The first-ever report from the Environmental Protection Agency (EPA) assessing environmental factors that may affect children’s health indicates that the nation has made progress in reducing risks to children but has more work to do.

The report, “America’s Children and the Environment: A First View of Available Measures,” focuses on environmental contaminants in air and water that are likely to affect children’s health, concentrations of contaminants like lead in children’s bodies, and trends in childhood diseases that may be related to environmental pollution.

Co-authored by COEH affiliate Amy D. Kyle, research scientist in the School of Public Health at UC Berkeley, with Tracey Woodruff (PhD, ’91, UC Berkeley/UC San Francisco) and Daniel Axelrad of the EPA’s National Center for Environmental Economics, the report provides quantitative measures and information that can serve as the impetus for developing new and better measures to inform policy intended to protect children from environmental health risks.

COEH faculty member Patricia Buffler, professor of epidemiology and former dean of the School of Public Health at UC Berkeley, served as a reviewer of the report.

Among the key improvements since 1990, the report cites:
- A decrease in the percentage of homes where children under age seven live with a regular smoker (from 29 percent in 1994 to 19 percent in 1999)
- A decrease in the percentage of children living in areas where the public water system violates drinking water standards (from 19 percent in 1993 to 8 percent in 1998)

Challenges still to be met include:
- An increase in the prevalence of childhood asthma (from 5.8 percent in 1990 to 7.5 percent in 1995)
- A continuing problem with too much lead in the blood of some 1.5 million children (1992-1994), despite removal of lead from gasoline and other measures to prevent lead poisoning
- A disproportionate level of environmentally-related health problems among

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Examining What Went Wrong with MTBE

It didn’t take long. In April of 1996, California drivers began filling their tanks with gas that had been oxygenated with MTBE (methyl tertiary-butyl ether), an additive that had been promoted as an answer to “cleaner” burning fuel and cleaner air. But by August, the City of Santa Monica discovered that about half of its municipal water supply wells were contaminated with very high levels of MTBE, which tasted and smelled awful.

The Santa Monica experience focused attention on MTBE’s potential for contaminating water supplies on a massive scale. State officials went on the alert, and, in 1997, asked the University of California to study the impact of MTBE in detail.

At UC Berkeley, COEH faculty member Catherine Koshland, the Wood-Calvert Professor in Engineering, along with colleagues in the Energy and Resources Group, Professor Robert Sawyer of Mechanical Engineering (Class of 1935 Professor of Energy Emeritus), and Researcher Donald Lucas of the Lawrence Berkeley National Laboratory focused on MTBE’s impact on air quality. The timetable set by the state was tight, and, graduate student Pamela Franklin, a student of Kyle, who has worked with the EPA and other organizations for several years on environmental health indicators, the opportunity to focus on children’s health gave her new insight into areas where the nation needs more and better standards, measuring techniques, and research with a focus on childhood exposures.

“People are paying more attention to children when they talk about the environment and health,” she said. “We think that verifiable, quantifiable measures that point out both areas of progress and areas where shortfalls remain can help to move us from a general discussion to more specific policy proposals. We are developing quantifiable measures that can be tracked over time. This report is only a first step, but we hope to build on it, working with the many advisors and researchers who have helped us so far.”

Kyle considers it “shocking, given how much we know about how deleterious lead exposure is,” that the nation still has “pockets of kids—especially black children below the poverty level—that haven’t been protected.”

Among other areas that need to be addressed, she noted:

• the lack of national standards for hazardous air pollutants other than the six “criteria air pollutants” for which national air quality standards already exist
• no requirement that states report the results of monitoring the quality of their drinking water, making it impossible to assess any health risks from drinking water exposures to chemicals
• a possible upward trend in air pollution since 1996, despite efforts to control it
• widespread exposure to hazardous air pollutants associated with cancer risk: exposure levels resulting in one case per hundred thousand people (one case per million is of concern for purposes of environmental policy and regulation)
• a dearth of information about environmental cancer risks as they pertain to children
• problems with measuring and characterizing the prevalence of asthma and its relationship to environmental factors

Based on the experience of this study, Kyle and her colleagues hope to develop even better environmental health indicators and track environmental quality trends more precisely in future reports. The report is available at www.epa.gov/children/indicators.
A nationally recognized expert on the respiratory effects of environmental pollutants has joined the medical faculty at UC San Francisco and affiliated with COEH.

Mark Eisner, assistant professor in the Department of Medicine (Divisions of Occupational and Environmental Medicine and Pulmonary and Critical Care Medicine), is perhaps best known for research showing that California’s pioneering 1998 ban on smoking in bars and taverns almost immediately improved the respiratory symptoms and lung function of bartenders.

Eisner is particularly interested in the impact of environmental tobacco smoke and other pollutants on adults with asthma. He is discussing his work in this area, this month, at COEH’s spring symposium at UC Berkeley.

Eisner began his residency at UC San Francisco in 1992, after earning his bachelor’s degree from Stanford University and his MD degree from the University of Pennsylvania. He has served as chief medical resident, clinical fellow in pulmonary and critical care medicine, and post-doctoral fellow at UC San Francisco, earning his MPH from the School of Public Health at UC Berkeley at the same time.

In his new position, Eisner devotes the bulk of his time to studying epidemiological questions related to asthma, a disease that affects about five percent of the population and is not well understood.

“The prevalence of asthma has increased by about 50 percent in the last decade, and the death rate from asthma has increased as well—we don’t know why. We can have a lot of impact by learning more about the factors that make asthma severe,” he said, explaining his interest in studying the disease.

In cooperation with Kaiser Permanente, he is currently conducting long-term research to determine what role environmental factors, such as exposure to indoor pollution, psychosocial factors, such as depression, and other factors, such as personal behavior and health care practices, play in exacerbating severe asthma.

With COEH colleagues at UC Berkeley, Eisner recently completed a study of the effects of second-hand smoke on people with asthma. Preliminary findings indicate people who were exposed to more nicotine in the air than others, as indicated measured by a nicotine “badge” that study participants were wearing, had more respiratory symptoms and used more medication. Nicotine is a key component of environmental tobacco smoke.

In addition to his research, Eisner serves as an attending physician in the intensive care unit, trains medical residents and fellows in critical care, and sees patients at UC San Francisco’s outpatient chest and lung clinic. His work in public health has policy implications that have caught the attention of the medical community as well as state government. Last year, he led a session on environmental tobacco smoke in the workplace at the International Lung Conference of the American Thoracic Society, and he testified at a meeting of the New York City Health Commission, which is considering a stricter ban on smoking in restaurants.

His work has been recognized with a five-year K23 Mentored Patient-Oriented Research Career Development Award from the National Institutes of Health.

Study Links Workplace to Musculoskeletal Disorders

Lending credence to proponents of regulations to protect workers from ergonomic hazards on the job, an expert panel of the Institute of Medicine and the National Academies of Science and Engineering has issued a report linking work-related factors to “musculoskeletal disorders of the low back and upper extremities.”

These musculoskeletal disorders affect about 1 million workers and cost the nation an estimated $50 billion each year in compensation fees, lost wages, and lost productivity, the panel found.

The panel concluded that the evidence of its two-year study justifies “a broad, coherent effort to encourage the institution of ergonomic and other preventive strategies,” including “employee involvement, employer commitment, and the development of integrated programs that address equipment design, work procedures, and organizational changes.”

The study was requested by the U.S. Congress and sponsored by the U.S. Department of Health and Human Services. COEH faculty member David Rempel, associate professor of medicine at UC San Francisco and director of the UC Ergonomics Program, served on the panel.
International Study Calls for New Policies to Promote Safe, Sustainable Energy Use

California’s recent power outages notwithstanding, a major United Nations study has concluded that the world has abundant energy resources, at least for the next 50 years. The problem is that access to energy is so dangerously out of balance that 2 billion people don’t have enough for their most basic needs.

“Energy production and use have negative impacts at the local, regional and global levels that threaten human health and the long-term ecological balance,” the study report warned. “The continuation of business-as-usual practices may compromise the prospects of future generations.”

The report, “World Energy Assessment,” is the result of a two-year international effort to analyze the social, economic, environmental, and security issues linked to energy and to build consensus about how to use energy most effectively to support long-term human well-being and ecological balance.

The report has been prepared for the April meeting of the United Nation’s Commission on Sustainable Development in New York.

COEH faculty members, Kirk Smith, professor of environmental health, and Catherine Koshland, professor of environmental health and energy and resources, at UC Berkeley contributed to the report: Smith as a lead author and Koshland as a member of the advisory panel that reviewed the report.

The study found that “affordable, commercial energy is beyond the reach of one-third of humanity,” but that “a variety of new renewable and advanced energy technologies may be able to provide substantial amounts of energy safely, at affordable costs, and with near-zero emissions.”

To develop safe and sustainable energy resources, the report concluded, governments must adopt policies that promote higher energy efficiency, increased use of renewable resources, and development of cleaner energy systems and resources.

Smith and John Holdren of Harvard’s Kennedy School of Government contributed a chapter analyzing the principal health impacts of energy, breaking these down by the scale at which they occur—from household use of energy through to the impact of energy on the global scale.

“About half of the world’s households use solid fuels (biomass and coal) for cooking and heating in simple devices that produce large amounts of air pollution—pollution that is probably responsible for 4-5 percent of the global burden of disease,” they wrote.

In the workplace, solid-fuel fuel cycles, such as those for coal and uranium, put workers at risk. In communities, fuel use is the main cause of urban pollution. At the regional scale, fine particles and ozone do the most damage to health, and, worldwide, energy systems “account for two-thirds of human-generated greenhouse gas increases,” they said.

Smith and Holdren argue that strategies to improve energy use and reduce pollution at one scale can have positive effects at other scales as well.

To order the report online or download individual chapters, go to http://www.undp.org/seed/eap/activities/wea/drafts-frame.html. The chapter by Smith and Holdren is also available at http://ehs.sph.berkeley.edu/krsmith.
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Koshland’s, found herself involved in “an intense, eight-month flurry of activity.”

As Franklin analyzed the technical issues, coordinated with researchers on other campuses who were working on other parts of the MTBE puzzle, and followed the public hearings, she became fascinated with the policy process surrounding the research—and with some key questions: “How did this happen? How was it that we put this compound in gasoline thinking that it was going to improve air quality, but we hadn’t considered its impact on water quality, its toxicological effects, its effects on aquatic systems?”

Franklin’s ruminations became the impetus for doctoral work examining environmental policy-making in the case of MTBE, mercury emissions, and chloroform in drinking water.

Her examination of the MTBE fiasco with co-authors Koshland, Lucas, and Sawyer, “Clearing the Air: Using Scientific Information to Regulate Reformulated Fuels,” in Environmental Science & Technology, 34 (18), provides insights into the powerful role that political pressures, marketing goals, organizational structure, and institutional mindsets play in influencing decision-making that affects environmental and public health.

“The history of MTBE in the United States illustrates several typical but problematic features of environmental policy making,” Franklin found. “The policy process that led to MTBE’s predominance was flawed, since no systematic attempt was made a priori to evaluate multimedia implications of MTBE’s widespread use.”

Neither did policymakers consider the environmental impact that MTBE could have at the scale at which it would be used.

“The MTBE history highlights a potentially important gap in regulatory policy,” Franklin said. “While there are regulatory triggers to evaluate the entry of new chemicals into the environment, there are no comparable review mechanisms associated with increasing scales of usage….With respect to ‘poisoning’ groundwater, the history of MTBE usage in gasoline provides an ecological metaphor for the classic toxicological adage, ‘the dose makes the poison.’”

Franklin found that institutional factors constrain policymakers, that political and economic “actors” exert a strong influence, even in supposedly “technical” debates, and that all parties bump up against communication barriers.

Some of her observations about the policymaking process:
• The ethanol industry had lobbied hard and successfully for legislation mandating oxygenated fuels (ethanol is an oxygenate)
• Facing this mandate, oil companies opted for MTBE, another oxygenate, because it is cheaper to manufacture or purchase than ethanol
• Statutory mandates handed down by Congress severely constrained the actions of the Environmental Protection Agency (EPA) and required implementation within tight deadlines, with incomplete information available
• The EPA did not employ some of the regulatory options it had until late in the game, and was constrained from taking a big-picture view both by its compartmentalized organizational structure (separate offices for air, water, and hazardous waste) and by a culture that favors technical solutions that can withstand legal challenges
• Reliance upon narrow disciplinary interests inhibited and fragmented scientific inquiry
• “Scientific” arguments reflected differences in social values and economic concerns

The MTBE story is not yet complete. MTBE remains in our gas tanks, but Franklin believes UC research and analysis “contributed to the movement to think more about what we had done.” In 1999, following the UC studies, Governor Gray Davis announced that California would phase out the use of MTBE. A few months later, a blue-ribbon panel of the EPA recommended that the compound be phased out nationally. ☩
Radiation exposure wasn’t the only health risk for workers at the Nevada Test Site (NTS), where nuclear weapons experiments took place from 1951 to 1992, doctors have found.

A nationwide medical screening program for former NTS workers, sponsored by the Department of Energy, has uncovered a spectrum of work-related health problems ranging from hearing loss to lung cancer.

Cloaked in secrecy, as many as 15,000 workers drilled tunnels, hauled monitoring devices, and operated heavy equipment in southern Nevada at the peak of underground testing in the mid-’80s.

Hazards at the site included diesel exhaust from mining equipment, radiation exposure from detonated weapons, silica dust, and asbestos, which was used to insulate tunnels.

Over the past two years, doctors from UC San Francisco and the University of Nevada have screened some 1,700 workers, predominantly blue-collar, union participants who built and serviced the NTS at a time when the dangers inherent in many of the materials to which they were exposed were not well known.

Screening results to date have revealed that over 80 percent of the workers tested thus far suffer from hearing loss and about seven percent have scarring of the lungs, most likely due to exposure to silica, asbestos dust, and beryllium. The medical team has also found several previously undiagnosed cases of lung cancer that may have been caused by exposures at the NTS.

COEH faculty members Robert Harrison, Leslie Israel, and Raymond Meister of UC San Francisco have been working with researchers from the Boston University School of Public Health and the University of Nevada, in collaboration with the Southern Nevada Building Trades. The project physicians have been screening workers four times a year in Las Vegas since 1998, with support from Project Manager Judie Guerriero and staff members Mai Tran and Arlene Ervin of UC San Francisco and from residents in UC San Francisco’s occupational medicine program.

The NTS program includes an extensive occupational and medical history questionnaire, a breathing test, chest x-ray, blood test, and a physical exam to detect problems that are likely work-related. It does not, however, include a program for compensating those who are found to have work-related illnesses—a source of frustration for the patients and the medical staff alike.

“We are careful to tell everyone that there are no funds available for further treatment. We help them as much as we can, but they feel like they are left stranded,” Israel said. “Many don’t have a primary care doctor.”

Through a combination of focused medical examinations and historical sleuthing, the research team has discovered that NTS workers were also at risk for lung damage caused by beryllium dust that scars the lungs, eventually inhibiting lung function.

“We didn’t know about the beryllium when we started,” Harrison said, “but we were seeing lung disease that looked like it was caused by beryllium. At the same time, our collaborators at the Boston University School of Public Health were researching possible hazards at the site, and ferreted out people who knew beryllium was there.”

The screening program is one of a dozen such programs underway throughout the nation. Screening at other sites has also uncovered illness that appears to be due to beryllium exposure, Harrison said. Beginning this month, the medical team is introducing a new test to detect lung damage caused by beryllium.

The growing concern about beryllium influenced new legislation, the Energy Employees Occupational Illness Compensation Program Act of 2000, which establishes a program to compensate DOE and DOE-related workers who suffer from cancer caused by radiation, beryllium disease, or chronic silicosis. While hailing the legislation as a step forward, Harrison expressed concern that it needs to be broadened to help workers with less severe lung disease caused by exposure to silica.
Inhaled Dust Damages Lungs Early, Researchers Find

The concentrations of inhalable particles in Fresno County, the heart of California’s agricultural San Joaquin Valley, are among the highest in the United States. The impact of mixed dusts from agricultural work is largely unknown. To address the effects of these particles in the air, Marc Schenker, director of COEH programs at Davis, and colleagues are studying lung specimens from deceased young Hispanic men who lived in Fresno County.

In early results, the researchers have found small particles deposited deep in the part of the lungs where gas exchange occurs. They also found changes in the lung tissue, such as wall thickening and fibrosis, associated with the dust deposition.

The findings indicate that lung damage from inhaling airborne particles occurs early, well before respiratory symptoms appear.

“We can only speculate about the long-term impact of this dust deposition; however, other studies of occupational groups and cigarette smokers suggest that there may be long-term adverse effects,” Schenker said.

The median age of the Hispanic males in the study was only 33, which sets this study apart from other studies of lung pathology in humans. Other studies on lung tissue have been obtained in older subjects or subjects with advanced disease, making it difficult to separate the impact of inhalable particles from other age-related and chronic disease changes on the lungs.

“This approach gave us very detailed histologic and pathologic information,” Schenker said. “Many people have felt that agricultural dusts are an innocuous nuisance that don’t present a health problem. This study shows definitively that dust particles from the air of Fresno County penetrate deep into the lungs of healthy young people and cause structural changes. If the changes we have seen in the lungs due to inhaled particles were to continue, they would lead to clinically significant pulmonary fibrosis and related impairment of lung function.”

To date, the research team has analyzed more than 40 lung tissue specimens. When the sample is complete—120 specimens in total—Schenker hopes to have a better understanding of how much impact agricultural dust has had as compared to particles associated with environmental pollution or other sources.

Schenker’s collaborators include Kent Pinkerton of the Department of Anatomy, Physiology, and Cell Biology at UC Davis; Frank Green of the University of Calgary in Canada; Margaret Menache of the University of New Mexico in Albuquerque; Val Vallyathan of the National Institute for Occupational Safety and Health (NIOSH); and Venu Gopal of the Fresno Medical Coroner’s Office.

Study Gives High Marks to Connecticut Program to Protect Workers from Lead

When an unusually high number of California bridge painters were found to have lead poisoning last year, state health officials expressed alarm.

Lead poisoning, an occupational hazard that dates back to ancient times, can have a range of deleterious effects—from fatigue and nausea to seizures, coma, and brain damage.

Under state law, employers must provide training, decontamination equipment, and follow-up for workers dealing with lead, but standards and enforcement have not been sufficient to avoid violations.

Now, a study by a UC Berkeley graduate student indicates that a program pioneered in Connecticut holds promise as a model for protecting workers from lead exposure.

Working with COEH faculty member Katharine Hammond, professor of environmental health sciences at UC Berkeley’s School of Public Health, doctoral student Kathleen Vork analyzed data from 90 bridge projects undertaken as part of the Connecticut Road Industry Surveillance Project (CRISP). A demonstration project, CRISP had several unique features: a centralized medical monitoring system, contract-specific lead health protection programs, and stringent blood lead level requirements.

Vork found that CRISP was instrumental in lowering bridge worker blood lead levels. “Compared to similar workers in other states, Connecticut workers had significantly lower peak blood levels,” she reported in a recent article in the American Journal of Industrial Medicine 38:1-11 (2001).

“We are interested in Kathy Vork’s analysis and are hoping to have her present a seminar for our staff,” said Barbara Materna (PhD ’92 UC Berkeley), chief of California’s Occupational Lead Poisoning Prevention Program (OLPPP). Hotline for the OLPPP is 510/622-4332.
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