federal stimulus funds have run out. Beginning in January 2012, 38 states and Puerto Rico have reported a combined $91 billion shortfall. This shortfall, on top of shortfalls for the past several years, means even less money for programs.

Since the Great Recession began, state legislatures have cut $510 billion from their budgets. Adding the $91 billion in additional necessary cuts brings the total to $600 billion since FY 2008, or half of the $1.2 trillion that the congressional supercommittee was seeking to cut from the federal budget.

But unlike the federal government, the states do not have to pay for social security or defense. Instead they have the big ticket items of education (both higher education and K–12), corrections, transportation, and Medicaid reimbursement. These programs take the largest share of the pie and are most likely to see the largest cuts.

On the one hand, environmental health is seen as an "enterprise operation" because of the fees most of its programs generate. Since environmental health receives fewer general funds appropriations, it is less likely to suffer from general fund cuts. On the other hand, environmental programs often are anathema to most Republicans, who now control the legislatures in 26 states and the legislature and governors' offices in 21. Democrats control the legislature in 15 states, with the control being split in the remaining 8 (Nebraska has a nonpartisan legislature). After the November 2011 elections (where Mississippi, New Jersey, and Virginia elected legislators, along with a handful of special elections), Republicans have a 3,973 to 3,324 legislative seat advantage over Democrats. The 2012 legislative sessions will see the most Republicans ever, with more state governments being controlled by Republicans than ever before.

In these tough times we are seeing state environmental health programs being dismantled, but not by legislative fiat. Rather, legislatures are cutting budgets where they can and streamlining policy if possible. State legislatures are not eliminating environmental

health protection. They are simply forcing the state to do more with less, a mantra that many state agencies pass onto their local environmental health departments.

Environmental Health Legislation

As with the 2009 and 2010 legislative sessions, having a less robust economy or more conservative elected officials does not translate into less legislation. During the 2011 legislative sessions, 1,096 bills on environmental health were introduced in 48 states, Puerto Rico, and Washington, DC. New York and New Jersey proposed the greatest number of laws, with New York proposing 226 bills and New Jersey proposing 130. Only Idaho and Wisconsin did not introduce any environmental health–related legislation.

By October, 131 laws had been enacted in 40 states. And in half the states, bills introduced in 2011 can carry over into the 2012 sessions.

Air Quality

Indoor

Sixteen laws were passed in Arkansas, California, Illinois, Kentucky, Maine, Maryland, Michigan, New Hampshire, Oregon, and Virginia. Of those laws, six are devoted to radon issues, two are related to mold, and three are related to smoking.

Radon

IL H 141 amends the Illinois Radon Awareness Act to require landlords to inform tenants and potential tenants of the presence of a radon hazard, if one is discovered after a radon test is conducted. The amendment applies only to "units located below the third story above-ground level." Maine passed three laws regarding radon. Notably, ME H 783 requires landlords to have rental buildings tested for radon prior to March 1, 2014, and afterward once every 10 years.

Mold

VA H 1768 holds tenants responsible for continuing to make rental payments in units where the landlord has deemed it necessary to temporarily relocate the tenant to perform mold mitigation activities. The temporary removal of the tenant from the rental property does not give the tenant the right to end the lease.

Smoking

CA S 332, titled Rental Dwellings: Smoking, allows landlords to forbid tenants from smoking inside or outside of a rental unit, or anywhere on the rental property. Similarly, ME H 802 requires landlords to inform tenants of areas of a rental property where smoking is forbidden, which may include the inside of a rental unit or any other areas on the rental property.

Outdoor

New York and Tennessee both passed laws related to the relationship between smoking and outdoor air quality. NY A 5516 bans smoking in outdoor areas of Metropolitan Transportation Authority rail stations. TN S 1936 allows local governments to ban smoking on the campuses of hospitals or public outdoor areas near a hospital.

Asbestos

Six laws in Alabama, Connecticut, Georgia, New Jersey, Utah, and Wyoming were passed to address issues related to asbestos. Of those six, three of the laws passed related to liability issues.

Of note, NJ SJR 24 identifies September 26 as Mesothelioma Awareness Day.

Bed Bugs

The renewed presence of bed bugs has become increasingly worrisome to states and the public.

Arizona enacted AZ S 1306, which requires landlords to supply informational materials regarding bed bugs to tenants and forbids landlords from leasing properties infested with bed bugs. Tenants may not bring items into a leased property that have been infested and must inform their landlord if they find an infestation in their home. The requirements of the statute do not apply to leases of single-family homes.

Ohio has found that bed bugs represent a growing threat to the state. In response, Ohio has enacted OH HR 31, which asks the U.S. Environmental Protection Agency (U.S. EPA) to grant an emergency exemption for the use of propoxur, an insecticide, in Ohio.

Biomonitoring and Health Tracking Systems

Nebraska and Oregon each passed one law related to biomonitoring and health tracking systems. Nebraska passed NE L 591, which compels the department of health and human services with the creation of a syndromic surveillance system. The law creates a means to track and report a variety of public health information.

OR S 107 permits the health authority to release information from the immunization registry and tracking and recall system for purposes of public health assessment and evaluation, including lead screenings.

Bisphenol A (BPA)

Five laws in Connecticut, Delaware, Maine, and Maryland were passed to address the use of BPA in certain products. Connecticut forbids the chemical's use in thermal receipt

2011 Environmental Health Legislative Summary

1096 bills proposed in 48 States and Washington, DC: Alabama (5), Alaska (5), Arizona (10), Arkansas (11), California (36), Colorado (3), Connecticut (32), Delaware (2), Florida (27), Georgia (11), Hawaii (48), Illinois (52), Indiana (9), Iowa (32), Kansas (5), Kentucky (9), Louisiana (4), Maine (25), Maryland (31), Massachusetts (44), Michigan (8), Minnesota (16), Mississippi (20), Missouri (10), Montana (9), Nebraska (7), Nevada (2), New Hampshire (12), New Jersey (130), New Mexico (3), New York (226), North Carolina (6), North Dakota (6), Ohio (6), Oklahoma (16), Oregon (29), Pennsylvania (11), Rhode Island (15), South Carolina (14), South Dakota (7), Tennessee (25), Texas (21), Utah (6), Vermont (13), Virginia (36), Washington (19), West Virginia (14), Wyoming (6), and Washington, DC (2).

131 laws enacted in 40 states: Alabama (1), Arizona (4), Arkansas (6), California (4), Colorado (1), Connecticut (3), Delaware (2), Florida (1), Georgia (4), Hawaii (2), Illinois (8), Indiana (3), Kansas (2), Kentucky (1), Louisiana (2), Maine (12), Maryland (9), Michigan (1), Minnesota (1), Mississippi (3), Montana (4), Nebraska (2), New Hampshire (3), New Jersey (2), New Mexico (1), New York (3), North Carolina (2), North Dakota (3), Ohio (1), Oregon, (7), Rhode Island (2), South Dakota (2), Tennessee (5), Texas (2), Utah (2), Vermont (2), Virginia (13), Washington (2), West Virginia (1), and Wyoming (2).

paper and cash register receipt paper via CT S 210. The law becomes effective October 1, 2013. Delaware bans the chemical from use in food and beverage containers for children via DE S 70. Maryland passed MD H 4 and MD S 151 to prevent the use of BPA in concentrations exceeding 0.5 parts per billion (ppb) in containers for infant formula. The laws also prevent the state from buying infant formula containers that contain concentrations of BPA greater than 0.5 ppb.

Utah passed UT HJR 24 to conduct a number of studies, including a study of whether the state should ban BPA.

Carbon Monoxide

AR H 1385 created Act 146, which requires that homes built after January 1, 2012, in Arkansas be equipped with a low-voltage carbon monoxide detector on each floor.

CT H 5326 enacted Public Act 11-248, which requires that all public and private school buildings be equipped with carbon monoxide detectors.

Children's Environmental Health

Eleven laws were passed in nine states to address environmental health issues pertaining to children.

Although several states attempted to pass restrictions on smoking in motor vehicles while children are passengers, only Arkansas was able to do so successfully. AR S 1004 passed as Act 811, which forbids smoking in a motor vehicle when a child under 14 years of age is present. The previous version of the law forbade smoking in a motor vehicle with a child under six years of age.

CO S 12 allows students to carry certain medications while in a public school, so long as the student has a treatment plan for a valid health condition or the school board has otherwise created a policy to allow students to carry medications. Similarly, Texas passed TX S 27 that mandates school districts and open-enrollment charter schools to create plans for the treatment of students who are susceptible to anaphylaxis.

Florida, Georgia, and Illinois passed laws to restrict smoking within the context of public schools. FL S 1430 allows school districts to limit smoking "on school district property." Likewise, GA HR 497 encourages "local school systems and schools" to forbid smoking on school campuses and to educate students about the harmful effects of smoking. IL S 1669 limits the circumstances under which a person may be permitted to drive a school bus, and, among other requirements, forbids smoking in vehicles.

Maryland, Maine, and Illinois have also passed laws to protect children from heavy metals. MD H 145 bans the manufacture or sale of children's jewelry that contains cadmium in concentrations greater than 0.0075% by weight. The law comes into effect on July 1, 2012. IL S 1943 amends the Lead Poisoning Prevention Act to create new standards for warning labels regarding lead-containing items. ME S 89 widens the availability of lead testing for children.

Fertilizers

New Jersey and Washington each enacted one law related to the use of phosphorus-containing fertilizers. NJ A 2290 creates limits and guidelines for "the application, sale, and use" of fertilizers containing nitrogen and phosphorus. The law also creates a certification program for professionals who apply fertilizer. WA H 1489 limits the sale and use of fertilizers containing phosphorus.

Food Safety

Forty-one states proposed 169 laws designed to address food safety issues. Ultimately, 30 laws were passed in 22 states, far more laws than were passed in any other issue area, indicating a heightened interest in addressing food safety standards.

Illinois passed a major food safety bill in the form of IL S 1852, which amends the Food Handling Regulation Enforcement Act. In recognition of the increasing economic importance of farmers' markets within the state, the law creates a Farmers' Market Task Force. The task force assists the department of public health in creating standards for food products sold at farmers' markets.

Cottage/Home-Based Foods

Cottage and home-based food production is an area of increasing legislative interest. Fifteen laws were proposed that related to the cottage food industry and foods produced in home-based facilities. Of the laws passed, seven were enacted in Arizona, Arkansas, Hawaii, Tennessee, Virginia, Washington, and Wyoming.

Some states chose to exempt home-based kitchens and cottage foods from inspection, so long as certain conditions are met. For example, AZ H 2103 exempts nonpotentially hazardous foods made in a home kitchen from inspection by the department of health services, as long as the foods to be sold are properly labeled. AR H 1323 exempts home-based food operations from permitting requirements, so long as the foods sold are not potentially hazardous.

Other states prefer to retain the ability to inspect cottage food producers. TN S 1850 amends § 53-8-117 of the Tennessee Code, which allows for the production and sale of nonpotentially hazardous foods prepared in home-based kitchens. Food preparers are required to "have adequate knowledge of safe food handling practices." If the commissioner becomes aware that foods produced in a home kitchen have been contaminated and pose a threat to public health, the commissioner has the authority to forbid their sale until the kitchen undergoes an inspection.

WA S 5748 requires that cottage food operations undergo an annual inspection and hold a permit that must be renewed annually. Foods produced in a home kitchen must be nonpotentially hazardous and sales may not exceed a predetermined yearly limit.

In the same vein, several states have passed laws exempting certain entities from meeting the requirements typically associated with establishments that serve or sell food to consumers. Laws in Virginia and California are key examples.

Virginia enacted two laws, VA S 117 and VA H 495, that exempt church kitchens and certain other groups and establishments from the regulations governing restaurants. California passed a similar law with CA A 1014. In addition to exempting churches, certain "care facilities," private residences, and certain other establishments are exempt from retail food facility regulations. Beer and wine tasting facilities where no potentially hazardous beverages and no food aside from crackers or pretzels are offered are exempt.

Heavy Metals

Maine sought to strengthen its chemical safety law by amending the priority chemicals program. ME H 841 prohibits the state department of environmental protection from initiating rule making unless the chemical

at issue has been included in a regulatory agenda, creates a new list of chemicals of high concern, and specifies appropriate *de minimis* levels for each chemical of high concern. The law also limits the definitions of children's products and consumer products, encourages safer alternatives, and provides exemptions from disclosing information for priority chemicals and sales prohibitions.

Georgia H 40 requires manufacturers of engine coolant or antifreeze containing more than 10% ethylene glycol to include a bittering agent, to make it unpleasant to people and animals.

Lead hazard control was an important topic, as was the regulation of mercury.

Lead

Eight laws were passed that directly addressed lead as it relates to environmental health. Georgia and Utah adopted language to require renovators and contractors be trained on lead hazards. Rhode Island passed RI S 652 and RI H 5945, which allow for the creation of a lead court to conduct proceedings related to the Lead Poisoning Prevention Act or Lead Hazard Mitigation as well as other lead-related actions.

Several states have passed laws to prevent lead poisoning. For example, MD H 1033: Lead Risk Reduction Standard requires renters to ensure the safety of properties previously "affected" by lead-based paint.

Arkansas, by contrast, has repealed the Lead-Based Paint Hazard Act of 1997 through the passage of AR S 833, which also creates the Lead-Based Paint Hazard Act of 2011. The act moves the lead program to the department of health and updates licensing and training requirements for activities involving lead.

Mercury

Six laws in five states have been passed to address mercury issues. IL S 1213 outlaws the sale of mercury switches within the state. Similarly, NY A 668 forbids the sale of mercury thermostats and other consumer devices with the exception of devices for the "visually impaired." In such a circumstance, plans for the proper disposal of the mercury-containing devices must be in place.

Maine, Virginia, and Vermont have implemented laws to encourage the recycling or proper disposal of mercury-containing lamps and thermostats. ME S 145 allows recycling facilities that accept mercury-containing lamps to use crushing devices if certain requirements are met. VT S 34 requires manufacturers of mercury-containing lamps to collect and dispose of said lamps. Manufacturers must also prove that no other viable alternative to the use of mercury-containing lamps exists, among other requirements. VA H 326 allows local governments to forbid the disposal of mercury-containing devices in private landfills if a program is in place to allow for proper recycling.

Pesticides

Thirteen laws were enacted in 12 states regarding pesticides. California and New Hampshire have each passed laws related to mosquito control. CA SCR 10 identified April 24–30, 2011, to be West Nile Virus and Mosquito and Vector Control Awareness Week in an effort to raise public awareness of mosquito control issues. New Hampshire passed NH H 483 to allow local governments to control mosquito populations through the use of biological agents. The agents may be applied to wetlands and other "water bodies" in areas "where a public health threat is declared, or has been declared within the last three years."

Toxics and Chemicals

Eight states passed 11 laws substantially related to toxics and chemicals. The laws address a variety of issues. The following focuses on those laws that address uranium, Chinese drywall, and brominated flame retardants.

Uranium

AZ SCM 1003 was enacted to support veterans who have been exposed to depleted uranium, which has been linked to serious health concerns by the World Health Organization. The law asks the departments of veterans affairs and defense to assist any veteran who has been exposed to depleted uranium, as well as their dependents, in receiving testing for uranium exposure.

Chinese Drywall

Virginia has successfully passed two laws to mitigate harms associated with the use of Chinese drywall. VA H 46 establishes the Virginia Defective Drywall Correction and Restoration Assistance Fund. The fund will be used to make loans to homeowners and other entities for restoration or mitigation costs associated with defective drywall. VA S 942 requires sellers or renters of property to disclose the presence of defective drywall to buyers or tenants. A tenant who discovers the presence of defective drywall may end the lease within 60 days of the discovery of the defective materials.

Brominated Flame Retardants

Maryland has forbidden the use of decabrominated diphenyl ether (DecaBDE) on mattresses, furniture intended "for residential use," and electronic equipment in concentrations exceeding "one tenth of 1%" of the total mass of the object in question. On December 31, 2012, the restriction will be extended to all products except military and transportation equipment. Beginning December 31, 2013, the restriction will also apply to transportation and military equipment and their components. MD S 221 and MD H 54 have allowed an exception, however, for the use of DecaBDE in "certain aircraft."

Water

Mississippi, Nebraska, South Dakota, and Tennessee each passed laws related to water quality. Interestingly, Nebraska and Tennessee both passed laws regarding fluoridation of municipal water supplies. NE L 36 requires cities and towns with populations greater than 1,000 people to fluoridate their water supplies. Municipalities with populations of more than 1,000 may pass local ordinances to ban the fluoridation of water. TN S 1055 requires public water systems that choose to discontinue fluoridating their water to inform the departments of environment and conservation and health.

MS H 105 allows the use of onsite wastewater disposal systems for individual homeowners and establishes guidelines for their installation. The law also allows for the certification of disposal system maintenance personnel.

Other

IL S 2106 requires manufacturers of certain electronic devices, such as computers and televisions, to "recycle or reuse at least 40% of the total weight," of the devices produced. This standard will be in place through 2012, and will increase to 50% for 2013.

TX S 710 requires sellers of residential property to disclose the presence of a single, blockable main drain in pools or hot tubs/spas, if present. The stated reason for the disclosure is the potential hazard presented by the drain to trap a person via suction.

LEGAL BRIEFS

Why the Retention of Public Health Records Matters

Andrew Weisbecker, JD

Editor's Note: **The *Journal* recognizes the importance of providing readers with practical and relevant legal information and is pleased to bring back the popular Legal Briefs column in the January/February 2012 issue. In every other issue of the *Journal* this information will be presented by the attorneys at Seattle-based Marler Clark, LLP, PS (www.marlerclark.com). Marler Clark has developed a nationally known practice in the field of food safety. They represent people who have been seriously injured or the families of those who have died after becoming ill with foodborne illness during outbreaks traced to restaurants, grocery chains, and other food suppliers.**

Andrew Weisbecker has been involved in the litigation and resolution of numerous significant personal injury claims brought on behalf of persons injured in food liability incidents and foodborne illness outbreaks since the foundation of Marler Clark in 1998. His practice has been especially concerned with the representation of minor children, and with the presentation and resolution of their personal injury claims.

"Truth is confirmed by inspection and delay; falsehood by haste and uncertainty."
—Tacitus

The topic of records management and retention policies usually does not generate much excitement. The rapid advance of technology results in vast quantities of information, however, and accordingly a need exists for an effective records and information management program. A good records management program in turn involves the establishment of retention requirements based upon the records' legal, fiscal, administrative, and historical requirements and values. Without such requirements, organizations either destroy records that should be retained or retain everything, thereby taking a legal risk or assuming unnecessary costs.

Initially, agencies should be aware of all the laws and regulations directly relating to their records and record-keeping requirements. Federal, state, or local laws and regulations may apply regarding the record keeping and records retention for specific agencies or specific types of records. Given our firm's focus on foodborne illness cases, this article briefly addresses the retention of records generated and maintained by public health agencies as related to food safety issues and enforcement.

Texas provides an example of how such laws and regulations affect the retention and disposal of public health agency records. The Texas State Library and Archives Commission has issued retention schedules for records common to all types of local government, including every "local public health agency." No local public health agency may dispose of a record listed in the schedule prior to the expiration of its retention period. For example, reports of sanitary inspections carried out by local health authority personnel as required by state law or regulation or by local ordinance must be retained for three years (Texas State Library and Archives Commission, 2011).

The retention period for a record applies to the record regardless of the medium in which it is maintained. Electronically stored data used to create a record must be retained, along with the hardware and software necessary to access the data. A local government record may not be destroyed if any litigation, claim, or other action involving the record is initiated until the resolution of all related issues. Anyone destroying local government records without legal authorization and contrary to the provisions of the Local Government Records Act or the Public Information Act may also be subject to criminal penalties and fines.

The Records Schedules page at the Council of State Archivists Resources Center Web site (http://rc.statearchivists.org/Resource-Center/Topics/Records-schedules.aspx) provides a helpful listing of similar state and local record retention schedules in place across the country.

A second reason to implement a document retention policy is to comply with public record request requirements. According to most public record statutes and regulations,

the custodian of a public record may not dispose of a record for a period of a minimum of specified days after the date on which a written request to inspect or copy the record was made. If a civil action is then instituted, the custodian shall not dispose of the record except by order of a court.

Courts have already found that public health agency records related to agency investigation of outbreaks clearly fall within the statutory definition of public records. A Maryland court had to decide if a woman who contracted hepatitis from an unknown establishment was entitled to information regarding the results of the investigation conducted by the department of health, pursuant to the Maryland Public Information Act. The department refused to disclose the requested information, asserting in part that the information was "confidential." The court instead found that the department's desire to maintain the confidentiality of records that identify persons who were the subject of case investigations was not a sufficient ground upon which to avoid disclosure under the act (*Haigley v. Department of Health and Mental Hygiene*, 1998).

A third important reason to implement a proper document retention policy is the need to respond to potentially diverse litigation needs. Records provide documentation, if necessary, that reasonable care was exercised by the agency, and that appropriate actions were taken. Accordingly, when a public agency has been given notice that a potential cause of action is pending or underway, or when an agency can reasonably anticipate that litigation might occur, records related to that cause should not be disposed of in any manner.

Public health records are frequently essential to establish the source of our clients' foodborne illnesses and to support their claims against the responsible parties. Recent litigation following an outbreak of *Salmonella* tied to cantaloupes, however, provides a striking example of how a public health agency may at times itself have to depend on its records in support of its own legal position. Federal and Oregon state officials in the spring of 2011 traced the *Salmonella* outbreak to a farm in Guatemala that grew cantaloupe for Del Monte Fresh Produce. The Food and Drug Administration (FDA) then urged a recall of the cantaloupes imported into the U.S. from the farm, and issued an alert banning any further imports from the farm.

Del Monte responded in August 2011 with court actions against the FDA and Oregon, contending that its cantaloupes never tested positive for *Salmonella* and that federal and state investigators did not have proof of the contamination. Del Monte asserted that the government actions were based upon an "erroneous speculative assumption, unsupported by evidence (*Del Monte v. United States of America*, 2011)." Del Monte also filed notice to sue the Oregon Public Health Division and its senior epidemiologist for misleading allegations regarding Del Monte's cantaloupe.

On September 27, 2011, Del Monte dropped its suit against the FDA, and the FDA lifted its import ban on the same day. Neither entity would comment on the timing of the actions. Clearly, however, the FDA and the Oregon Public Health Division would have had to rely heavily on their documentation of the investigation to support their original outbreak findings and conclusions.

State and local governments need appropriate policies and procedures to provide for the systematic retention and disposal of records. At a minimum, a local government record should never be destroyed if any litigation, claim, negotiation, audit, public information request, administrative review, or other action involving the record is initiated, until the completion of the action and the resolution of all issues that arise from it.

Disclaimer: Legal Briefs is published for information purposes only; none of the information is intended to be, nor is, formal legal advice. NEHA and the *Journal of Environmental Health* are not liable or responsible for actions taken on the basis of the information contained in these columns.

References

Del Monte v. United States of America, No. 8:11-cv-02338-JFM (D. Md., filed August 22, 2011).

Haigley v. Department of Health and Mental Hygiene, 736 A. 2.d. 1185 (1998).

Texas State Library and Archives Commission. (2011). Local schedule HR 13 TAC §7.125(b)(10) (2nd ed.), "Retention schedule for records of local public health agencies."

CAREER **OPPORTUNITIES**

Food Safety Inspector

Everclean Services is the leader in the restaurant inspections market. We offer opportunities throughout the country. We currently have openings for professionals to conduct Q.A. audits of restaurants.

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Dallas, TX	Pensacola, FL
Des Moines, IA	Phoenix, AZ
Honolulu, HI	Pittsburgh, PA
Indianapolis, IN	Rapid City, SD
Jackson, MS	Roger, AR
Lincoln, NE	Shreveport, LA
Little Rock, AR	Spearfish, SD

Past or current food safety inspecting is required.

Interested applicants can send their resume to: Bill Flynn at Fax: 818-865-0465. E-mail: bflynn@evercleanservices.com.

Tenure-Track Faculty Position
College of Health Professions and Social Work
Temple University

Job Title: Faculty Position in Environmental Health/Health Policy

Department: Department of Public Health, College of Health Professions and Social Work

Institution: Temple University in Philadelphia, PA

Academic Field(s): Environmental Health, Global Health

Job Description: The Department of Public Health in the College of Health Professions and Social Work at Temple University, located in Philadelphia, PA, invites applications for a full-time, tenure track faculty position (Assistant Professor) in the area of environmental health with a focus on policy. Eligible candidates must possess a doctorate in public health, environmental health, or related fields and demonstrate content expertise in the areas of environmental health and health policy. In addition, candidates are expected to demonstrate strong methodological skills (qualitative or quantitative) both in research conducted and courses taught; evidence of an established or evolving externally funded research program in the area of environmental health or global health is also required. The ideal candidate would continue his/her research agenda, while teaching public health courses at the graduate and undergraduate levels, as well as work with MPH and doctoral students.

The Department of Public Health in the College of Health Professions and Social Work offers one of the nation's only accredited BS in Public Health, a CEPH-accredited MPH with tracks in Social and Behavioral Sciences, Environmental Health, Epidemiology/Biostatistics, and Global Health. In addition, the Department houses an accredited MS in Epidemiology and a PhD in Public Health (concentrations in Social and Behavioral Health or Health Policy). Students are highly involved with faculty research ranging from risk communications, cancer detection and prevention, special populations' health research, violence and injury prevention, tobacco control, food safety, and public health law. The Department has over $21 million in active externally-funded research support across these health areas.

Temple University of the Commonwealth System of Higher Education is a comprehensive public research university with more than 36,000 students. It has a distinguished faculty in 17 schools and colleges, including Schools of Law, Medicine, Pharmacy, Podiatry, and Dentistry, and a renowned Health Sciences Center. Temple University is the 27th-largest university in the United States, and it is the 6th-largest provider of professional education in the country.

Applicants should send a letter of intent (that includes a statement of teaching philosophy and research agenda), curriculum vitae, and three letters of reference. Samples of scholarship are also highly encouraged. The position will start September 2012 and the search will remain open until the position is filled.

Temple University is committed to creating a diverse community: one that is inclusive and responsive, and is supportive of each and all of its faculty, students, and staff. All members of the University community share a responsibility for creating, maintaining, and developing a learning environment in which difference is valued, equity is sought, and inclusiveness is practiced. Temple University is an equal opportunity/affirmative action institution. People of color, women, veterans, and persons with disabilities are encouraged to apply.

Submit application to: Alice J. Hausman, PhD, MPH, Interim Chair
Department of Public Health
1301 Cecil B Moore 9th Floor
Philadelphia, PA 19122
hausman@temple.edu

PEOPLE ON THE MOVE

People on the Move is designed to keep NEHA members informed about what their peers in environmental health are up to. If you or someone you know has received a promotion, changed careers, or earned special recognition in the profession, please notify the Journal's *content editor. It is NEHA's pleasure to announce our reader's achievements and new directions to fellow members. Like Letters to the Editor, this department will run only when we have material to print—so be sure to send your announcements.*

U.S. Environmental Protection Agency Bronze Medal Awarded to CAPT Mike Herring and Vince Radke of the Centers for Disease Control and Prevention

On November 10, 2011, CAPT Mike Herring, REHS, MPH, senior environmental health scientist, and Vince Radke, MPH, RS, CP-FS, DAAS, CPH, sanitarian, from the Environmental Health Services Branch (EHSB)/Division of Emergency and Environmental Health Services (EEHS)/National Center for Environmental Health (NCEH)/Centers for Disease Control and Prevention (CDC), were awarded the U.S. Environmental Protection Agency's (U.S. EPA's) Bronze Medal for their outstanding accomplishments and participation in the Federal Bed Bug Workgroup. The award recognizes their work to improve the consistency, quality, and efficiency of the federal response to bed bug problems. Bronze Medals are the third-highest formal honor award given by the U.S. EPA. The award was presented to CAPT Herring and Mr. Radke by U.S EPA's Office of Pesticide Programs.

CDC and U.S. EPA have issued a joint statement about bed bugs that can be accessed at www.cdc.gov/nceh/ehs/Publications/Bed_Bugs_CDC-EPA_Statement.htm. This document was developed to highlight emerging public health issues associated with bed bugs in communities throughout the United States.

NEHA congratulates CAPT Herring and Mr. Radke on their outstanding achievement and for all the hard work they have dedicated to the advancement of the environmental health profession.

DAVIS CALVIN WAGNER SANITARIAN AWARD

The American Academy of Sanitarians announces the annual Davis Calvin Wagner Award. The award will be presented by the academy during the Annual Educational Conference of the National Environmental Health Association. The award consists of a plaque and a $500 honorarium.

Nominations for this award are open to all diplomates of the academy who:

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

The nomination for the award may be made by a colleague or a supervisor and must include the following:

1. Name, title, grade, and current place of employment of the nominee.
2. A description of the nominee's educational background and professional experience.
3. A description of the nominee's employment history, including the scope of responsibilities.
4. A narrative statement of specific accomplishments and contributions on which the nomination is based, including professional association activities, publications, and community/civic activities.
5. Three endorsements (an immediate supervisor and two other members of the professional staff or other person as appropriate).

NOMINATIONS MUST BE RECEIVED BY APRIL 13, 2012. THREE COPIES OF THE NOMINATION DOCUMENT MUST BE SUBMITTED TO:

American Academy of Sanitarians
c/o Thomas E. Crow
25278 Kennebec Drive
South Riding, Virginia 20152
tcrow23701@aol.com
www.sanitarians.org/davis_calvin_wagner_award_process.pdf

EH CALENDAR

UPCOMING NEHA CONFERENCES

June 28–30, 2012: San Diego, California.

NEHA AFFILIATE AND REGIONAL LISTINGS

California
April 2–5, 2012: 2012 Annual Educational Symposium, sponsored by the California Environmental Health Association, Sacramento, CA. For more information, contact Rashmi Nair, e-mail: NairR@SacCounty.net, or Judinae Ablang, e-mail: AblangJ@SacCounty.net.

Idaho
March 14–15, 2012: 2012 IEHA Conference, sponsored by the Idaho Environmental Health Association, Boise State University, Boise, ID. For more information, please contact Jami Delmore, e-mail: jami.delmore@phd3.idaho.gov.

Kentucky
February 22–24, 2012: KAMFES 2012 Annual Educational Conference, sponsored by the Kentucky Association of Milk, Food, and Environmental Sanitarians, Lexington, KY. For more information, contact Jeff Edelen, e-mail: jeff.edelen@kroger.com.

Michigan
March 28–30, 2012: 2012 Annual Educational Conference, sponsored by the Michigan Environmental Health Association, Kalamazoo, MI. Letter of request for abstracts posted at http://www.meha.net/banner.htm.

New Jersey
March 4–6, 2012: 2012 NJEHA Educational Conference & Exhibition, sponsored by the New Jersey Environmental Health Association, Tropicana Resort and Casino, Atlantic City, NJ. For more information, visit http://www.njeha.org/conference.html.

Ohio
April 16–18, 2012: Spring AEC, sponsored by the Ohio Environmental Health Association, Doubletree Hotel, Worthington/Columbus, OH. More information coming soon.

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.

Onsite Wastewater
February 1–2, 2012: Southwest Onsite Wastewater Conference, sponsored by the Arizona County Directors of Environmental Services Association, Riverside Resort and Casino, Laughlin, NV. For more information, visit www.southwestconference.net.

Workforce Development
March 26–28, 2012: Management and Leadership Skills for Environmental Health and Safety Professionals, sponsored by the Harvard School of Public Health Center for Continuing Professional Education, Boston, MA. For more information, visit https://ccpe.sph.harvard.edu/EHS-Leadership.

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.

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JEH QUIZ

FEATURED ARTICLE QUIZ #4

A Chikungunya Outbreak in the Metropolis of Chennai, India, 2006

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

1. Read the featured article carefully.
2. Select the correct answer to each *JEH* Quiz question.
3. a) Complete the online quiz at www.neha.org (click on "Continuing Education"),
   b) Fax the quiz to (303) 691-9490, or
   c) Mail the completed quiz to
   JEH Quiz, NEHA
   720 S. Colorado Blvd., Suite 1000-N
   Denver, CO 80246.
   Be sure to include your name and membership number!
4. One CE credit will be applied to your account with an effective date of January 1, 2012 (first day of issue).
5. Check your continuing education account online at www.neha.org.
6. You're on your way to earning CE hours!

Quiz Registration

Name

NEHA Member No.

Home phone

Work phone

E-mail

Quiz deadline: April 1, 2012

1. The reemergence and spread of chikungunya throughout India were influenced by
   a. economic factors.
   b. social factors.
   c. virological factors.
   d. a and b.
   e. a, b, and c.

2. Chikungunya is a viral disease transmitted by the bite of an infected __ mosquito.
   a. *Aedes*
   b. *Culex*
   c. *Anopheles*

3. Primary prevention of chikungunya is through vaccination.
   a. True.
   b. False.

4. Along with reviewing reported cases of chikungunya during the time of the outbreak, the authors also reviewed reported cases for
   a. West Nile virus.
   b. dengue.
   c. malaria.
   d. b and c.
   e. a, b, and c.

5. *Aedes aegypti* usually takes its blood meal during
   a. the early hours of the day and before sunset.
   b. the few hours after sunset.
   c. the late night hours.
   d. the noontime hours.

6. A suspected case of chikungunya was defined as a patient presenting with __ at a medical camp on or after June 20, 2006.
   a. fever and a headache
   b. gastrointestinal distress and arthralgia
   c. fever and arthralgia
   d. low blood pressure and dehydration

7. The house index and Breteau index were used as indicators of the density of __ vector populations.
   a. immature
   b. mature
   c. deceased

8. The __ and __ of the vector population are influenced by climatic factors.
   a. breeding, lifespan
   b. size, competence
   c. species sex, size

9. The majority of suspected cases of chikungunya during the outbreak period were
   a. male.
   b. female.

10. Chikungunya reemerged in the article's study region after __ years of absence or low circulation.
    a. 10
    b. 20
    c. 30
    d 50

11. A house index __ than 1% and a Breteau index __ than 5 indicate a low risk of dengue transmission.
    a. lower, lower
    b. lower, higher
    c. higher, lower
    d. higher, higher

12. The incubation period of chikungunya ranges from
    a. 6 to 12 hours.
    b. 12 to 24 hours.
    c. 1 to 5 days.
    d. 2 to 12 days.

JEH Quiz #2 Answers
October 2011

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

NEHA Food Safety Program

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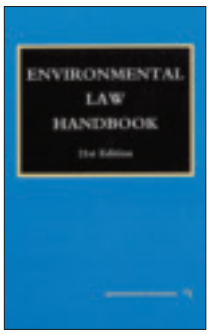
Resource Corner highlights different resources that NEHA has available to meet your education and training needs. These timely resources provide you with information and knowledge to advance your professional development. Visit NEHA's online Bookstore for additional information about these, and many other, pertinent resources!

NEHA BOOKSTORE
www.neha.org/store

Environmental Law Handbook (21st Edition)

Daniel M. Steinway, James W. Spensley, Stanley W. Landfair, Marshall Lee Miller, John M. Scagnelli, Rolf R. von Oppenfeld, Christopher L. Bell, Kevin A. Ewing, David R. Case, Karen J. Nardi, F. William Brownell, Duke K. McCall, III, Austin P. Olney, Thomas Richichi, and Ronald E. Cardwell (2011)



New Edition Now Available! The *21st Edition* of this well-known handbook has been thoroughly updated, with major changes to chapters on the Clean Air Act and the Oil Pollution Act and a rewritten chapter on the Safe Drinking Water Act. This edition also includes a brand new chapter on climate change and environmental law. This is an essential reference for both environmental students and professionals and anyone who wants the most up-to-date information available on environmental laws. Study reference for NEHA's REHS/RS exam.

1,084 pages / Hardback / Catalog #615
Member: $99 / Nonmember: $109

Resolving Messy Policy Problems: Handling Conflict in Environmental, Transport, Health, and Ageing Policy

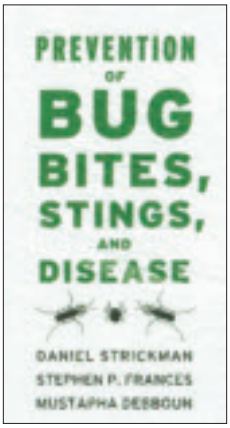
Steven Ney (2009)

Our lives increasingly take place in ever more complex and interconnected networks that blur the boundaries we have traditionally used to define our social and political spaces. Accordingly, the policy problems that governments are called upon to deal with have become less clear-cut and far messier. This book focuses on the intractable conflict that characterizes policy debate about messy issues. The author first develops a framework for analyzing these conflicts and then applies the conceptual framework to four very different policy issues: the environment—focusing on climate change—as well as transportation, aging, and health. The aim is to contribute to a more refined understanding of policy making in the face of uncertainty and, most importantly, to provide practical methods for critical reflection on policy and to point to sustainable adaptation pathways and learning mechanisms for policy formulation.

210 pages / Hardback / Catalog #1080
Member: $110 / Nonmember: $117

Prevention of Bug Bites, Stings, and Disease

Daniel Strickman, Stephan P. Frances, and Mustapha Debboun (2009)

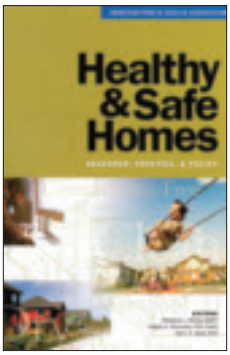


Here is all the information you will ever need—no matter where you are—to identify, avoid, and protect yourself against all manner of blood-sucking or venomous arthropods. Topics covered range from scorpions, spiders, ants, and bees to mites, ticks, lice, bed bugs, sand flies, biting midgies, mosquitoes, and horseflies. Attractive line drawings and color photographs help identify bugs accurately, and information on each bug's particular habits and habitats allows readers to minimize potentially annoying, painful, and even lethal encounters. This book is packed with helpful tips on using barriers and on choosing the right repellent for the right bug in the right place. Based upon the best available science, this well-illustrated, crystal-clear guide is a useful reference for public health professionals and the public.

323 pages / Paperback / Catalog #756
Member: $20 / Nonmember: $24

Healthy & Safe Homes: Research, Practice, & Policy

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



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NEHA **NEWS**

NEHA's Industry-Foodborne Illness Investigation Training (I-FIIT)

NEHA's Industry-Foodborne Illness Investigation Training (I-FIIT) will be held at the Food Safety Summit in Washington, DC, on April 16, 2012, from 8:00 a.m. to 5:00 p.m.

NEHA, in collaboration with the Food Safety Summit, is pleased to offer a one-day in-person training opportunity designed for those in industry at the retail food service, food stores, and restaurant level. I-FIIT will provide you and your company with a better understanding of a foodborne investigation process as a whole, setting the foundation for stronger collaborative efforts among you, your company, and public health professionals.

Everyone wants to provide safe, wholesome, and healthy food to their customers. This workshop will give you the tools and insight needed to efficiently and effectively handle potential issues that you may encounter. The workshop will connect you with government food safety officials and other involved personnel to improve foodborne disease outbreak response by identifying industry's roles and responsibilities during a foodborne disease incident. This workshop is recommended for the midlevel manager and above and is composed of interactive group exercises, Q&A sessions, and lectures spanning the scope of an investigation.

Upon completion of the course, each attendee will be awarded a certificate of completion and 7.5 NEHA continuing education credits. Attendees will also receive the *I-FIIT Course Manual*, a copy of *FDA Retail Food Protection: Employee Health and Personal Hygiene Handbook*, and various handouts, forms, and useful resources. Space is limited to 30 people so early registration is recommended. The cost to attend the workshop is $350 per person. The registration deadline is March 2, 2012. For more information about I-FIIT or to register, please visit www.neha.org/IFIIT.

Mangold Winners—Past and Future

The Walter S. Mangold Award is more than NEHA's highest honor—it is also a recognition of the outstanding contributions environmental health professionals make to public health and safety.

Each year, NEHA members have the opportunity to recognize extraordinary achievement among their peers. Each year, they recognize the man or woman who exemplifies superior achievement, professionalism, dedication, and technical excellence.

This year should be no exception. Quietly step back and take a moment to identify that one individual who makes all the difference in environmental health. Who has high standards, and rises to them? Who sees challenges and rushes to meet them? Who has a deep concern for the welfare of men, women, children, and our environment? Who knows that his or her activities and concerns make all the difference?

That person should be your nominee for the coveted Mangold Award. Nominations may be submitted by an affiliate or by any five NEHA members. A complete history of the award and the nominating process can be viewed at www.neha.org/pdf/about/Mangold_Award_History_and_Nominating_Criteria.pdf. For further information, please contact Terry Osner at 303-756-9090, ext. 302, or at tosner@neha.org. Nominations are due by March 15, 2012.

Past Mangold Winners

1956 Walter S. Mangold—California
1957 Milton M. Miller—Colorado
Floyd M. Miller—Louisiana
1958 Harlan Kingsbury—Massachusetts
1959 Verne C. Reierson—Oregon
1960 A. Harry Bliss—California
1961 Jerrold M. Michael—Washington, DC
Larry J. Gordon—New Mexico
1962 Seymour Barfield—California
1963 V. Harry Adrounie—U.S. Air Force
Frank A. Gohr—California
1964 A. H. Crenshaw—Florida
David B. Peden—Ohio
1965 Samuel Reed—Washington
1966 A. Clark Slaymaker—Virginia
1967 Frank A. Justice—Colorado
1968 Francis J. Goldsmith—Washington, DC
1969 Ben Freedman—Louisiana
1970 John G. Todd—Oklahoma
1971 Jack Hatlen—Washington
1972 William G. Walter—Montana
1973 William A. Broadway—North Carolina
1974 Joseph H. Martin—California
1975 CAPT Dale Truesdell—Uniformed Service
1976 S. M. Stephenson—Michigan
1977 Not Given
1978 Ward C. Duel—Illinois
1979 Monroe T. Morgan—Tennessee
1980 Not Given
1981 John J. McHugh—New York
1982 Vernon Sloulin—Montana
1983 Not Given
1984 Bailus Walker, Jr.—Massachusetts
1985 Trenton G. Davis—North Carolina
1986 G. A. Verrone—Uniformed Services
1987 Richard L. Roberts—California
1988 Richard K. Rowe—South Carolina
1989 F. Oris Blackwell—Kentucky
1990 Sarah B. Kotchian—New Mexico
1991 Nina I. McClelland—Michigan
Bernard S. Weintraub—California
1992 Amer El-Ahraf—California

NEHA NEWS

1993 RADM Webster Young, Jr.—Uniformed Services
1994 Joseph W. Walsh, Jr.—Massachusetts
1995 CAPT Bruce R. Chelikowsky—Uniformed Services
1996 Leonard F. Rice—South Carolina
1997 Charles W. Felix—National Capitol Area
1998 Eugene Devenport—Utah
1999 David McSwane—Indiana
2000 Not Given
2001 George A. Kupfer—Illinois
2002 Harry Grenawitzke—Michigan
2003 Larry M. Eils—Illinois
2004 Daryl E. Rowe—Georgia
2005 Herman Koren—Indiana
2006 Not Given
2007 Chris Wiant—Colorado
2008 John M. Barry—North Carolina
2009 COL Anthony C. Aiken—Georgia
2010 Gary Coleman—North Carolina
2011 CAPT Craig A. Shepherd—Tennessee

ACCEPTING NOMINATIONS NOW

2012 Walter S. Mangold Award

The Walter S. Mangold Award recognizes an individual for extraordinary achievement in environmental health. Since 1956, this award acknowledges the brightest and the best in the profession. NEHA is currently accepting nominations for this award by an affiliate or by any five NEHA members, regardless of their affiliation.

The Mangold is NEHA's most prestigious award and while it recognizes an individual, it also honors an entire profession for its skill, knowledge, and commitment to public health.

Nominations are due in the NEHA office by Thursday, March 15, 2012.

For information, please visit www.neha.org/about/awardinfo.html. Members can obtain nomination forms by calling 303.756.9090, ext. 302, or by sending an e-mail to tosner@neha.org.

Did You Know?

San Diego 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. Now that's a destination! Escape to San Diego this June to attend the NEHA 2012 AEC.
www.neha2012aec.org

LETTERS TO THE EDITOR

Water and Sewer Services in Marginalized and Underserved Communities

Dear Editor:

I find the article titled "Use of Community-Owned and -Managed Research to Assess the Vulnerability of Water and Sewer Services in Marginalized and Underserved Environmental Justice Communities" (*JEH, 74*[1], July/August 2011) interesting in that it uses race as a scientific adjunct to a common rural or semiurbanized American situation.

As unfortunate as it is to not have municipal services, it is a fact of life that such services cannot be extended to all areas of a given community, even if they are on the outskirts of a municipality that has such services. The reason, as many of us know, is the cost of such services. Regardless of color, such areas exist in all states and in many communities.

To use statements such as "descendants of slaves" should not be a part of a scientific study that is used to focus on "racism." The fact that such services are unaffordable to a group of people does not make it racist, and any and all such statements appear to be a matter of personal subjectivity of the researcher(s).

I recently moved into a rural area, not far from a municipality that has all of the typical city services, yet until recently we did not have municipal water (or sewer/gas, cable, etc.), and the groundwater is unbearable. Even my Labrador refused to drink it. Yet people lived in these areas for decades, hauling in drinking water, as they do in much of this area.

Recent municipal water became a matter of residents requesting such services from the municipality servicing the area. It took residents petitioning the local governmental unit. Engineering studies were then performed along with a cost analysis. Then residents, once armed with all the necessary information, voted on the project. A majority (51%) was needed to vote in the project. Most of you reading this letter know the procedure.

When I hear statements like "Environmental Justice," I think of more entitlements without any local citizen financial input. Our particular water extension project cost each resident over $7,000, which could be spread over a number of years for payoff.

The fact the some people reside in areas that may have landfills, heavily trafficked areas, etc., as stated in the article, can once again fit in most any community of people of all color. It often means cheaper land and lower taxes.

This is not a matter of "denial" of such services, but rather a matter of the community either not being able to afford them, or not petitioning for such services. Instead of extending these services, why does the community not focus on fixing what they already have? We cannot extend services without some compensation. Someone has to pay for it. But to state it is "racism" is unfounded and a ploy to get the government to service communities without any compensation.

It is unfortunate that everyone cannot have all the modern services that are available to certain areas of a community, but it is also a matter of "doing with what you have," or working to improve it through however you can afford. Joplin, Missouri, residents are a prime recent example of community support, where a devastating tornado recently imploded a once viable community. No one was crying for the federal government to come in and save them; they are doing it themselves through donations, community support, and little government assistance.

We all cannot have everything for doing nothing. It takes the hard work of citizens, and a matter of self-reliance to grow a community and keep it safe.

Chuck Lichon, RS, MPH
Linwood, MI

The Authors Respond

Institutional Racism: A Teachable Moment

Dear Editor:

We thank the letter writer, Chuck Lichon, RS, MPH, for raising his questions and appreciate the opportunity to give more background on our recent feature article, "Use of Community-Owned and –Managed Research to Assess the Vulnerability of Water and Sewer Services in Marginalized and Underserved Environmental Justice Communities." In our response, our primary focus is on broader systems of institutional racism that lead to discrimination and environmental injustice. We hope that our response will provide the readership of *JEH* a teachable moment on the forms of institutional racism and discrimination that still produce barriers to minimum quality of life standards for low-income, minority, and tribal populations.

It is unfortunate that in 2011, with President Barack Obama serving as the first elected African-American leader of the "free world," many continue to profess the notion that race, class, income, and politics have nothing to do with inequities in access to basic amenities (e.g., clean air, safe drinking water, and toxic-free soil), and public health protections. In addition, we are very aware that despite empirical evidence, some of our more educated colleagues and powerful government officials, scientists, educators, and religious leaders continue to infuse their public opinions with revisionist denials of racism and economic discrimination.

Although some believe it is not scientific to frankly acknowledge the past, we contend that it is a prerequisite for science. Our *JEH* article is grounded in the socioeconomic contexts of three communities of color in the previously small textile mill town of Mebane, North Carolina. The city of Mebane straddles both Alamance County and Orange County and has a current population of less than 10,000. The three target communities are 85% to 95% African-American with a mixture of Native American heritage that predates the end of slavery in 1865. The generations of families of color, churches—with cornerstones struck as early as

1868—and segregated cemeteries are all legacies of Jim Crow; yet some would believe these taxpaying citizens chose to be segregated and preferred drinking contaminated water while their fellow citizens received the benefits of municipal drinking water, sewer services, and paved streets. On the contrary, after years working side by side with people of all colors concerned about the survival of these communities, we believe our article provides a more rational explanation.

Two of the co-authors of this paper, Omega Wilson and Marilyn Snipes, were born and raised in Mebane. They are both descendants of former slaves and Native Americans and co-founders of the West End Revitalization Association (WERA). WERA was incorporated as a 501c3 nonprofit in 1995, and it serves as Mebane's first U.S. Environmental Protection Agency (U.S. EPA) "community-based environmental protection model" organization. It has led efforts in African-American communities to stop racial discrimination and adverse effects associated with leaking underground storage tanks, unpaved streets, contaminated drinking water, failed backyard septic systems, and landfills (Wilson, Bumpass, Wilson, & Snipes, 2008).

The communities WERA represents emerged out the "reconstruction period" after the Civil War, when those freed slaves and displaced Native Americans were forced to settle in South African–type "hostels" on the least desirable land. WERA communities began as buffers between whites and the town dump, discarded mill and factory waste, sewage pits, aboveground piles of dead farm animals, and an eight-acre pit used to mine soil for brick making. This pattern continued from the beginning, past 1920 when Mebane placed the public landfill and sewage treatment plant in one of these communities, through the era of legalized discrimination.

In February 1999, WERA filed administrative complaints under Title VI of the Civil Rights Act of 1964 and Environmental Justice Executive Order 12898 of 1994 at the U.S. Department of Justice (DOJ), when local, state, and federal government agencies had planned construction of the Highway 119 bypass/interstate for 16 years without public input. The four-lane highway, in an eight-lane corridor, would have destroyed homes and churches in two of the historic communities that had been denied access to basic municipal drinking water and sewer services (Wilson, Bumpass, Wilson, & Snipes, 2008). At the time, officials from DOJ described WERA communities as suffering from "patterns of historic discrimination" that denied access to "basic amenities." WERA's DOJ complaints were renewed in February 2010 and are currently under "jurisdictional review" at DOJ and U.S. EPA's Office of Civil Rights in Washington, DC.

The African-Americans in WERA communities have been requesting access to services for years. One of the most glaring examples of blatant racial discrimination in this case happened after WERA went above the city for help. In 2000, the North Carolina Department of Transportation and Department of Environment and Natural Resources set aside over $5 million for the installation of first-time municipal drinking water and sewer collection lines where failed backyard septic systems and outhouses of 134 homes contaminated community ditches and streams with sewage and *E. coli*. Local government officials repeatedly refused to sign contracts for these state and federal dollars because the money was earmarked to reduce public health disparities in low-income minority communities targeted for destruction by the planned highway corridor—a transportation project planned and supported by city and county governments for three decades. The U.S. Department of Transportation placed the highway project on moratorium after WERA filed the DOJ complaint to prevent it from destroying two of Mebane's minority communities that faced decades of adverse and disproportionate impacts.

From the beginning, WERA has been proactive and patient in efforts to work with the city of Mebane and county governments. WERA's collaborative legal, public health, university, foundation, and government partners have worked to pursue and leverage millions in block grants and local government matching funds to install first-time sewer and safe drinking water services, pave dirt streets, and remove underground storage tanks leaking petroleum as well as toxic benzenes and xylenes (Wilson, Bumpass, Wilson, & Snipes, 2008). Since 2000, Omega, Marilyn, and other members of WERA's board and staff including co-author Natasha Bumpass, who served as WERA's communications manager and field/office research assistant via AmeriCorps VISTA, have worked very closely with Drs. Chris Heaney, John Cooper, and Sacoby Wilson on a series of community-led research studies. These efforts focused on documenting out-of-compliance infrastructure, contaminated drinking well water, contaminated municipal water, and pollution in surface water at levels over 300 times U.S. EPA Clean Water Act guidelines. In 2000, the city of Mebane intentionally installed sewer lines for future taxpayers while ignoring taxpaying residents of WERA communities. In 2003, WERA research documented the actions of the city of Mebane, which provided sewer line connections for new high-income white subdivisions, bypassing dozens of contiguous African-American homes that had been there for decades—some only two to three blocks from Mebane's newly upgraded and federally funded waste water treatment facility.

The financial responsibility of officials for public expenditures is an old argument in cases of environmental injustice and parallels arguments made against antidiscrimination policies: the most expedient and cheapest option for those who control government and industry is to deny services to, and dump on, the same people as always because their land is worth less and they don't have political power. Environmental racism/injustice saves money for some officials by creating burdens on the poor and people of color. That is institutionalized, that is the way the system often works.

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Our efforts to raise awareness about these issues have resulted in publications in scientific journals (Heaney, Wilson, & Wilson, 2007; Wilson, Cooper, Heaney, & Wilson, 2008; Wilson, Heaney, Wilson, & Cooper, 2007; Wilson, Wilson, Heaney, & Cooper, 2008) and garnered invitations from national and international organizations. Omega has supported other communities around the country. His knowledge of how to build and manage collaborative partnerships resulted in an invitation to serve as a "community perspective" member of U.S. EPA's National Environmental Justice Advisory Council (NEJAC) during 2007–2010, providing input on interagency policy and compliance for air, water, and soil in low-income minority communities and tribal areas throughout the United States. Omega was the lead writer for the "Community Facilitated Strategies" section of NEJAC's Goods Movement Recommendations (involving air, maritime, and rail ports and highway corridors) that adversely affect low-income minority communities and tribal areas (U.S. Environmental Protection Agency, 2010). The Obama-Biden transition team also requested Omega's input on December 16, 2008, to present 10 environmental justice policy priorities to incoming staffers of President-elect Barack Obama's administration, focusing on interagency actions to reduce or eliminate environmental contaminants and health care disparities, improve enforcement of health statutes, and generate new preventive efforts (Wilson, 2008). There is still work to do on expanding the consciousness of ethnically diverse audiences of policymakers, educators, health professionals, and the public.

A broader application of quantitative as well as qualitative methods of scientific research is paramount to improving the quality of life in low-income minority communities and tribal areas and to removing the intellectual and institutional grip of old South cultural and racial legacies of "states' rights" over federal statutes. The co-authors believe that collaborative problem-solving partnerships must move from research, to advocacy, and to activism to translate scientific information and knowledge about institutional racism and health disparities into effective strategies to eliminate environmental and public health hazards. This activism is also needed to dispel the myth that communities should be expected to pull themselves up by their bootstraps in the midst of a severe environmental crisis. An encouragement of the people of color in Mebane to be more self-reliant like the citizens of Joplin, Missouri, is misguided, as Missourians affected by the severe storms, tornadoes, and flooding had received $77 million in federal relief as of August 31, 2011 (Federal Emergency Management Agency, 2011).

The points raised in the letter to the editor closely parallel public comments expressed by Mebane's city council when WERA filed Title VI and environmental justice complaints nearly 13 years ago. Some may not be aware that starting this summer, President Obama's administration has secured the commitment for 18 branches of the federal government to sign a memorandum of understanding (MOU) to include environmental justice guidelines in their operating procedures (U.S. Department of Justice, 2011). One of WERA's attorneys led the drafting of the MOU. Many still deny, however, that institutional racism is a significant factor in providing access and financial resources necessary to reduce and eliminate legacies of discrimination and segregation.

Our response to the letter to the editor reflects the public and private scientific positions of many in the public health field as the *North Carolina Medical Journal*, with a circulation of over 30,000, invited Omega Wilson to write a commentary, published in May 2011, entitled "Lack of Basic Amenities: Indicators of Health Disparities in Low-Income Minority Communities and Tribal Areas (Wilson, 2011)." We are encouraged that the *JEH* has joined the *North Carolina Medical Journal*, WERA's collaborative partners, and President Obama's administration to help expand the discussions about broad systems that perpetuate environmental injustice and innovative and proactive efforts that can address racial and economics disparities in public health policies.

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Marilyn Snipes
Natasha Bumpass
John Cooper, PhD
Sacoby Wilson, MS, PhD

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Did You Know?

Starting in March, the Agency for Toxic Substances and Disease Registry (ATSDR) will be writing a column in every other issue of the *JEH*. Look in next month's issue for this valuable new resource.

Managing Editor's Desk
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Officials (NACCHO), the public health workforce (of which many NEHA members are a part) has shrunk by almost 20% since the Great Recession began. No number of protest signs or letters to the president are going to change those numbers.

In the blind rush to man the barricades and protect what we have, I am also seeing professions get caught up in the specious argument that cutting their ranks automatically translates into a loss of capacity (i.e., the amount of work that can be done). Implicit in this argument is the idea that capacity is a function of workforce size. Cut the size of the workforce and you automatically cut the capacity of that workforce.

This argument, which drives many of the protests now taking place, is just not valid. Worse, hiding behind it hinders our ability to confront the brutal realities of our day, which as Stockdale maintained, is the necessary step that we have to take to get ourselves to a better tomorrow.

As many of you know, I come from the world of engineering. In studying engineering I became familiar with the idea that technology can be seen as a "disruptor." That is, the application of technology to a system or way of doing things can multiply by orders of magnitude the productivity (and capacity) of that system, just as we are seeing today through the loss of many middle-class jobs.

Technology can boost the output of a system and decrease the personnel investment necessary to accomplish a set amount of work. As economies move toward higher levels of efficiency, this trend will continue to accelerate irrespective of what anyone thinks or wants. It is one of those brutal realities that we face today.

It is important not to misread what I am saying. I am not overlaying any particular political or humanistic perspective on the essence of what technology is or does. *It just is*, that is, to understand technology is to understand how it changes the game and "disrupts" the order. Technology itself is value neutral. (It is in how we apply technology that we enter into the world of values, ideologies, intentions, etc.)

Let me now go back to the two quotations from the beginning of my column:

- The rampaging elephant: we're not going to reverse the economic forces impacting us.

  Irrespective of what we think or feel, the Great Recession happened and its legacy continues. Moreover, this economic event, whether we like it or not, has had, and continues to have, an impact on our profession (and of course, many others!)
- The Stockdale Paradox: we have to deal with the brutal facts even as we are determined to prevail.

  We ignore at our peril the brutal realities that our profession is now facing. We are a downsized profession—whether we like it or not—and no amount of protesting or wishing that things were different is going to change that. *Yet we can still prevail in the end* if we can understand how the future is unfolding and how we can take advantage of these trends, which includes the wise use of new technologies.

NEHA is not committing resources to recreate 1987. That would be futile and a dereliction of our duty to prepare this profession for its future. Instead, we have our sights set on tomorrow and we are working to understand better how the events of today are likely to transform this profession so that we can prepare our members for success in that future.

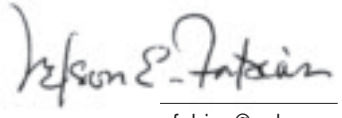
As examples of this effort, last year we presented a play at the Annual Educational Conference (AEC) & Exhibition that previewed how we might be working in the future (and I might add, with new technologies). I am happy to note that the session was standing room only. Furthermore, we will soon be presenting a new column in our *Journal* that will be written by a futurist—in fact, Google's top-rated futurist speaker—Tom Frey. Frey is an expert in discerning how work is changing and what we need to do to be in phase with how it is evolving. Tom will also present the keynote at our 2012 AEC in San Diego. His message will center on how we can prepare ourselves for success in the future. And then, NEHA just took the unprecedented action to cobrand with Decade Software Company.

As we were beginning to appreciate that the work world of environmental health was evolving, our interest in the disruptive nature of technology grew. We decided that the time had come to work more closely with technology companies with the intent of tapping into their technologies to build capacity even as the size of our workforce was diminishing. To make matters easier, we determined that it would be wise to begin this venture by working closely with a single company from among our many friends in this industry. We conducted an elaborate request-for-proposals process. After reviewing a number of well-prepared and attractive bids, we decided to select Decade Software to be our cobranding partner.

The mission of this program is to push capacity building aggressively within our profession by tapping into the power of new IT applications. In choosing to work closely with one partner (while continuing to work more generally with all of our IT partners), we envision that this program will open up opportunities for us to drive the work of our profession to higher levels of capability despite an environment of program, financial, and staffing cutbacks.

Through this column, I am happy to formally announce to the membership that NEHA and Decade are now partners. NEHA couldn't be more pleased with this partnership as our respect for Decade and its commitment to environmental health have been unwaveringly high and rock solid over the years. We will be working closely together to explore how we can jointly design and introduce IT products into the practice of environmental health and by so doing, increase the productivity and accomplishments of this profession. This initiative will also involve training and preparations for our members so that they can gain an upper hand on the future.

To see a profession undergo the trauma that ours has gone through has been painful. To watch this happen knowing that nothing can be done to stop it is all the more frustrating. Nevertheless (to echo the two pearls of wisdom from the beginning of my column), there is no excuse for idly standing by and just hoping that someday things might get better. NEHA's membership needs to know that NEHA has taken the initiative to understand the lessons of the economic events sweeping through our profession. Moreover, we are determined to find ways to build capacity in environmental health through the use of disruptive technology. In the process, we persist in our goal to help each and every practicing environmental health professional become more successful in the future.



nfabian@neha.org

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KM14 – New Waterproof Dishwasher Digital Thermometer

Comark is introducing its newest Pocket Digital Thermometer, the KM14.

The KM14 is waterproof, field calibratable and with a MAX hold reading, can be used to test the rinse cycle in commercial dishwashers. The slim design fits easily in a pocket or sleeve.

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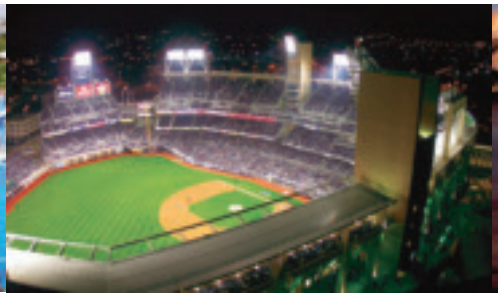
Register for the NEHA AEC June 28-30, 2012

The NEHA AEC is the premier event for environmental health training, education, networking, advancement, and more!






NEHA AEC 76th

National Environmental Health Association (NEHA)
Annual Educational Conference (AEC) & Exhibition

Register Today for the NEHA 2012 AEC!

neha2012aec.org/register.html

Don't miss the training, educational, networking, and advancement opportunities that await you at the NEHA 2012 AEC. Register today to attend at neha2012aec.org/register.html. For personal assistance, contact Customer Service toll free at 866.956.2258 (303.756.9090 local) extension 0.

	Member	Non-Member
Full Conference Registration	**$565**	**$725**
One Day Registration	$305	$355
Student/Retired Registration	$155	$225

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Stay at the designated AEC hotel–*the San Diego Marriott Marquis & Marina*– and receive a $50 food voucher to use toward your meal purchases.

Certain terms and conditions apply.

See AEC website for details.

Save on AEC Registration – Join NEHA as a Member Today!

Become a NEHA member and take advantage of the member registration rate of $565 for the full conference. An annual membership is just $95 and includes a free subscription to the *Journal of Environmental Health*; free Continuing Education credits for e-Learning courses; access to a members-only website, which includes a member directory; affinity programs with discounts for NEHA members on various goods and services; and more!

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 guaranteed return on the investment made for you to attend the AEC.

Need additional reasons to attend the NEHA 2012 AEC?

Visit neha2012aec.org for more information.

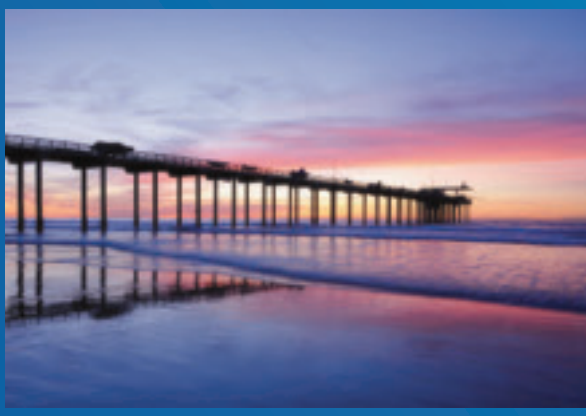
Enjoyment of the Destination

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.

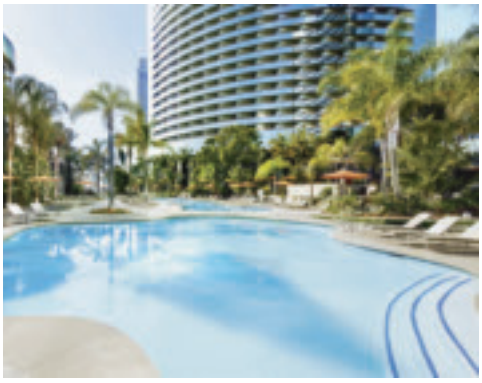
San Diego County's 4,200 square miles offer immense options for business and pleasure. San Diego is renowned for a dazzling array of world-class family attractions including the world-famous San Diego Zoo and San Diego Zoo Safari Park, Sea World San Diego, and LEGOLAND California. The city offers an 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!



Marriott MARQUIS SAN DIEGO MARINA



AEC Designated Hotel

San Diego Marriott Marquis & Marina

333 West Harbor Drive, San Diego, CA 92101

To make your hotel reservations, visit neha2012aec.org/hotel.html.

The San Diego Marriott Marquis & Marina is southern California's premier San Diego hotel, and is the designated venue and hotel for the NEHA 2012 AEC. Book your hotel room today to secure your stay at the beautiful San Diego Marriott Marquis & Marina at a wonderfully discounted rate of $149/night*!

Rooms are available within the NEHA block from June 24–July 4, 2012.

*Taxes and fees also apply. To receive the discounted rate of $149/night, you must book your hotel room within the NEHA block. Discounted rooms are available on a first-come, first-serve basis. Rooms with a bay view are also available at $169/night plus taxes and fees.

Special Events at NEHA AEC

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

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

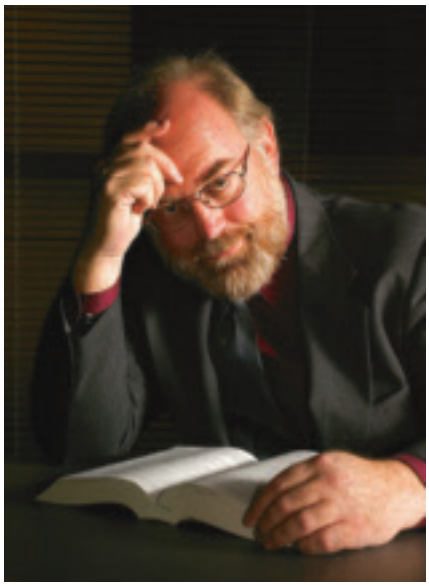
NEHA will be holding a Community Volunteer Event as part of the 2012 AEC. This is the second year that NEHA has organized a Community Volunteer Event as part of our efforts to "green" the AEC, and to give back to the host city in which the AEC is held.

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

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.

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



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

Thomas Frey is author of "Communicating with the Future: How Re-engineering Intentions Will Alter the Master Code of Our Future" and Executive Director and Senior Futurist at the DaVinci Institute. 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.

As things continue to change across our communities, there are "new normals" emerging. Thus, Frey's presentation at the NEHA 2012 AEC will continue to explore where things are likely to go in the future, and continue the discussion of "new normals" that began at the NEHA 2011 AEC.

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.

Preliminary Schedule

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	NEHA General 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			

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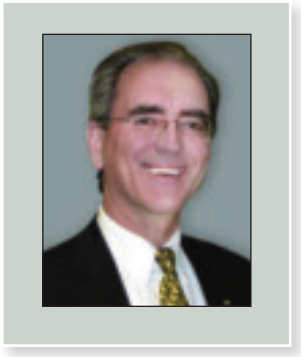
MANAGING EDITOR'S DESK



Increasing Capacity Even as the Size of the EH Workforce Declines: NEHA Cobrands With Decade

Nelson Fabian, MS

When I was studying philosophy and Eastern religions, I came across a phrase the essence of which I have never forgotten. It went something like this: It is easier to get out of the way of a rampaging elephant than to try to get on it to somehow stop it.

The point is that sometimes things happen that we can't control. It is the wise person who chooses to both accept that and to do his or her best to work with the aftermath (of the rampaging elephant!).

Today, we sit and watch as the rampaging Great Recession and its legacy continues to play out. As painful as it is to watch rising debt levels, layoffs, cuts in programs, and so forth, neither you nor I nor NEHA is going to stop this elephant of an event.

I came across another quotation recently that has maintained a hold on me. I found it in Jim Collins' excellent book, *Good to Great.* The quotation follows from the story of Admiral Stocktdale, who was held in captivity for eight years during the Vietnam War. Collins interviewed Stockdale and asked him how he survived when others didn't. Stockdale explained that the optimists never made it out because they couldn't handle the crushing disappointments that followed broken promises of prisoner releases. He stressed that people develop the capacity to endure and ultimately make it through such an ordeal only when they accept the harsh realities of their situation.

Collins coined the term "Stockdale Paradox" from Stockdale's story. He went on to note that the truly great companies all practiced this concept, which he defined as follows:

"Retain faith that you will prevail in the end, regardless of the difficulties AND AT THE SAME TIME, confront the most brutal facts of your current reality, whatever they might be."

> ***Moreover, we are determined to find ways to build capacity in environmental health through the use of disruptive technology.***

When facing a difficult situation, such as what our profession is dealing with in this economic downturn, it is crucial that we accept the many burdens and changes that these times are forcing upon us while we maintain a strong faith we will come out of this OK in the end.

Taking these two quotations into account, it is important that the NEHA membership knows that our association holds no illusions that we can somehow protect our profession from the economic forces impacting us. (We can't stop the rampaging elephant.) What we can do, however, is actively tune into and use the lessons from this experience to prepare our profession for future success. (Confront the realities that we are facing while maintaining faith that we can prevail in the end.)

As we try to understand the aftermath of the economic issues playing out, one in particular stands out. Much has been written about income and wealth disparity in the United States as we follow story after story about the shrinking of the middle class. It is instructive to note that many middle-class jobs involve some form of information manipulation. Information is processed through these jobs to produce higher value information outputs.

The Internet and a host of related technologies are changing that as these technologies provide less expensive ways to produce even higher value information outputs. The price being paid for a more efficient and productive economy is the loss of many of the information manipulation jobs formerly held by middle-class workers. And yes, this trend is also touching our field of practice.

Rather than deal with these kinds of brutal realities, I see many professions ignoring them. In response to reduced levels of funding, I see one professional society after another "taking to the streets" to argue how important their profession is and to point out what the dire consequences will be if further cuts to their ranks occur (as if anyone is even listening). It is as if the name of the game is to protect what we have, all the while pretending that somehow we can turn back the clock to some glorious past, say, 1987. To put it bluntly, that ain't gonna happen.

These kinds of reactions violate the Stockdale Paradox by ignoring the brutal realities that we need to be confronting and adapting to instead. No program, including those long held sacred by local governments (such as police and fire), is immune from the economic ravages and workforce changes roiling our communities today. According to the National Association of County and City Health

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Challenging Times—Our Profession's Response.

The economic pressures that are bearing down on environmental health programs today are virtually without precedent. These pressures are forcing personnel and resource cuts that threaten the ability of environmental health programs to deliver the results expected of them. Situations like this call for daring new ways of accomplishing more for less. NEHA is committed to exploring how advances in information technology can help this profession transcend the challenges it now faces.

Together with our co-branding partner Decade, we have moved to create a powerful alliance to advance the technological sophistication of the profession. This co-branding partnership was initiated only after going through a carefully designed and executed RFP process. NEHA and Decade Software are now moving to assess how IT can enable the profession to build capacity, capability and program sustainability even as program funding for personnel and resources become increasingly precarious.

Together, NEHA and Decade Software will work to develop and introduce information technology solutions that can better serve both the present and future needs of environmental health. Financial pressures notwithstanding, NEHA and Decade are committed to finding any and all ways to enable IT to support the advancement and significance of environmental health work.

Look for news of our progress in the upcoming months. To learn more visit www.decadesoftware.com/vision.

Nelson Fabian
Executive Director and CEO

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

Kevin Delaney
President

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