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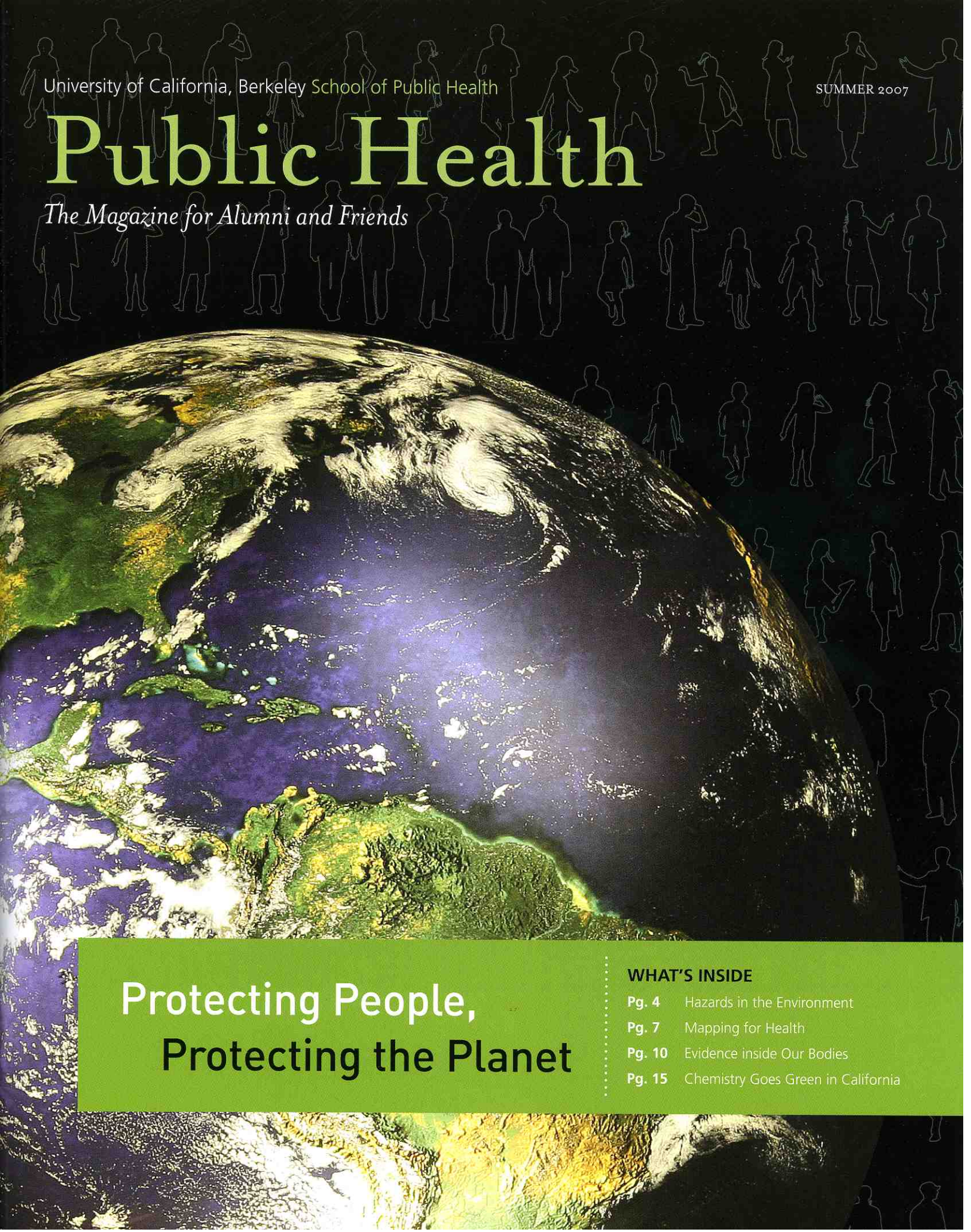
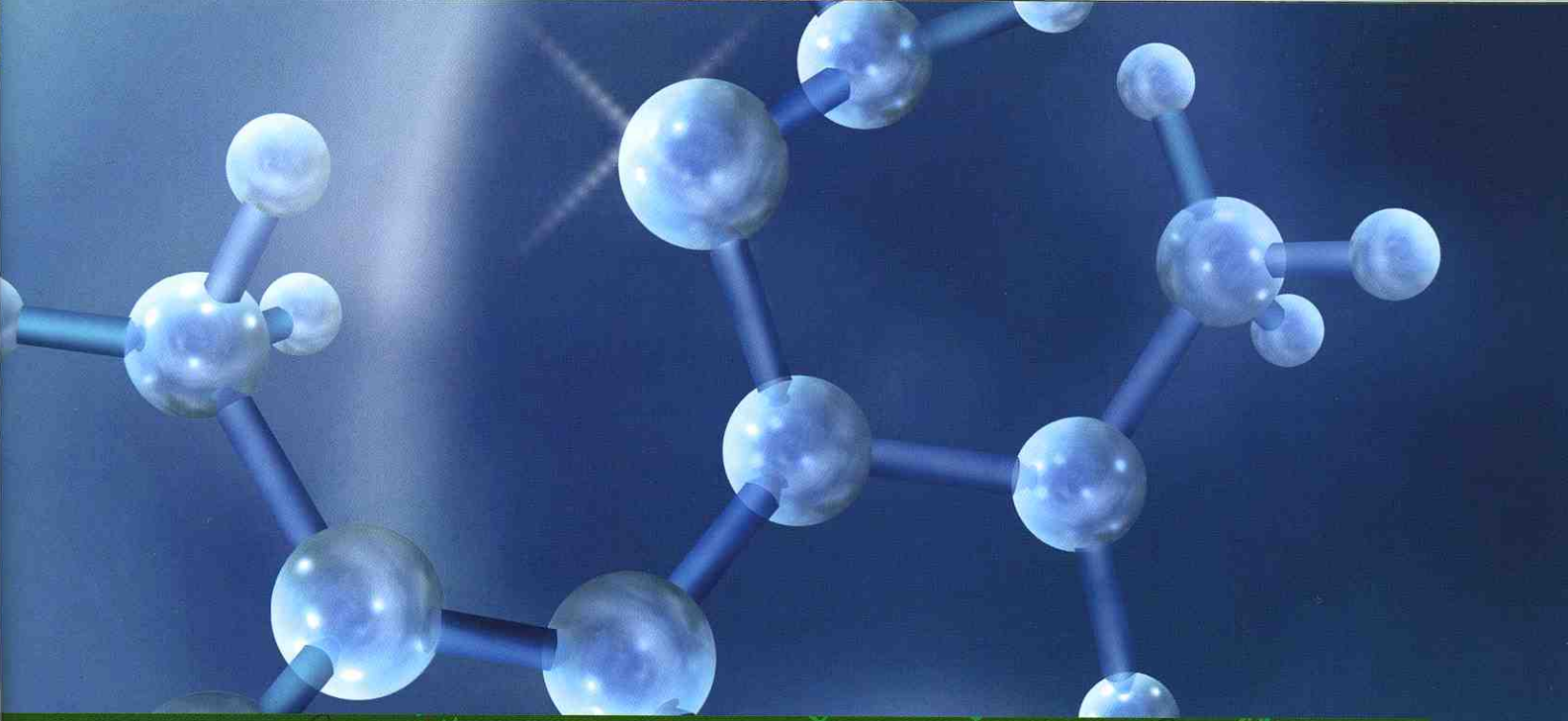


Protecting People, Protecting the Planet

WHAT'S INSIDE



Chemistry Goes Green in California

By Kelly Mills

Most of us feel secure in the belief that chemicals used in consumer products and industrial processes are safe; surely they must be highly regulated to ensure they pose little or no risk to people or the environment.

Surprisingly, this is far from true. The U.S. Toxic Substances Control Act of 1979, which was intended to regulate chemicals both before and after they enter commerce, does not require chemical manufacturers to disclose information on the toxicity of the substances they introduce into the market. It also greatly constrains the EPA's capacity to control the sale of chemicals that are known to be hazardous.

"We have built a chemical industry that markets its products—42 billion pounds each day—on the basis of their function, price, and performance," says **Michael P. Wilson**, research scientist at the Center for Occupational and Environmental Health (COEH). "The hazard piece, how these substances affect human health and ecosystems, is largely missing as a consideration in the market."

This explains, says Wilson, why "one can earn a Ph.D. in chemistry at universities across the United States without demonstrating even a rudimentary understanding of toxicology or ecotoxicology. These topics are not part of the curriculum of chemistry students today simply because they are not all that valued in the chemicals industry." As a consequence, hazardous chemicals have remained competitive in the market, and the public is exposed to them every day in the workplace, in consumer products, and in air, water, food, and waste streams.

Scientific evidence showing that chemical exposures can cause chronic diseases, particularly when they occur early in life, continues to accumulate. Professor of epidemiology and maternal and child health **Brenda Eskenazi** participated in the findings of this past May's "International Conference on Fetal Programming and Developmental Toxicity," which concluded that "toxic exposures to chemical pollutants during these windows of increased susceptibility can cause disease and disability in childhood and across the entire span of human life," and that "these adverse effects have been linked to chemical pollutants at realistic human exposure levels similar to those occurring from environmental sources."

Potentially hazardous chemicals run the gamut, from those used in the manufacture of goods to consumer products sold at local hardware stores. In California, an estimated 23,000 workers each year are diagnosed with a deadly chronic disease attributable to chemical exposures in the workplace.

Enter "green chemistry." This phrase has become part of the lexicon in California and Washington, D.C., as policy makers have conducted hearings and sponsored legislation and policies that would motivate the production of chemicals that are more environmentally sustainable and safer for the public. The attention is due, in large measure, to a UC Berkeley report, *Green Chemistry in California: A Framework for Leadership in Chemicals Policy and Innovation*, authored by Wilson and colleagues and published in March of 2006 by the California Policy Research Center, under the aegis of the UC Office of the President.

The report, commissioned by the California Senate Environmental Quality Committee and the Assembly Committee on Environmental Safety and Toxic Materials, calls for California to implement a modern chemicals policy or pay the price in environmental and health damage and lost opportunity for new investment in cleaner chemical technologies. It points out that much of the industrial world, particularly the European Union, has already implemented

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Chemistry Goes Green, continued

such policies, and that by neglecting to follow suit, the United States runs the risk of losing markets and becoming a "dumping ground" for substances prohibited for sale in other parts of the world.

When it was released, Wilson's report produced a firestorm of interest among policy makers and advocates, as well as stiff resistance from the national chemical lobby, the American Chemistry Council, which scrambled to refute it. Other industry leaders, however, confided to Wilson that the analysis was correct, and many softened their position, with some even calling for internal reform and continued leadership by UC Berkeley.

In August 2006, Wilson was asked to testify before the U.S. Senate Environment and Public Works Committee at the first hearing on the U.S. chemical management system and the Toxic Substances Control Act in 10 years. In May this year, California's EPA launched the ambitious Green Chemistry Initiative, prompted and enabled by the report. California State Senator Joe Simitian (D-Palo Alto) and Assemblyman Mike Feuer (D-Los Angeles) have each proposed far-reaching legislation that would help pave the way for California to become a national leader in green chemistry and chemicals policy. Some California industries that are major purchasers of chemicals—such as the electronics and health care industries—are beginning to examine hazardous chemicals in their supply chains, and they are developing new standards that must be met by chemicals suppliers.

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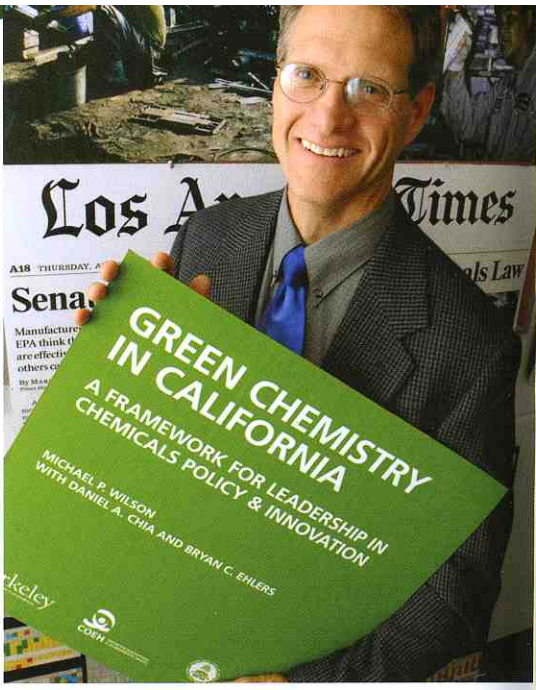

Michael Wilson and colleagues authored an influential report calling for California to become a global leader in green chemistry innovation.

Observers attribute the success of the report to a number of factors. Rather than focus on banning or regulating one or two toxic substances, for example,

What Makes an Intervention Sustainable?

Catherine Koshland has looked at multiple aspects of combustion, fuels, and emissions, and while her lab employs the latest technologies and has developed new technologies for diagnostics, Koshland believes it doesn't end there. To develop successful, sustainable interventions to improve health and the environment, she says, it is necessary for researchers to move away from simply creating technological advances, to examine through fieldwork whether the latest alternative energy source is actually workable for the people it is designed to aid.

Many interventions have failed because engineers, researchers, and officials neglected to find out if the new technology would actually prove helpful or be maintained in the long term, says Koshland, who is a professor of environmental health sciences, the Wood-Calvert Professor in Engineering, and UC Berkeley's vice provost for academic planning and facilities.

For this reason, Koshland, along with her former student Susan Fischer and anthropologist John Young from Oregon State University, conducted an ethnographic study on the implementation of an alternative bioenergy system in northeast China. The project they examined was an attempt to replace the use of coal or wood for household cooking with a biogas derived from corn stalks. To assess the environmental health impact, they made a series of measurements of indoor air quality as well as villagers' exposures to carbon monoxide. They also conducted interviews and made observations of villagers, the development team implementing the project, and officials in the village and elsewhere to assess the social and economic impact.

"Our goal was to try to understand the factors that contribute to a successful project," says Koshland.

They found some serious flaws in the intervention: Although the project was portrayed as a success by the development team, there were problems with its implementation, operations, and contracts, which led to spotty availability of the fuel and poor financial performance. Villagers were very unhappy with the project as a result as their real needs, and concerns were not considered in the project design or in its implementation.

Koshland holds that more studies like this are needed when interventions are designed and implemented. "We can't just work in isolation, she says. "One of the things that characterizes the Berkeley environmental health sciences group is that while we all may be doing fundamental work in the lab…that work is all embedded in a larger context of understanding the landscape around you."

Wilson and his colleagues examined the structural problems in the chemicals market and the chemical regulatory system, and they integrated public health concerns with those of economic competitiveness and industrial innovation. Wilson assembled researchers from a wide range of disciplines to guide the report, such that the final document is a multidimensional, solution-oriented analysis of the role of industrial chemicals and their role in society, now and in the future. As a result, the report speaks to a wide range of concerns, from California's competitiveness in the global economy, to the growing impacts of the state's expanding population, to the ethical dimensions of allowing children and workers to be exposed to known toxic substances. The report has become a model of effective interdisciplinary work at the intersection of science and policy.

Wilson's interest in chemical safety, particularly among workers, was sparked by his years of work as a firefighter and a paramedic with the Salinas Fire Department, south of San Jose. Not only were he and his coworkers exposed to myriad occupational hazards, they were often called to the scene of workers injured in the Salinas agricultural industry. Most of these calls were for traumatic injuries; some involved chemical exposures. At 36, he came to the UC Berkeley School of Public Health for the express purpose of finding solutions to occupational diseases and injuries. He earned a master's degree in public health in 1998 and a doctorate in 2003. In his dissertation, he conducted an exposure analysis among auto mechanics in the Bay Area who had developed a neurological disease that caused them to lose function in their limbs. With COEH physician **Robert Harrison** at UCSF, Wilson traced the origins of the disease back to the mechanics' use of cleaning solvents that contained hexane, a known neurotoxic solvent. "Here we are in this modern industrial economy with workers using a well-known neurotoxic chemical under totally uncontrolled conditions, inhaling the vapors, and becoming disabled," says Wilson. "The more I looked at this issue, the more it became obvious that this was not an isolated event but was a lens into an enormous set of problems with the way we design, use, and regulate industrial chemicals."

Four years later, California is now poised to become the national leader in green chemistry innovation. Stay tuned.

To access the reports noted in this article:
The Green Chemistry Report: coeh.berkeley.edu/news/06_wilson_policy.htm

International Conference on Fetal Programming and Development Toxicity statement: www.pptox.dk/

The California EPA Green Chemistry Initiative: www.dtsc.ca.gov/PollutionPrevention/GreenChemistryInitiative/index.cfm

Air Pollution: It's Not Just Outside

"Most people, when they think of air pollution, think about outdoor air pollution—smog in the cities," says **Kirk Smith**, who holds the Brian and Jennifer Maxwell Endowed Chair in Maternal and Child Health. "But poor people in rural areas of the world are using poor-quality fuel, which produces a rather large amount of pollution. If they have a stove without a chimney, particulate matter is released right where people are every day. It is among the most important causes of ill health for approximately 40 percent of the world's population."

Smith has spent more than two decades working to establish the relationship between the use of biomass fuel—wood, crop residue, and dung—and ill health, especially among women and children who spend most of their days within the confines of poorly ventilated houses. Although not widely recognized, the problem is extensive: The World Health Organization estimates that two-thirds of the developing world rely upon these biomass fuels. In homes without ventilation, exposures to particulate matter, along with carbon monoxide, formaldehyde, benzene, nitrogen dioxide, and other gases, can reach 1000 µg/m3 over a 24-hour period—more than 20 times higher than the standards set by the U.S. Environmental Protection Agency.

The consequences of burning biomass fuel are especially tragic for children. Consistent exposure to airborne particulates increases the incidence of acute lower respiratory infections (ALRI), such as pneumonia and bronchitis, in children under five years of age. In less-developed countries, where access to medical attention is limited, ALRI is the primary cause of death among children.

Although Smith and others sounded the alarm about indoor air pollution in 1984, it took until 2001 to convince funding agencies to support the first randomized control trial. The recently concluded study, conducted in Guatemala, has found a roughly 40 percent reduction in serious childhood pneumonia in households with improved chimney stoves compared to those using open woodfires for cooking.

While the statistics for indoor air pollution are staggering in the amount of mortality and morbidity they describe, Smith holds out hope that his careful gathering and interpretation of data will offer a clearer picture of worldwide public health risks and prompt interventions that save lives.