In December 2009, COEH researchers, community advocates, health department professionals and National Research Council committee members came together in Oakland, California, for a symposium: *Assessing and Addressing Cumulative Impacts in California Communities*. The event was the culmination of research projects to develop methods and approaches to cumulative impacts supported by the Office of Environmental Health Hazard Assessment of the California Environmental Protection Agency (Cal/EPA).

Principal investigator and conference organizer Amy D. Kyle comments, “Much of what we do in environmental health has focused on single chemicals or agents, in terms of both research and in policy. While this has led to significant reductions in emissions of regulated pollutants, it has not protected people in communities with accumulation of multiple sources of pollution. We are trying to look at how we can do a better job with the environments that actually exist in communities.”

The project was prompted by California legislation requiring state agencies to consider the cumulative impacts of environmental and other factors that can disproportionately affect communities. Cal/EPA has adopted a broad definition continued on page 4
Health Risks Fail to Deter Proposed Use of Methyl Iodide on California Crops

Advocacy groups concerned about occupational and environmental health issues and growers worried about their economic interests have long been at odds when it comes to pesticide regulation in California. A new battle has been waged for the past several years over a potential substitute for methyl bromide, a fumigant that has been widely used by California strawberry growers, who account for 88% of the nation’s production of this popular fruit. Methyl bromide is listed as “highly toxic” by the US Environmental Protection Agency (EPA) because inhalational exposure can cause both acute (pulmonary and neurological) and chronic (neurological and reproductive) effects. Many of the readers of this column will remember largely unsuccessful efforts over 20 years ago to restrict its use to protect workers from occupational exposures. As unfortunately is often the case, the economic benefit of this chemical, which is widely used as a gaseous fumigant, trumped occupational health concerns.

Interestingly, methyl bromide use has been decreasing in recent years, but not because of new-found concerns over the health of largely low-paid, immigrant farm workers. The production and application of methyl bromide has been banned under the Montreal Protocol to prevent depletion of stratospheric ozone. This ban took effect in the United States in 2005, but American farmers were given a reprieve because the use of methyl bromide was deemed “critical” for the economic survival of certain types of agriculture, including strawberry production.

The search for alternatives to the use of methyl bromide has been intense, and the agent that the strawberry industry has been pushing is methyl iodide. Although methyl iodide is considered even more toxic to health than its chemical cousin, it has much lower stratospheric ozone depleting and greenhouse gas properties. Despite protests from scientists and environmental health advocates, the US EPA first registered methyl iodide as a pesticide in October 2007. Tokyo-based Arysta LifeScience, the world’s largest producer of methyl iodide, began gearing up to make the product available to the US market under the brand name Midas, but the initial approval was limited, registering use of methyl iodide for only one year.

Of note, Stephen Johnson, EPA Administrator under the Bush administration, hired Elin Miller as Regional Administrator for EPA Region 10 shortly before the limited registration of methyl iodide. Miller had been CEO of Arysta’s North American operations. During the final months of the Bush Administration, the US EPA quietly removed the time limits on its decision, effectively giving Arysta a green light to sell methyl iodide in the United States.

A change of wind came with the Obama administration. In September 2009, the US EPA agreed to reopen its decision on methyl iodide, pending results of an evaluation of methyl iodide’s toxicity by a special Scientific Review Committee. Four COEH scientists—John Froines, Committee Chair (UCLA), Paul Blanc, Kathie Hammond and Tom McKone—were members of this committee. Not surprisingly, their final report in February 2010 indicated that “any anticipated scenario for the agricultural... use of this agent... would have a significant adverse impact on the public health.” Yet despite this warning, on April 30 the California Department of Pesticide Regulation (DPR) proposed approving the sale and use of the methyl iodide statewide. Final approval, if granted, would not come until sometime after June 14, when the public comment period ends.

To me, the story of methyl iodide’s registration by the US EPA and its tentative approval for use in California by the DPR says much about what is wrong with current chemicals policy in our country and state. Hopefully, the US EPA under the present administration will reconsider its registration of this highly toxic chemical.
Flame Retardants Linked to Delayed Pregnancy

Most people don’t know what PBDE stands for, but they should. Polybrominated diphenyls (PBDEs) are a class of flame retardants found in furniture, carpet padding, cell phones and other electronics. PBDEs leach out of consumer products into our environment. Animal studies have confirmed their adverse effects, but now researchers from UC Berkeley are the first to show that PBDEs may disrupt fertility in women.

Participants in the study were part of a birth cohort investigation by the Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS). “A couple of years ago we started measuring PBDEs in house dust and in the blood of our participants and found very high levels,” said study author Kim Harley. “We went to Salinas to study the health effects of pesticides, but what we’re learning is that PBDEs also seem to be an important exposure in the community.”

Almost all Americans have detectable levels of PBDEs in their blood. Levels are 20 times higher in the United States than in Europe, with the highest levels in California, possibly due to the state’s strict flammability standards.

“It’s something we’re concerned about,” reported Harley. “In study after study, levels of PBDEs in dust, breast milk and blood samples in Californians are higher than the rest of the country.”

Kim Harley is associate director of the Center for Children’s Environmental Health Research within the School of Public Health at UC Berkeley. The project was funded by the National Institute of Environmental Health Sciences and the US Environmental Protection Agency.

“Animal studies are showing us that PBDEs are endocrine disrupters. They affect thyroid hormone balance, they impact brain development, and they interfere with sex hormones and reproduction—three outcomes that we are interested in looking at in our human population,” said Harley.

Researchers interviewed 223 pregnant women over age 18 from six prenatal care clinics in Salinas Valley, California, to determine how long it took for them to get pregnant. Residents of the area are predominantly low-income Mexican immigrants.

Blood samples were taken near the end of the second trimester to detect four PBDE substances found in greater than 75% of the general population (BDE-47, -99, -100, -153). All four were found in over 95% of participants. The strongest predictor of PBDE levels was years of residency in the United States. Increasing levels of BDE-47, -99, -100, -153, and the sum of the four substances, were associated with longer time to pregnancy.

“What we are seeing is a 30% decrease in the odds of becoming pregnant each month,” said Harley. “Women with higher levels of PBDEs took significantly longer to become pregnant.”

Researchers took into account variables that might affect their results such as maternal age, a history of gynecologic medical conditions or breast feeding in the two months prior to conception. “We also controlled for working in agriculture and pesticide use in the home,” confirmed Harley.

The good news is that PBDEs are being phased out, but their legacy remains in big ticket items like TVs and sofas that we don’t replace very often. “It’s hard for consumers to know which items contain PBDEs and which don’t,” added Harley.

She suggested that people can reduce their exposure to house dust that may contain PBDEs by using a wet mop or a HEPA (high efficiency particulate absorbing) filter vacuum. “Washing hands is important. We may be ingesting PBDEs by hand-to-mouth contact with remotes and cell phones.” Consumers can also inquire about flame retardants when purchasing new furniture.

“Our next steps are to see if PBDEs are associated with other health outcomes,” said Harley. “We’ve seen in animal studies that PBDEs affect learning and memory, and we’re concerned they might be having the same effect in children.”

Cumulative Impacts (continued from cover)

of cumulative impacts as “exposures, public health, or environmental factors from the combined emissions and discharges in a geographic area, including environmental pollution from all sources, whether single or multi-media, routinely, accidentally, or otherwise released. Impacts will take into account sensitive populations and socio-economic factors, where applicable and to the extent data are available.”

Faculty presented methods to identify high-risk communities and quantitative metrics to assess uniformity of exposures. Community advocates discussed the value of this work for neighborhoods, the need for action and the usefulness of health impact assessment strategies.

UC Berkeley Investigator Findings
Rachel Morello-Frosch highlighted key findings from the evidence base supporting work on cumulative impacts, pointing out the depth and significance of disparities in environmental exposures and in health status, the importance of considering particular susceptibilities, and how social vulnerability can amplify effects of environmental exposure.

Measurement and Inequalities
Morello-Frosch discussed methods to identify areas with higher burdens of contamination and vulnerability developed with Manual Pastor of the University of Southern California (USC) and James Sadd of Occidental College. The method uses metrics of environmental exposure, demographic factors, and vulnerability factors that are scored to allow for comparison and applied on a geographic basis to identify areas with higher combined impact. Postdoctoral scholar Bill Jesdale demonstrated different ways of considering inequality in environmental exposures.

Michael Jerrett talked about quantitative methods to assess cumulative inequalities in environmental exposure by race/ethnicity and socioeconomic factors. Postdoctoral scholar Jason Su presented an index based on these concepts, then provided a quantitative assessment of inequality in exposures within Los Angeles.

Policy Contexts
Kyle explored how concepts of cumulative impact were reflected in current environmental policies and how they might be addressed more broadly. For example, the California Environmental Quality Act (CEQA) requires environmental review for certain projects and requires consideration of cumulative impacts. Her case studies developed with graduate students Beth Altshuler, Miriam Zuk, and Tina Yuen suggest that CEQA does not necessarily protect communities for two main reasons. One is that projects may proceed when there were “overriding considerations” of economic or social benefits, so there is no absolute limit to impact. Second is that methods used to characterize both environmental and cumulative impacts are limited and may not reflect current scientific knowledge.

Community Perspectives
Kyle’s comments were supported by community advocates who have long articulated a need to move beyond the single chemical approach to environmental management. Bill Gallegos from Communities for a Better Environment (CBE) applauded the value of the screening and mapping methods developed by Morello-Frosch. CBE advocates for resource investment in highly impacted areas for successful remediation and future opportunities.

Joe Lyou from the California Environmental Rights Alliance discussed the range of environmental and other stressors that some communities face. He highlighted the challenge in getting the research and policy communities to focus on what seem like obvious needs and inequalities and called for actions to adopt usable, practical approaches to making a difference now in affected areas.

Rajiv Bhatia from the San Francisco Department of Public Health discussed tools used to assess a wider array of health-related environmental and social factors through health impact assessment (HIA). This method expands traditional approaches to reveal health and social justice implications of projects or improvements to urban infrastructure.

Building on the National Discussion–NRC Panel Contributions
Professor Jonathan Levy from Harvard University emphasized the importance of improving the technical quality of measurement methods, their value to users and adaptability to demands—while acknowledging the complexity of this approach. He further discussed the report, “Science and Decisions,” which strongly recommended the US EPA upgrade and reform its methods for assessing environmental health risks.

Gary Ginsberg from the State of Connecticut discussed background exposure of populations to environmental contaminants and how this is generally not considered when dose-response relationships are adapted during risk assessment procedures. The NRC panel highlights the significance of these findings.

The symposium concluded with comments from a panel of public health and environmental health leaders, chaired by COEH director John Balmes. He comments that “the panelists agreed governmental agencies should consider the cumulative impacts of multiple environmental factors when making regulatory policy decisions. There was less agreement about how cumulative impacts should be integrating into the decision-making process.”

In March 2010, Morello-Frosch and Kyle served on the scientific advisory panel for the US EPA national meeting on the science of disproportionate impacts.
Stove Sensor Project Takes Top Prize in Vodafone Competition for Wireless Innovation

In a world where millions of simple stoves contributing to climate change and premature deaths are being replaced by lower-emission alternatives, individual household visits to evaluate the success of the interventions are simply out of the question. The method of measurement—vital to the continuing development of these lifesaving programs—needs to be low-cost, accurate, sustainable, and scalable.

A groundbreaking “stove use monitoring system” (SUMS) developed at UC Berkeley won the first-place $300,000 prize in the 2010 Vodafone Americas Foundation Wireless Innovation Project, which selects three wireless projects with the potential to save lives and solve critical global challenges. The three winners were chosen from a pool of nearly 100 qualified applicants from universities and nongovernmental organizations from throughout the United States.

The “100 Million Stoves” device is a simple wireless SUMS, powered with the excess heat of the stove, which can be attached to the millions of new low-emission stoves being used in developing regions. The device will record usage data and send them to a dedicated reader carried by someone in the village making a monthly walk through. The cumulated data will then be uploaded via cell phone to a central database for systematic processing. The low-cost technology will allow the assessment of household energy programs, enable feedback from users, and provide transparent verification of carbon credits.

“The wireless SUMS can be deployed in a careful subsample across millions of households in a statistically valid manner,” says Professor of Global Environmental Health Kirk R. Smith, who leads the UC Berkeley research team at the School of Public Health. “Unlike household visits, the monitors provide unique and valuable information that can be scaled to millions.”

The “100 Million Stoves” team consists of Smith’s research group, three small Berkeley companies—BioLite, Electronically Monitoring Ecosystems, and Berkeley Air Monitoring Group—and the Department of Environmental Health Engineering at Sri Ramachandra University in Chennai, India. Together they have built prototypes of the wireless SUMS, and the Vodafone award will help bring the project to the next stage of implementation and scale. The team plans to use the device in trials and its initial application will be in India as part of the country’s National Biomass Cook-stoves Initiative.

“Soon it will be ready for use by groups around the world wishing to validate carbon credits for stove programs on the international carbon market,” says Smith. “In addition, it can also serve as the basis for other devices to remotely and efficiently monitor the use and effectiveness of household health and energy interventions for research, program evaluation, and user feedback.”

More information about the Vodafone Americas Foundation Wireless Innovation Project, “100 Million Stoves,” and the other two prize-winning projects is available on the Vodafone website.

Story from UC Berkeley Public Affairs.
Climate Change Interventions Benefit Health

Two new studies by COEH member Kirk Smith show how mitigation strategies to reduce global warming often improve public health by reducing risks for disease and mortality, particularly in the world’s poorest and most vulnerable nations.

Smith’s research formed part of a Health and Climate Change series in The Lancet that examined mitigation strategies in four sectors: household energy; urban transport; electricity generation; and food and agriculture, with a separate evaluation of the role of short-lived greenhouse pollutants. The series was timed to inform discussions at the December 2009 UN Climate Change Conference in Copenhagen.

The first article co-authored by Smith, professor of global environmental health at UC Berkeley, used hypothetical case studies in the UK and India to identify co-benefits realized through interventions within the household energy sector.

Researchers estimate that, in the UK, household insulation, ventilation, fuel switching and behavioral interventions would result in 850 fewer disability-adjusted life years (DALYs) and 89 fewer premature deaths, and a savings of more than half a megaton of carbon dioxide (CO₂) per million population per year.¹

In India, introducing 150 million low-emission household cookstoves produced an estimate of 12,500 fewer DALYs and 89 fewer premature deaths, and a savings of more than half a megaton of carbon dioxide (CO₂) per million population per year.²

In total, over the 10 years of the stove introduction, more than 2 million premature deaths would be avoided from childhood respiratory infection, chronic obstructive pulmonary disease and ischemic heart disease.

Currently, the use of household biomass fuel accounts for nearly half a million premature deaths in India per year, reports Smith. The majority occur under five due to acute respiratory infections such as pneumonia.³

The second study in The Lancet, conducted by an international team including COEH member Michael Jerrett, professor of environmental health sciences at UC Berkeley, is the first comprehensive review to jointly examine the health effects of short-lived greenhouse pollutants — sulfates, elemental (black) carbon and ozone. Black carbon and ozone exert health effects and have global warming potential. In contrast, sulfates exert health effects, but act to cool the atmosphere.

Researchers conducted a meta-analysis of existing time-series studies, a toxicological review, and a cohort study of 352,000 people followed for 18 years in 66 US cities. The cohort study was the first to examine the joint effects of ozone, black carbon and sulfates with mortality.

Study authors also reported the first estimates of the health effects of elemental carbon on long-term mortality risk.

The pollutants causing most of the direct damage to human health from energy use worldwide are also all climate-active, some warming and some cooling.⁴

“Interventions targeted to reduce short-lived pollutants in the atmosphere would produce health benefits within days, if not weeks, and lead to reductions in global warming,” said Jerrett.

“For black carbon and ozone, this would also be accompanied by quick reductions in climate impact,” added Smith. “For sulfates, however, there is an unfortunate inverse relationship. Needed reductions in sulfate levels to protect health will reduce the sulfate cooling that now partly counteracts warming produced by other climate-active pollutants, such as CO₂.”

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² World Health Organization, Regional Health Forum WHO South-East Asia Region (Volume 7, Number 1)

UC Davis is one of only three sites in California to become part of the National Institutes of Environmental Health Sciences (NIEHS) nanomaterials consortium. Researchers received a 2-year, $1 million grant through the American Recovery and Reinvestment Act to examine the health effects associated with engineered nanomaterials, with a focus on workplace exposures. Kent Pinkerton, director of the Center for Health and the Environment and COEH member, will lead the study.

Nanomaterials are particles of metals, ceramics, polymers or composite material engineered for commercial use in food, clothing, electronics and cosmetics. They are less than 100 nanometers in diameter, or about a 1,000th of the width of a sheet of paper. Nanomaterials have properties that are unique from the same compound at a larger scale making them useful in manufacturing, but potentially a risk to health.  

California leads the country in nanotechnology—a field that is rapidly expanding. “Today, approximately 900 products contain nanomaterials, up from 300 only one year ago,” said Pinkerton. “By the year 2015, it’s estimated to be a trillion dollar a year business.”

Nanotechnologies hold a tremendous amount of promise, but scientists are concerned about their impacts on human health. “We know that eventually these materials may enter into the environment,” said Pinkerton. “Those who are most at risk of potential health effects are the workers who are synthesizing these materials or handling them during packaging and shipping.”

Though workers and consumers alike may be exposed to nanoparticles through hand-to-mouth ingestion and dermal or eye contact, from an occupational standpoint, inhalation is likely to be one of the most significant paths of exposure.

“Titanium dioxide, for example, in large particle form has no health effects, but when you reduce it in size to less than 100 nanometers in diameter, the same material is known to be quite toxic,” said Pinkerton. “Epidemiologic and toxicology studies show materials of this size can produce the greatest effects both in the lungs and the cardiovascular system.”

Pinkerton’s grant will support two doctoral students from pharmacology and toxicology, both involved in inhalation studies. Laurie Hopkins will be using quantum dots—nanomaterials that become florescent when hit with ultraviolet light—to visualize how they travel, literally within hours, from the nose to the olfactory bulb in the central nervous system.

Quantum dots may gain widespread use in the next generation of mobile phone cameras. InVisage, a start-up company from Menlo Park, California, announced plans to launch the first commercial quantum dot-based image sensors later this year, a technology they claim will improve photo quality by capturing more light than silicon.

Amy Madl will examine the potential health effects associated with single and repeated exposure to carbon nanotubes. “They are like little fibers,” explained Pinkerton. “The question is whether nanotubes have some of the potentially adverse health effects of more commonly known fibers, such as fiberglass and asbestos.”

Madl is also comparing carbon nanotubes to carbon black, its pure parent compound, and to a form of asbestos—crocidolite—that has similar fiber-like properties. Both carbon nanotubes and crocidolite contain iron, which may be associated with their potential toxicity.

Pinkerton’s participation in the consortium has led to new collaborations with Chris Vulpe, associate professor of Nutritional Science and Toxicology at UC Berkeley. Vulpe also won a federal stimulus grant from NIEHS. Their next proposal, if funded, will provide $3.7 million for five years to identify key genes and processes that determine cellular responses to nanomaterials. In addition, they will develop innovative risk exposure methodology for estimating their impacts on population health.  

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1 National Nanotechnologies Initiative website  
Workers and community advocates were at the center of COEH’s 2010 Symposium, Immigrant Workers II: Voices from the Workplace, putting a human face on health and safety issues confronting low-wage immigrants in California.

Other workers were remembered, such as 17-year-old grape harvester Maria Isabel Vasquez Jimenez who died while pregnant in Stockton, California, after working nine hours without breaks or water in heat that reached 95 degrees, and Irma Ortiz, 46, a Latina who developed an irreversible lung condition called bronchiolitis obliterans from exposure to diacetyl, a product used in the flavoring industry. These injuries were preventable, said co-organizer Marc Schenker, COEH member and professor at the School of Medicine, UC Davis.

In his opening remarks, Schenker drew attention to the words on US currency, E PLURIBUS UNUM, to illustrate the symposium’s theme of unity. “Out of many, One.” He emphasized, “We come from many backgrounds to form one nation.”

Schenker is director of the new Migration and Health Research Center (MAHRC), a joint collaboration launched in September 2009 by UC Davis and Berkeley. MAHRC focuses on research related to acute and chronic illnesses and injuries among migrating populations. It also fosters collaborations with Latin American and international research institutions, as well as local, state and federal governments.

Said co-organizer Robin Baker, director of UC Berkeley’s Labor Occupational Health Program (LOHP), “What we want to talk about today is the real story—working immigrants and the challenges they face.”

Plenary speaker Maria Echaveste, lecturer-in-residence at the School of Law at UC Berkeley, focused on whether immigrant status is a factor in health risk. “When we look at safety and health of the immigrant workforce—do they suffer because of the industry they are in, their status as immigrant workers, or because as foreigners they have related issues like language?” Echaveste asked participants. “We won’t come up with the right public policy unless we answer these questions.”

Women’s health and safety issues are critical to Echaveste. Though women comprised 46.5 percent of the total US labor force in 2008, she said little attention is paid to the invisible workers—housekeepers and nannies—who make other women’s participation in the workforce possible.

The Honorable Carlos Felix Corona, Consulado General de México en San Francisco, underscored how undocumented workers are key to the labor force in the United States. They also suffer the greatest number of labor injuries. In 2006, foreign born Mexicans represented 45% of all fatal injuries at work.

Two influential agreements in 2004 between the Mexican government and the US Department of Labor’s Occupational Safety and Health Administration shaped new collaborations on outreach and training to help Mexican workers understand their rights for a safe and healthy work environment. “These agreements are examples of how we can work together, but it’s not enough,” said Corona, who invited participants to meet with representatives of the Consulate on hand to explore future collaborations.
Drawing analogies from current day China, Bob Spear highlighted the global nature of hazards to migrant workers. “The stable village population in the mid 1990’s has now changed, and it’s occupationally driven,” said Spear, former COEH director and professor emeritus, School of Public Health, UC Berkeley. Literally millions of Chinese are migrating throughout the country to service new industries where they are now facing changes in lifestyle and occupational environments, similar to the migrant workers here in California.

Len Welsh, chief, California Division of Occupational Safety and Health (Cal/OSHA), said one of the barriers to immigrant health and safety is that workers don’t know if they can trust the distinction between Cal/OSHA and US Customs Immigration and Enforcement. Workforce migration is a further challenge, added Welsh. Compliance officers follow-up complaints within three days, but sometimes the worker has moved on by then.

Although resources are in short supply, Cal/OSHA develops intelligence to conduct “sweeps” in agriculture to catch employers in the act of placing workers in unsafe conditions. Even now, California is one of only two states with a tracking methodology that measures how rules and enforcement affect injury, illness and fatality. “The step forward we made was historic,” according to Welsh. He reported the downward trend in occupational fatalities from 12 in 2005, half being farmworkers, to none in 2009.

Immigrants like supermarket janitor Victor Enriquez, SEIU–USWW, and Khaled Hamou from the taxi industry, brought sharp focus to the problematic conditions in which they work. “Money first, safety second,’ explained Jose Padilla from the Bay Area Roofing and Waterproofing Apprenticeship program.

Suzanne Teran, coordinator of public programs at LOHP, and UC Berkeley alumnus Garrett Brown, a compliance officer for Cal/OSHA and COEH Advisory Committee member, summarized cross-cutting themes from the symposium’s labor presentations: health disparities related to workplace exposure to chemical hazards, the lack of culturally relevant communications and the impact of corporate outsourcing on safety standards.

“Over the last ten years, many companies have reduced their full-time, direct employees as much as possible, and now there are growing numbers of temporary agency employees who are essentially second-class citizens with lower pay and few benefits in the same work site,” explained Brown. “Most of these workers are immigrant workers who ‘fall through the cracks’ between the temp agency and the site employer.” Because there are only 200 Cal/OSHA compliance officers making workplace inspections in the state, Brown said the only way to effectively protect the health, safety and rights of all workers in California is to foster and promote genuine worker participation in worksite safety programs.

“We introduced something new to this year’s symposium by having workers at the table,” COEH Director John Balmes said in his closing remarks. They showed how the impact of a single voice can prove more powerful than any statistic.

1 US Department of Labor website
Researchers at the University of California, Berkeley, have received a five-year, $10.9 million grant from the Bill & Melinda Gates Foundation to evaluate several interventions to combat diarrheal disease in developing countries.

Dr. Jack Colford, professor of epidemiology at UC Berkeley’s School of Public Health, will coordinate the project, working with the International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B) and Innovations for Poverty Action (IPA).

An estimated 2.2 million children under the age of 5 die from diarrheal diseases each year, according to the World Health Organization. Most of these diseases are thought to be preventable with improvements in sanitation, water quality and hygiene.

Due to the high cost of developing and maintaining large infrastructure projects, such as networked water, there is now a movement toward simpler, alternative methods to improve health in rural areas. However, there is almost no evidence that allows direct comparison of the health benefits or cost effectiveness of these simpler interventions, such as improved latrines, household water treatment and hand washing with soap.

The goal of the new project is to determine how sanitation interventions, delivered alone or as part of combined intervention packages, impact child health and well-being. In addition to improved sanitation, the intervention packages will include drinking water improvements and hand washing solutions. The results have the potential to influence how billions of dollars are directed towards long-term improvements in health and economic outcomes for millions of children each year, said Colford.

"Increasingly, foundations, governments, the World Bank and development agencies such as the MCC (Millennium Challenge Corporation) are demanding evidence of effectiveness when awarding development funds," said Colford. "Right now, it is unknown whether single interventions are as cost effective as combinations of these interventions. This grant will fund the first large-scale, randomized impact evaluation designed to gather rigorous evidence about this question."

The study will test the impact of these sanitation, water and hygiene interventions in Bangladesh and Kenya. These two countries are representative of the two regions that account for the majority of the world’s gastrointestinal disease burden: South-east Asia and sub-Saharan Africa. The researchers expect to enroll a total of 23,000 children in the trials, which will be monitored by several institutional review boards.

Of the $10.9 million, about $7.9 million will be subcontracted out to the two field sites. Dr. Stephen Luby, head of the Programme on Infectious Diseases and Vaccine Sciences with ICDDR,B, and Michael Kremer, Ph.D., a research affiliate with IPA, will lead the trials in Bangladesh and Kenya, respectively. They will be joined by a team of experts from various disciplines, including public health, economics, behavioral change, nutrition, cognitive development and tropical enteropathy.

By Linda Anderberg, UC Berkeley School of Public Health
Green Chemistry Curriculum Growing at UC Berkeley

Green chemistry, a hot topic in scientific, environmental, industry and government circles, becomes an official part of UC Berkeley’s chemistry curriculum starting in Fall 2010, supported by a $250,000 grant from the California Department of Toxic Substances Control. Already at the forefront of green chemistry science and policy analysis, UC Berkeley is now building a leading-edge curriculum intended for students from the sciences, engineering, law, policy and social sciences.

Green chemistry, also known as sustainable chemistry, is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. In 2006, more than 34 million metric tons of chemical substances were produced or imported in the United States every day. The great majority are unregulated, though there is mounting evidence of global health and environmental harm caused by chemical pollution and exposures.

Two of the innovators behind the new curriculum, which will be offered first by the College of Chemistry, are COEH scientists Megan Schwarzman and Michael Wilson. They have been a driving force behind the new Berkeley Center for Green Chemistry (BCGC), a first-in-the-nation consortium of faculty and researchers working to advance green chemistry science and policy through collaborative research, education and service.

Based on the Twelve Principals of Green Chemistry, the curriculum is interdisciplinary, encompassing studies in chemistry as well as toxicology, environmental health, business, law and public policy — recognizing that the next generation of scientific leadership will need to understand all of these areas of scholarship as they confront the challenges of sustainability.

Marty Mulvihill and Akos Kokai, recently appointed program affiliates, are working to introduce the Principals of Green Chemistry this fall into the existing Chem 1A course, which typically attracts some 2,400 non-chemistry majors each year. By 2011, the curriculum will be available to advanced undergraduate and graduate students. Course modules will focus on sustainable technologies, novel laboratory methods and the political and social issues driving change in chemical policies around the world. The curriculum will offer students an integrated understanding of both emerging science and the social, ethical and political aspects of industrial chemical technologies.

Members of the BCGC plan to roll-out the full curriculum to other California colleges and universities in the summer of 2011 as part of California EPA’s innovative Green Chemistry Initiative, launched by Governor Schwarzenegger in 2007.

Gap Between Science and Chemicals Policy

In a recent issue of Science, authors Schwarzman and Wilson emphasize how US chemicals policy has failed to keep pace with scientific evidence on chemical hazards. The great majority of chemicals, they point out, are simply unregulated, including hundreds of known endocrine disrupting chemicals (EDCs), which can interrupt the biological signaling mechanisms central to development, reproduction and immune function in humans and wildlife.

In their article, the authors describe how the European Union enacted in 2006 what may become a de facto global standard for chemicals policy. REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) is intended to improve information on chemical hazards and employ a more precautionary approach to decision-making in controlling chemicals of greatest concern. EDCs are likely to fall into this category.

Schwarzman and Wilson, whose work informed the state’s Green Chemistry Initiative, call for similar changes to US chemicals policy, pointing out that better information on chemical hazards and more efficient—and quicker—action to address the worst actors will produce health and environmental benefits, while also opening new investment and employment opportunities in green chemistry.
OEH Program in India Launched with UC Berkeley

India’s first MPH program in occupational and environmental health (OEH) was officially launched in January 2010 by Sri Ramachandra University (SRU) in collaboration with UC Berkeley.

The program was a key objective of the SRU-Berkeley Inter-Institutional Collaboration spearheaded in 2002 by COEH member Kirk Smith of UC Berkeley and Professor Kalpana Balakrishnan of SRU.

“What happened was a magical transformation from a one-on-one research collaboration to an institutional collaboration, taking it to a completely new platform,” said Balakrishnan.

The initiative builds capacity for research and training in occupational and environmental health in India with support from the NIH Fogarty International Center. “For one-sixth of the human race living with a range of occupational and health risks, this is truly a milestone,” says Smith.

The environmental disease burden is huge in India, Balakrishnan said on her visit to UC Berkeley in April. The program will fill a critical gap as India suffers from a tremendous shortage of trained professionals and inadequate resources for research in OEH. She confirmed several governmental agencies are showing their commitment by sending candidates for up to two years of study.

In addition to the OEH degree program, faculty from UC Berkeley and SRU collaborate on joint projects and publications. Six faculty from SRU have spent up to two semesters at UC Berkeley taking courses in areas of environmental health. “The most exciting spin-off is new research collaborations,” said Balakrishnan.

Non-governmental agencies, independent research companies and community organizations are looking for people with developing country experience, noted Balakrishnan. “Very soon we will be in a position to offer UC Berkeley students the possibility to rotate with us. We have a government field station for summer interns who want a flavor of whether this might be a career interest for them.”

Smith and UC Berkeley School of Public Health Dean Stephen Shortell attended the OEH program launch in Chennai, India. Shortell gave a CME lecture on chronic illness management and its implications for India. Smith delivered a lecture following the ceremony, “Mitigating climate, meeting the Millenium Development Goals (MDGs), and moderating chronic disease: the health co-benefits landscape for household energy.”

Adapted from press releases from UC Berkeley’s School of Public Health and Sri Ramachandra University

In Older Adults, Home Water Filtration Device Reduces Gastrointestinal Illness

The first randomized controlled trial of household drinking water treatment in the homes of older adults found that a countertop water filter reduced the risk of gastrointestinal illness.

In the blinded intervention trial, researchers enrolled 988 participants age 55 or older in Sonoma, California. Participants were randomly divided into two groups—half received an active water treatment device that included 1-μm filtration and ultraviolet treatment, while half received an identical looking sham device. Midway through the study, the devices were switched within the household to the opposite device type.

Following two, 26-week cycles, scientists found a 12% decrease in self-reported gastrointestinal illness per year among participants using the active versus sham water filter.1

The study, published in the November 2009 issue of the American Journal of Public Health, was led by COEH member John Colford Jr., a professor of epidemiology at UC Berkeley. The five-year project cost $2.8 million and was funded by the National Institutes of Health.

Colford noted that the findings could be meaningful because the elderly may be less tolerant of gastrointestinal infections and be more susceptible to serious complications when infected. He noted that the study site was chosen because Sonoma drinking water met all federal standards for drinking water quality. He expects that the results will be included as one element in the current national discussions about how drinking water standards should be set for the elderly, for children, and for those with immuno-compromising conditions (such as cancer or HIV).  

OEHN Students at UCSF Making a Difference

Each year, MS students from the Occupational and Environmental Health Nursing Program at UCSF take part in community projects to gain experience in their field. Here is a snapshot of their work in 2010:

Maya Armenta helped the San Francisco Fire Department promote employee health and wellness by developing computer-based training modules on cardiovascular health, nutrition, obesity and cancer screening.

Rangineh Bassir designed computer-based training to communicate the Aerosol Transmissible Disease Standard for measles, mumps, rubella and varicella to firefighters and emergency responders with the San Francisco Fire Department.

Alison Dunn crafted a pandemic triage response for the City of San Jose. The plan integrated the city-wide intranet for podcasts and use of the existing health service personnel plan to reduce employee exposures.

Christine Gilmore developed a decision-matrix tool that allows supervisors at Bayer Healthcare to assess the health status of employees who work in aseptic areas of pharmaceutical production.

Lea Glick conducted a company-wide post-training evaluation with Abbott Diabetes Care employees. She measured their understanding and application of a musculoskeletal injury prevention initiative several weeks after the initial training.

Beth Goldstein worked with the San Francisco Department of Public Health on a pilot study that measured street noise levels in the Lower Polk Neighborhood, home to the city’s second busiest fire house. Their results will allow stakeholders to assess the impact of noise within the community.

Lisa Hartmayer helped the City and County of San Francisco Departments of Public Health, Public Works, Environment, and the Mayor’s Office create a city-wide, residential pilot program for the collection and disposal of unwanted medications. These may pose a health risk if flushed into the city’s water system.

Erin Lum piloted a stress reduction program with Safeway employees. Before and after the program, she assessed employee stress by questionnaire and measurement of blood pressure and pulse. All three assessments demonstrated reductions suggesting the pilot was successful.

Kate Papadopoulos proposed an injury prevention program for hotel housekeeping staff that would provide non-slip shoes to reduce slips, trips and falls. She used Workers’ Compensation claims data to show that the cost of introducing the program to 300 workers could be recouped if less than one injury per year were prevented.

Salena Quan used detailed injury data to design a three-part intervention program for hospital workers. It included a safety awareness campaign communicated by intranet, a wet-floor signage policy, and an educational program targeted at high-risk departments as well as new employee orientations.

Project mentors included Colleen Bales, Ann Dinh, Catherine Dodd, Gaye Frisby, Julita Luty, Cynthia McNaughton, Tom Rivard, Kathy Tesdall and Tammy Watts, as well as OEHN program faculty member, Dana Drew Nord.
Cumulative Environmental Hazards Article Wins Editor’s Choice Award

Scientists from UC Berkeley won an Editor’s Choice Award from the leading journal, *Environmental Science and Technology* (EST). Out of nearly 1,500 articles published yearly, EST editors chose theirs as one of the best in 2009 from among 80 nominated. Lead author Jason Su is a post-doctoral scientist in the Health and Exposure Analysis Laboratory within the School of Public Health. Co-authors include Rachel Morello-Frosch, Bill Jesdale, Amy Kyle, Bhavna Shamasunder and Michael Jerrett, also from the School of Public Health.

In their study, Su and colleagues propose an index for summarizing racial-ethnic and socioeconomic inequalities in cumulative environmental hazards, then apply the method in Los Angeles County, one of the most ethnically diverse and polluted metropolitan areas in the United States.¹

Researchers show the interplay between individual and cumulative hazards using multiplicative and additive statistical approaches. To summarize social inequality, they measure poverty and racial-ethnic composition at the census tract-level. To illustrate unequal levels of pollution in the region, they use measurements of nitrogen dioxide (NO₂), particulate matter less than or equal to 2.5 micrometers in diameter (PM2.5) and estimates of cancer risk associated with diesel exhaust from the Environmental Protection Agency’s National-Scale Air Toxics Assessment (NATA) model.

The greatest environmental inequities were seen for diesel particulate matter cancer risk, followed by NO₂ then PM2.5. Importantly, the inequalities in cumulative hazards were more pronounced than for any single pollutant when assuming existence of synergistic impacts. The highest levels of cumulative impacts cluster in downtown Los Angeles followed by the Los Angeles/Long Beach port area. “A key question,” says Jerrett, “is whether the health risks also magnify, similar to exposures.”

Su says scientists can integrate other environmental risk factors in the model based on their research objectives, such as proximity to industrial or agricultural land uses—even positive attributes that are thought to benefit health, like access to green space or grocery stores. Scientists can further test assumptions by age or gender.

“The reason for using NO₂ and PM2.5 is that they are criteria pollutants with ambient air quality standards set by the US Environmental Protection Agency, which enables us to compare our data to national standards,” said Su. A widely accepted regulatory benchmark for cancer risk associated with diesel exhaust was also used.

Looking ahead, researchers will apply the index in two additional regions—San Diego and the San Francisco Bay area—and then compare cumulative impacts in all three regions to identify communities of concern in California.

“Quantitative indicators are extremely important for environmental and economic decision-making,” notes Michael Jerrett. “Two indices—the Air Quality Index and Gross Domestic Product—have had tremendous impact, but until now, we haven’t had a quantitative index to summarize the cumulative hazards suffered by disadvantaged groups. Once social disparities in exposure can be summarized quantitatively, the imperative for policymakers to act increases.”

¹US Census Bureau http://quickfacts.census.gov/qfd/states/06000.html
COEH Bridges Moves Online

Beginning in Spring 2010, COEH started publishing Bridges electronically. To view our current issue or receive notice of new issues by email, please visit coeh.berkeley.edu/bridges
The Northern California Center for Occupational and Environmental Health (COEH), a multidisciplinary program of the University of California at Berkeley, Davis, and San Francisco, promotes health and safety in workplaces and communities by:

- Educating health professionals in epidemiology, ergonomics, industrial hygiene, medicine, nursing, toxicology, and related fields to be leaders in occupational and environmental health.
- Developing new knowledge through an interdisciplinary research agenda focused on preventing illness and injury.
- Responding to the needs of people affected by hazards in their workplaces or communities, with special attention to vulnerable populations.

Through these activities COEH supports federal, state, and local agencies, health and safety professionals, industry, labor, and community-based organizations in their efforts to prevent occupational and environmental disease and injury.

COEH is an Education and Research Center (ERC) of the National Institute for Occupational Safety and Health (NIOSH).