



The Four Laws of Ecology . . . 1. Everything is connected to everything else, 2. Everything must go somewhere, 3. Nature knows best, 4. There is no such thing as a free lunch.

Barry Commoner, *The Closing Circle*, 1971

RESPIRATORY DISEASE

Deaths Out West: The Link to COPD

Lung diseases are becoming more prominent killers in the United States, particularly in the inland West. Many experts blame smoking, but some puzzling conflicts in the data suggest there may be other significant culprits.

Deaths from chronic obstructive pulmonary disease (COPD) have climbed about 45% over the past 20 years, while death rates from the other four biggest killers in the country have dropped or held steady, according to the National Center for Health Statistics. People with COPD suffer from crippling airflow obstruction; a COPD diagnosis, which is evolving and likely is underreported, historically has included labels such as emphysema, chronic bronchitis, and asthmatic bronchitis. COPD killed at least 109,000 people in 1997.

Many experts say that smoking and its residual effects decades later cause about 90% of COPD deaths. But the National Institute for Occupational Safety and Health says that nearly 30% of COPD and adult asthma incidence is caused by occupational exposures. Other sources say that air pollutants, including dust from many sources, may also trigger COI

A broader range of potential culprits might make sense, as smoking rates have dropped from 40% in 1964 to about 25% today. In addition, while COPD deaths and smoking correlate fairly well in the eastern United States, based on 1997 death statistics from the National Center for Health Statistics and on smoking and smoking-attributable mortality (SAM) data from the Centers for Disease Control and Prevention, the pattern falls apart almost completely in the inland western United States.

Arizona is the sixth worst state for COPD deaths, but has the thirteenth lowest SAM rate.

Similar discrepancies occur in New Mexico, Kansas, Colorado, Wyoming, Montana, and Idaho. Five of the country's eight worst states for COPD deaths are in the inland West, and only one, Nevada, is among the worst for SAM rates. Utah is the lone bright spot in the region, with the lowest SAM rate in the nation and the second lowest COPD death rate. The few papers published on the COPD anomaly in the inland West have discussed altitude and exposure to mining dust as possible factors. But other possibilities are being tossed around by various experts.

One widely held theory is that many people in the East with lung problems have fled to the West, says Jonathan Samet, chairman of the department of epidemiology at The Johns Hopkins University in Baltimore, Maryland. When they die, that boosts the West's COPD death rate. That could fit the pattern seen in a popular Sun Belt state like Arizona, but Wyoming, with a similar discrepancy in COPD and SAM rates, has had only a trace of immigration, and a powerful immigration magnet like California shows only a tiny discrepancy in COPD and SAM rates.

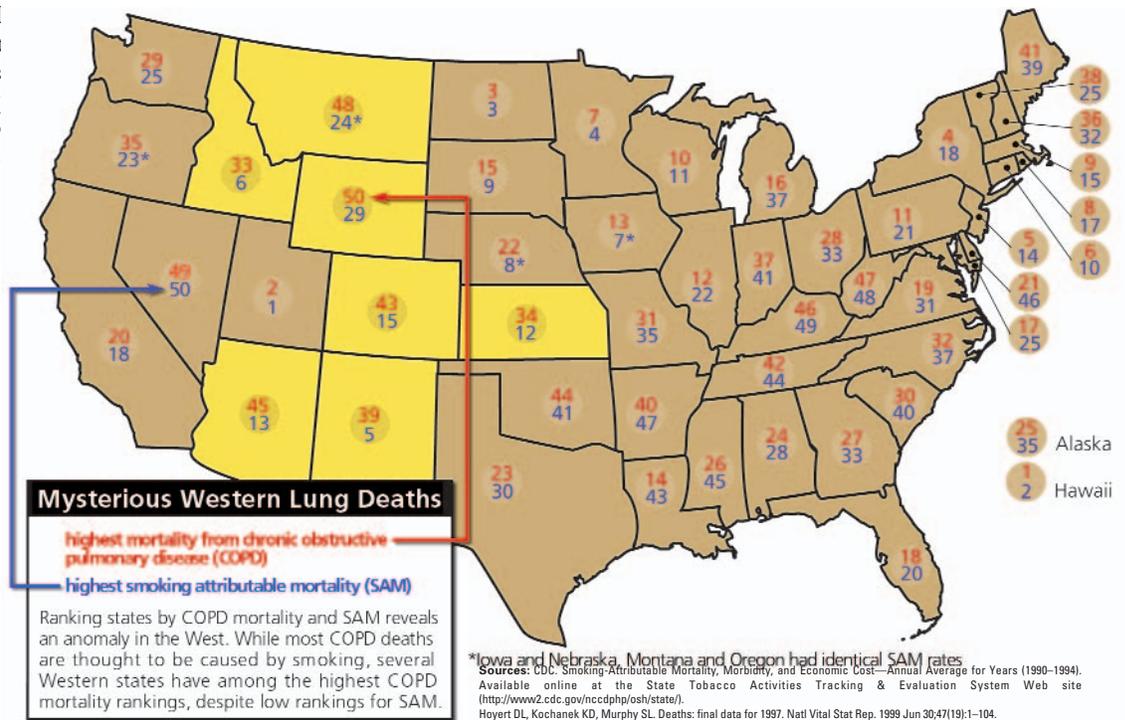
Another COPD suspect is dust, common in the inland West. The dry and dusty Phoenix area has a COPD death rate about

35% above the 1997 national age-adjusted rate of 21.1 deaths per 100,000 people. But the Santa Fe area is almost as dry, yet has a COPD death rate only three-fourths the national rate. Still another suspect is agriculture. Dozens of agricultural counties in the inland West have COPD death rates 25–100% higher than the national average. But some have average or below-average COPD death rates.

Outdoor pollutants may contribute to the problem. The COPD death rate in the core city of Denver is about 40% above the national average, while suburban Douglas County has a COPD death rate about 10% below the national average. And in the small town of Farmington, New Mexico, which is within 25 miles of two major coal-fired power plants and numerous natural gas processing facilities, COPD death rates happen to be 9% worse than the already-high rate for New Mexico.

Other possible influences are indoor pollutants, the changing parameters for COPD diagnosis, misdiagnosis, increasing COPD deaths as heart disease and cancer rates decline, lack of insurance, age, sex, race, ethnicity, and other genetic factors. The contrasting evidence shows that there are no simple explanations. But teasing out the influences could affect millions of lives.

—Bob Weinhold



ALTERNATIVE FUELS

Moving beyond MTBE

In March, prompted by rising concerns over groundwater contamination, the U.S. Environmental Protection Agency (EPA) called for a phaseout of methyl-*tert*-butyl ether, or MTBE, a chemical added to gasoline to reduce carbon monoxide (CO) pollution. The 1990 Clean Air Act requires that gasoline sold in polluted urban areas contain oxygen additives. This “oxygenation” supposedly promotes complete combustion and reduces exhaust concentrations of CO, which causes headache, mental dullness, dizziness, weakness, nausea, heart disease, and death, in high doses.

MTBE has been the petroleum industry’s additive of choice for several years. But when MTBE leaks (mainly from storage tanks), it migrates rapidly through groundwater, causing widespread pollution. In North Carolina, for example, thousands of public and private wells are contaminated with the foul-smelling, slow-degrading compound, and California has already ordered the chemical’s phaseout by 2002. The compound has also been shown to cause cancer in animal studies, although the National Toxicology Program voted in 1998 against listing MTBE as reasonably anticipated to be a human carcinogen in its *Report on Carcinogens*.

The EPA has asked Congress to amend the Clean Air Act to replace the existing oxygenate requirement with a standard for fuels made from renewable resources chemicals, and is also proposing to ban MTBE as an immediate threat to health under the Toxic Substances Control Act. The agency issued a 20 March 2000 press release claiming that it has authority under the law to “ban, phase out, limit, or control the manufacture of any chemical substance deemed to pose an unreasonable risk to the public or the environment.”

Ronald Melnick, a toxicologist at the NIEHS Laboratory for Computational Biology and Risk Analysis, says Congress should recognize that oxygenated fuels were less beneficial than expected, and that “for the most part, the impact on CO was overestimated in the initial models.” For instance, a 1996 review of MTBE by the Committee on Toxicological and Performance Aspects of Oxygenated Fuels of the National Academy of Sciences found that MTBE did not reduce CO emissions as expected.

If MTBE is indeed phased out, what

should be done about CO pollution? One option would involve replacing the Clean Air Act requirement for oxygenated fuels with a performance standard on ambient air CO standards, then allowing states to meet the standard as they deem fit. Another option would focus on getting the dirtiest cars off the road since, Melnick says, about 50% of CO comes from less than 10% of cars—better catalytic converters account for the improved performance of newer cars.

Still another option would be the use of a chemical resembling MTBE, such as ethyl-*tert*-butyl ether (ETBE). But, says Susan Borghoff, a staff scientist at the Chemical Industry Institute of Toxicology, toxicity information on alternatives is sketchy, and neither ETBE nor *tert*-amylmethyl ether, another proposed replacement, have undergone cancer bioassays. Furthermore, the 22 May 2000 issue of *Chemical & Engineering News* reports that a coalition of 90 environmental groups is asking Congress to ban all ether-based fuel oxygenates—not just MTBE—because they fear all members of this chemical family would present the same problems as MTBE.

Finding a safe replacement for MTBE is the EPA’s approach. In its March 20 statement, the agency swore its commitment to creating a “renewable fuel standard for all gasoline . . . particularly [corn-based] ethanol.” The agency’s call for action is designed to satisfy several goals, according to U.S. Department of Agriculture secretary Dan Glickman, who said, “Ethanol will play an important role in ensuring that we maintain the air quality gains we have achieved to date, and the renewable fuels standard will encourage substantial new growth in the use of ethanol and other renewable fuels across the country.” But ethanol has its own problems. Shipment to sites far from the Corn Belt is expensive. In addition, Melnick says, burning ethanol forms acetaldehyde, which causes nasal tumors in rats.

The ultimate solution could be based as much on politics and economics as on public health. While the EPA’s solution, ethanol, does not get wholehearted endorsement from toxicologists, neither does the use of oxygenated fuels. Says Myron Mehlman, an adjunct professor of toxicology at the Mount Sinai School of Medicine in New York and a former director of toxicology at Mobil Oil, “[Aside from potential toxicity problems,] they are really not that helpful. We were reducing CO for 25 years before MTBE was introduced.”

—David J. Tenenbaum

Imprisoned Activist Wins Award

Rodolfo Montiel Flores, founder of a campaign against commercial logging in the Sierra de Petatlán region of southwestern Mexico, is one of six recipients of the 2000 Goldman Environmental Prize. Montiel Flores’s campaign, which resulted in the suspension of logging operations by Boise Cascade, one of the largest U.S. logging companies, included attempts to arrange meetings with government officials, organization of protests, and setting up of roadblocks to disrupt convoys of logging trucks. In May 1999 the activist was jailed on charges including participation in an “eco-guerrilla” organization. The Goldman Prize recognizes grassroots environmental activists from each of six continental regions.



Goldman Environmental Prize

Sickening Decreases in Asthma

Italian researchers led by Paolo Matricardi have found that exposure to microbes such as *Helicobacter pylori*, hepatitis A virus, and *Toxoplasma gondii* may help protect people from developing asthma and hay fever. Their findings, published in the 12 February 2000 issue of the *British Medical Journal*, are linked to the debate over whether better hygiene and lower rates of childhood infections due to vaccination programs are related to increases in allergic asthma and rhinitis.

Although the study determined that exposure to six airborne pathogens (including those causing measles and chicken pox) had no effect on allergy development, it found that rates of allergic asthma and rhinitis were lower among study participants who had been exposed to two or more orofecal or foodborne microbes.

Safer Water for All Americans

On 28 March 2000, Vice President Al Gore announced new proposed U.S. EPA water standards to help ensure the safety of tap water throughout the United States. One

standard would require water systems that serve fewer than 10,000 people to establish filtration and monitoring requirements to control waterborne microbes such as *Cryptosporidium*, thereby extending the rule that has been in effect for larger water systems since 1998. The new standard could prevent as many as 83,000 cases of waterborne illness annually.

Gore also announced FY 2001 budget proposals that would allocate \$825 million to the Safe Drinking Water Revolving Loan Fund to offer low-interest loans to communities to help them improve their water systems and meet EPA regulations.



RECYCLING

Turning Wallboard Out to Pasture

Building a 2,000-square-foot house leaves about a ton of gypsum wallboard waste from end cuts, window and door cutouts, and broken boards. In the United States, three million tons of gypsum wallboard waste is dumped in landfills each year. In addition to depleting space, microbial action can decompose gypsum to malodorous hydrogen sulfide gas, which at high enough exposures can cause irritation of the mucous linings, headache, dizziness, nausea, convulsions, coma, and death.

A study at the University of Wisconsin at Madison by soil scientist Richard Wolkowski, published in the January–February 2000 issue of *Communications in Soil Science and Plant Analysis*, found that clean scrap gypsum wallboard can be crushed and applied to alfalfa as fertilizer. Alfalfa covers over three million acres in Wisconsin and is fed to dairy cows and other livestock. This crop requires large amounts of sulfur as a nutrient. Although commercial gypsum fertilizer has existed for a long time, says Wolkowski, crushed gypsum wallboard waste provides a way to reduce construction waste while nourishing the soil.

For three growing seasons, crushed wallboard was spread on alfalfa fields at four University of Wisconsin agricultural research stations with different soil types and climates

at rates ranging from 1 ton per acre to 16 tons per acre. Alfalfa yields were similar to those from fields treated with commercial gypsum fertilizer. “[Crushed wallboard] had neither a strong positive nor negative agronomic effects on alfalfa production,” Wolkowski says. He concludes that there is thus a reasonable alternative to tossing the waste into landfills.

Larger amounts of crushed wallboard were no better for the alfalfa than smaller amounts. Wolkowski explains that the largest amounts of crushed wallboard raised concentrations of soil calcium and sulfur but lowered soil magnesium; the excess calcium from the wallboard displaces magnesium from the soil, allowing it to leach away. Alfalfa grown on magnesium-deficient soil could therefore become magnesium-depleted and potentially cause tetany if fed to cows (the muscular spasms and twitching of tetany result from insufficient minerals such as magnesium). Sandy soils are especially susceptible to magnesium deficiency because they have little natural magnesium and a low soil organic matter content. The magnesium content of alfalfa grown with crushed wallboard should



Building better crops. Scientists spread crushed gypsum wallboard on alfalfa fields as a fertilizer.



be checked, says Wolkowski.

Finding a source of waste wallboard poses the greatest obstacle. Wolkowski teamed up with a local wallboard distributor who collected scraps from building sites. The material was hauled to a processing site, ground in a hammer mill, and sieved through a 12-millimeter screen. “It came out looking like lumpy flour,” says Wolkowski.

Furthermore, state laws may stifle its application. In Wisconsin, for instance, wallboard is classified as a solid waste, and spreading it on agricultural lands requires a permit. Promoting the recycling of wallboard will probably require local effort. The ideal situation, says Wolkowski, would be for a “local fertilizer dealer who’s open-minded about waste management to team up with a wallboard dealer.” If anyone steps forward and takes up the challenge, Wolkowski’s studies prove it can be done. —**Carol Potera**

ENVIRONMENTAL MEDICINE

New Drugs Engineered to Fight Asthma

Environmental allergens such as those associated with dust mites and cockroaches can trigger asthma attacks in predisposed individuals when they overwhelm the immunoglobulin E (IgE) cascade, a system believed to protect the body against parasitic invasion. About 5,000 people die each year from asthma attacks, and doctors believe that all those deaths could be prevented. At the American Academy of Allergy, Asthma and Immunology annual meeting, held 3–8 March 2000 in San Diego, California, doctors detailed how investigational bioengineered drugs target and soak up IgE and interleukin-4 (IL-4), key modulators of the IgE cascade. The drugs may eventually replace corticosteroids, currently the drug of choice, as preventive medication.

Henry Milgrom, a senior staff physician at National Jewish Medical and Research Center in Denver, Colorado, described progress in clinical trials with anti-IgE, a compound developed jointly by the drug companies Genentech, Novartis Pharma AG, and Tanox. “This is a breakthrough—anti-IgE was designed to perform a specific function in suppressing a disease process and it works,” Milgrom said.

Among the 268 adult patients suffering from moderate to severe asthma who received injections of anti-IgE in the first phase of a 28-week study, only 14.6% had asthma attacks, compared with 23.3% of the 257 patients on placebo. There were also reduced exacerbations of asthma during the second phase of the study when steroid medication was withdrawn.

In a second study involving 334 asthmatic children, 55% of the chil-

dren receiving anti-IgE were able to discontinue all steroid medication without suffering asthma attacks, compared to about 39% of patients receiving placebo injections.

“This is an exciting approach to treatment of asthma,” said Michael Wein, chief of allergy at Indian River Memorial Hospital in Vero Beach, Florida. “If you found something to remove IgE from the body, you wouldn’t have allergies.” Milgrom said anti-IgE also has potential for people who have food or latex allergies, atopic dermatitis, and other conditions. He said a new drug application for anti-IgE will be filed with the Food and Drug Administration this summer.

Larry Borish, an associate professor of medicine at the University of Virginia Medical Center in Charlottesville, reported that another new drug, IL-4R (for IL-4 receptor), is effective for 5–7 days with just one inhaled dose. IL-4 is responsible for the respiratory inflammation associated with asthma. Borish said the drug soaks up circulating IL-4 like a sponge.

Borish reported administering either placebo or three different dosages of IL-4R to 15–16 patients per group in 12 weekly inhalations. The patients were all suffering from moderate to severe asthma and had been taking inhaled corticosteroid medication, which was stopped on the first day of the study. The group taking the placebo showed a significant decline in lung function, whereas this decrease in function did not occur in the treatment group, Borish said, demonstrating the efficacy of the experimental drug. Borish said a larger study of IL-4R will be reported this summer.

In almost all chronic diseases, long-term patient noncompliance is probably the major reason why treatment eventually fails. So, says Charles Feldman, an associate professor of pediatrics at Columbia University in New York, the great promise of IL-4R is that if further studies prove its effectiveness, its ease of use should improve patient compliance—a key to keeping asthma in check. —**Ed Susman**



United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) is an international response to our planet's changing climate. Serving as a means through which governments have opted to deal with the threat of global warming, the UNFCCC was adopted at the 1992 Earth Summit in Rio de Janeiro. The ultimate objective of the convention is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with Earth's climate.

As of May 2000, 184 countries had ratified the UNFCCC. Since 1994, when the UNFCCC entered into force, the Conference of the Parties, the decision making body of the convention, has met 5 times. In addition, the UNFCCC's subsidiary bodies have met 12 times, and various workshops have been held to help implement climate change goals in such areas as agriculture, energy, and national resources. By sharing technology, such programs help to slow climate change caused by energy production, transportation, industry, agriculture, forestry, and waste management.

The UNFCCC's home page is located at <http://www.unfccc.int/>. The site introduces five main programs of the convention: Planning, Coordination and Emerging Issues; Implementation; Science and Technology; Intergovernmental and Conference Affairs; and Information, Outreach and Administration Services. These UNFCCC programs work to further develop the commitments individual countries have to lessening climate change. There are also links to resources such as a greenhouse gas inventory database under the What's New? box on the opening page. Within this database, tables include an analysis of each country's greenhouse gas emissions by gas, source, and year. Clicking on Resources under the opening page's sidebar leads to an index of official documents including detailed information about sessions of the Conference of the Parties, the subsidiary parties, and workshops.

The UNFCCC requires industrialized countries to achieve quantified targets for decreasing greenhouse gas emissions. In order to strengthen the international response to climate change, the Kyoto Protocol was adopted under the convention in 1997. Under the Kyoto Protocol, countries agree to cuts in emissions of three of the most important gases: carbon dioxide, methane, and nitrous oxide. The site features the latest ratification lists on the convention and the Kyoto Protocol, as well as the full texts of the convention and the protocol, under the Resources link. By following the Country Information link under Resources, users can click on a country's name for its individual data, such as the date that it ratified the convention.

The convention lists participating countries in two designations: the Annex I and Annex II Parties. The Annex I Parties include both the 24 relatively wealthy countries that were members of the Organisation for Economic Co-operation and Development (OECD) in 1992, the European Union, and countries with economies in transition, such as the Russian Federation and several other Central and Eastern European countries. These countries are committed to adopting national policies and measures aimed at returning their greenhouse gas emissions to 1990 levels by the year 2000. They must also submit regular reports, known as national communications, detailing their climate change policies and annual inventories of their greenhouse gas emissions. The Annex II Parties, a subset of the Annex I Parties, include wealthier countries—the 24 OECD countries and the European Union—which have a special obligation to help developing countries with financial and technological resources. The third national communication from Annex I Parties is due 30 November 2001. These national communications are reviewed by a team of experts and are available by clicking the National Communication heading under the Resources link.

Finally, also included under the Resources link are the Climate Change Information Kit and the Guide to the Climate Change Process. These two documents provide an introductory look at the climate change problem itself and answer frequently asked questions about climate change. —**Lindsey A. Greene**



Human Testing of Pesticides

In a one-of-a-kind test for the United States, paid volunteers ingested small-dose capsules of chlorpyrifos to assess the pesticide's potential human health effects. The U.S. EPA stated in 1999 that the widely used pesticide may be dangerous to humans because of its effects on the nervous system.

The study, done by MDS Harris Laboratory in Lincoln, Nebraska, for Dow Chemical, was conducted to supplement 3,600 earlier studies and reports on chlorpyrifos, says Dow spokesman Garry Hamlin. He adds that dosage levels for the study were established using information from the earlier research so that potential risks to the volunteers would be eliminated.

In 1998, the EPA established an advisory panel on human testing after concerns were raised following the publication of an agency notice stating that human testing might be useful in determining safety risks.

Second *Pfiesteria* Species Found

A 1995 fish kill in eastern North Carolina led to the discovery by North Carolina State University marine scientists of a second species of *Pfiesteria*. Named *P. shumwayae*, this new microbe is genetically and structurally different from the first species, *P. piscicida*, which was discovered in 1989.

Like *P. piscicida*, however, *P. shumwayae* has a complex series of life stages and is stimulated to generate fish-killing toxins by the presence of live fish. Both species inhabit an area along the East Coast from the Chesapeake Bay to the Gulf Coast of Alabama.



Stopping Runoff in Its Tracks

USDA Agricultural Research Service scientists at the National Sedimentation Laboratory in Oxford, Mississippi, have determined that vegetated drainage ditches can help farmers reduce the amount of chemicals and sediment carried by stormwater from fields into nearby bodies of water.

Study scientists found that drainage ditches, which are commonly used on farms to siphon off stormwater and control rice field water levels, trapped 60–90% of a liquid pesticide formulation that had been injected into the system prior to the test. The ditches act in much the same way as wetlands, where the soil and vegetation work together to filter the potentially harmful materials from the water.

In a 24 March 2000 press release, the scientists say this method provides farmers with a simple, low-tech, and inexpensive solution to improving surface water quality, and is vital as an alternative management practice.