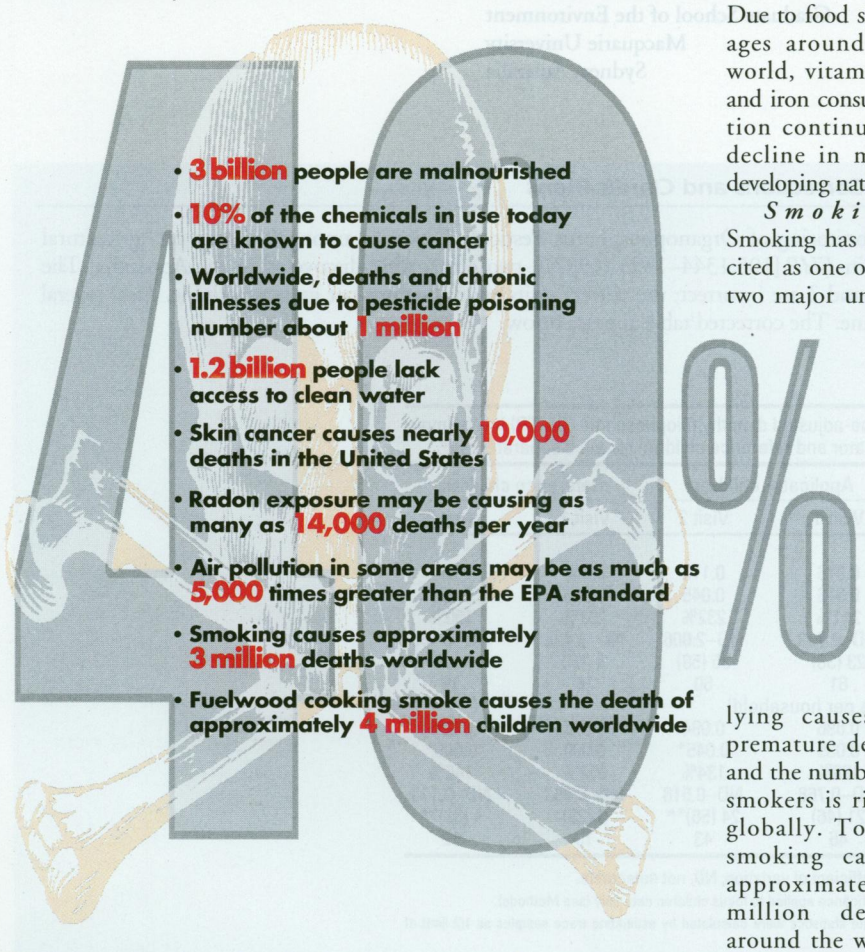
We have found the sources of hazardous waste and they are us.
U.S. EPA booklet, *Everybody's Problem: Hazardous Waste*, 1980

Killer Environment

It's the environment, stupid. At least, that seems to be the conclusion of a paper published in the October 1998 issue of *BioScience* that asserts that approximately 40% of the world's deaths can be attributed to environmental factors. The paper was written by David Pimentel, a professor of ecology and agricultural sciences at Cornell University in Ithaca, New York, and 11 graduate students who took Pimentel's special year-long course on environmental policy. Says Pimentel, "The reason that I suggested this investigation was my interest in environmental and population issues. The disease situation turned out to be more serious than we had anticipated."

Pimentel says his team arrived at the 40% figure based on the following facts: 1) more than 3 billion people are malnourished, with many dying directly and indirectly from malnutrition; 2) smoking is on the rise worldwide; 3) approximately 4 billion people are exposed to toxic smoke through their cooking fires; 4) heightened UV light exposure is causing more skin cancers; 5) humans are exposed increasingly to the 100,000-plus chemicals in use worldwide; 6) radon exposure is increasing worldwide; and 7) water and air pollutant exposure is increasing worldwide. "In our view," says Pimentel, "the 40% figure is conservative; it could be much higher."



Malnutrition. Malnutrition is endemic to areas of the world marked by political unrest, poverty, soil degradation (due to overfarming and unchecked urban expansion), and overpopulation. The World Health Organization has estimated that some 6–14 million people worldwide die each year from malnutrition. Of that figure, some 2 million die of vitamin A deficiency, and approximately 1–2 million deaths can be attributed to anemia, or iron deficiency. Due to food shortages around the world, vitamin A and iron consumption continue to decline in many developing nations.

Smoking. Smoking has been cited as one of the two major underlying causes of premature death, and the number of smokers is rising globally. Today, smoking causes approximately 3 million deaths around the world each year; by the year 2020, predicts one study, smoking will claim some 10 million lives worldwide. In the United States alone, deaths due to lung cancer rose 400% between 1950 and 1990.

Cooking fires. The smoke of cooking fires fueled by wood, coal, and other organic material contains not only particulate matter but also carcinogenic chemicals such as benzene, formaldehyde, and polycyclic aromatic hydrocarbons. A 1993 study of Indian households that cook over open fires found indoor particulate matter concentrations that were as much as 200 times higher than the maximum standard for U.S. homes. According to one World Bank study, fuelwood cooking smoke causes the death of approximately 4 million children worldwide each year.

Skin cancer. By one estimate, every 1% decrease in the ozone layer increases UVB radiation by 1.4%, and the incidence of skin cancer is increasing accordingly. Some North American white populations, whose lighter skin pigmentation puts them at greater risk for developing skin cancer, are experiencing a 30–50% jump every five years in the prevalence of the condition. The number of new cases of skin cancer in the United States has quadrupled over the past 20 years, resulting in nearly 10,000 deaths per year.

Chemical exposures. According to a 1994 World Resources Institute report, the United States uses at least 20 billion kg of hazardous chemicals each year, and nearly 10% of the chemicals in use today are known to cause cancer. Between 1989 and 1996, the number of pesticide poisonings reported in the United States nearly doubled. Worldwide, deaths and chronic illnesses due to pesticide poisoning number about 1 million per year.

Radon exposure. Radon, a radioactive gas that seeps up from the ground, is becoming a greater health risk as modern houses are constructed to be better insulated and more airtight. Radon exposure is thought to be a significant cause of lung cancer in the United States, and may be causing as many as 14,000 deaths per year. In Sweden, says the paper, radon concentrations in houses have risen as much as fivefold over the past 30 years.

Water and air pollution exposure. About 1.2 billion people lack access to clean water. In developing nations, as much as 95% of untreated sewage is dumped directly into rivers, lakes, and seas that are also used for drinking and bathing. Agricultural and erosion runoff can carry toxic chemicals to drinking water supplies. According to the report, 1993 air pollution levels in the world's 20 largest cities far overshot regulatory standards due to increased industrial and automobile emissions. In Los Angeles, for example, the average exposure to carcinogens found in

automobile exhaust may be as much as 5,000 times greater than the EPA standard.

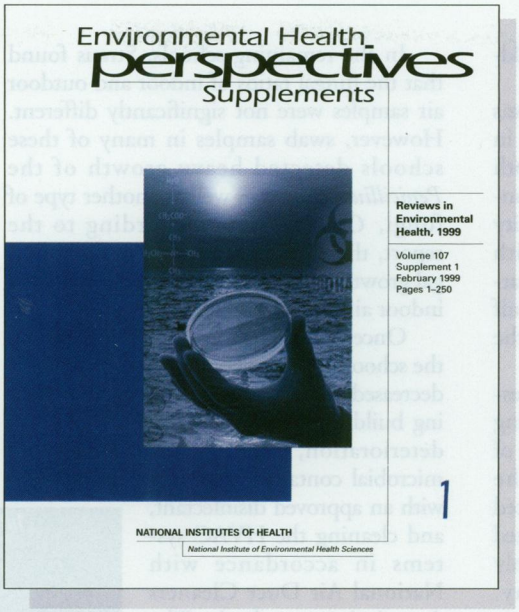
While the Cornell paper paints a discouraging picture of life on earth today, Pimentel hopes some good will come of the bad news. "We hope that our study will encourage more up-to-date reporting on diseases," he says.

Annual Review of the Environment

The association between nonionizing radiation and breast cancer, the human health implications of phenolic compounds in plants, and the impact of global climate change are among the environmental health issues given in-depth treatment in the annual review issue of *EHP Supplements*, the sister publication to *EHP*. This year's review issue, due out this month, contains 17 original peer-reviewed monographs on some of the past year's most pressing environmental health topics. Each review article contains extensive background information, as well as an author summary and analysis of the newest developments in the field.

For the 1999 review issue, Leeka I. Kheifets of the Electric Power Research Institute in Palo Alto, California, and C. Chantal Matkin of Stanford University in California examine the association between nonionizing radiation (electric and magnetic fields, or EMFs) and breast cancer. Because breast cancer occurs more often in industrialized countries, some researchers have theorized that it may be attributable to the increased use of electric power. Kheifets and Matkin assess more than 35 residential and occupational epidemiological studies that investigated the association between EMFs and breast cancer. Although most of the data do not unequivocally support an association between EMFs and breast cancer, the scientists point to the limited statistical power of the studies, as well as the possibility of misclassification and bias present in much of the existing data, as reasons why such an association should not yet be ruled out. "Given the ubiquitous nature of EMF exposure and the high incidence of breast cancer," they write, "even a small risk will potentially have a substantial public health impact." This review comes on the heels of the Working Group Report, funded by the NIEHS Electric and Magnetic Fields Research and Public Information Dissemination Program, that ruled that EMFs may be considered possibly carcinogenic to humans.

Otto Daniel and colleagues from the Swiss Federal Office of Public Health and the Swiss Federal Institute of Technology, both in Zürich, study the toxic and beneficial human health effects of certain phenolic compounds. These compounds are produced in plants to serve a number of purposes, including repelling herbivores, pigmentation, protection against UV light, and biocidal defense against bacteria and fungi. External stimuli such as chemical stress from heavy metals and pesticides can alter the chemical composition or quantities of phenolic compounds in a plant; depending on its concentration, chemical structure, and any external modulation, a given phenolic compound might be either toxic or beneficial to humans. The scientists examined three such compounds. Resveratrol, which is found in grapes and peanuts, has been found to inhibit the synthesis of substances that cause blood clotting, possibly offering protection against heart disease and thrombosis. Flavonoids, which are found in almost every food or beverage of plant origin, act as antioxidants, inhibit blood coagulation, promote vasodilation, and have anti-inflammatory effects—benefits that appear to outweigh their variable mutagenic properties. Furanocoumarins, which are found in plants such as limes and celery, can cause phototoxic burns but have also been harnessed for use in psoralen UVA therapy, which is used to treat skin conditions such as psoriasis and cutaneous T-cell lymphoma.



Janice Longstreth of the Waste Policy Institute in Washington, DC, and the Institute for Global Risk Research in Bethesda, Maryland, discusses the regional impact of global climate change in the United States. She says that many public health officials feel that any increases in health effects related to global climate change will be easily absorbed by the health care systems in place, but Longstreth warns that this position may be dangerously shortsighted. She discusses the possible effects of higher temperatures, increases in ground-level ozone and other air pollutants, changes in vector, host, and infectious agent habitats, rising water temperatures, and increases in extreme events such as hurricanes and tornadoes. She also discusses how such changes may vary among regions, possibly burdening some areas more than others with a shortfall between health care needs and resources.

A second public health paper in the review issue looks at methods for maintaining control of pathogens in drinking water while simultaneously ensuring that disinfection by-products do not present health risks. Other papers cover cellular mechanisms such as the known signal transduction pathways that regulate cell cycle progression and DNA stability mechanisms, the relationship between toxic environmental chemicals and apoptosis, the manner in which metabolic genotypes affect individual susceptibility to cancer, and the role of the *Bcl-2* gene family in prostate cancer. Four papers address the roles of cholinesterases and acetylcholine in the developing nervous system, and others discuss current issues in toxicology, including the development of short-term estrogenicity tests for identifying hormone disruptors, the toxicology and chemistry of toxaphene compounds, the field of geographic modeling and its role in environmental epidemiology studies, and the latest data on waterborne diseases caused by bacterial, protozoal, and viral pathogens.

EHP Supplements is published six times each year (including the annual review issue). More information is available on the Environmental Health Information Service Web site at http://ehis.niehs.nih.gov.

The Source of Sick Buildings

Indoor fungal contamination has been shown to produce allergies in building occupants. While fungi have also been suspected of playing a role in sick building syndrome (SBS), a health condition that results from poor indoor air quality, few studies to date have been able to verify this link. A recent study, however, links SBS with elevated indoor levels of the fungi *Penicillium* and *Stachybotrys*, both of which have been implicated in respiratory diseases such as asthma and pulmonary hemosiderosis. The research, which was published in the September 1998 issue of *Occupational and Environmental Medicine*, is the most comprehensive SBS