The air and water grow heavier with the debris of our spectacular civilization.
Lyndon B. Johnson
message to Congress, 30 January 1967

AIR POLLUTION

U.S. Air Only Fair

In the first federal study to assess ambient concentrations, human exposures, and estimated risks of a wide range of air pollutants, the U.S. Environmental Protection Agency (EPA) has found that millions of people live in areas where air toxics may pose potentially significant health concerns. Although this study of 1996 data only partially addresses the question of how much risk air toxics actually currently pose, all indications point to the risk being much higher than goals set by the EPA.

The National-Scale Air Toxics Assessment (NATA) found that the risk of developing any kind of cancer over a lifetime due to exposure to certain air toxics exceeded 10 in 1 million for the contiguous 48 states, Puerto Rico, and the U.S. Virgin Islands, substantially higher than the EPA's goal of 1 in 1 million. More than 20 million people lived in counties with much higher risk, exceeding 100 in 1 million, and localized "hot spots" posed an even higher risk within some counties.

To assess noncancer risks, the agency adopted a hazard index based on an evaluation of the respiratory hazard posed by eight of the air toxics. Many of the data for noncancer toxic mechanisms are not yet available, so the index is considered the best method to reflect a range of noncancer effects. A rating above 1.0 indicates the potential for adverse health effects, while a rating below 1.0 suggests that exposures pose little lifetime risk. The vast majority of the population lived in areas with an index above 1.0, and more than 20 million people lived in counties with an index above 10.0.

NATA uses data updated every three years as part of the National Toxics Inventory. The first findings, released 31 May 2002, are based on 1996 data, the latest available for all the evaluated substances. The study estimated the presence of and health risks posed by 32 air toxics, including benzene, chromium, formaldehyde, arsenic, acetaldehyde, acrylonitrile, acrolein, and cadmium. In addition, the EPA calculated the presence of diesel particulate matter in each county, but did not include it in the risk assessment because it doesn't yet have an agency-assigned numerical risk factor (and isn't expected to for several years).

The 33 air toxics—selected based in part on the availability of emissions and risk assessment data—are among the 188 air toxics for which the EPA must still develop emissions standards. The selected air toxics come from a variety of sources. On- and off-road vehicles account for about half the emissions. Other sources include industry (sources such as chemical plants and oil refineries generate more than 40% of 20 air toxics) landfills, fertilizers, fireplaces, wildfires, and globally transported pollutants.

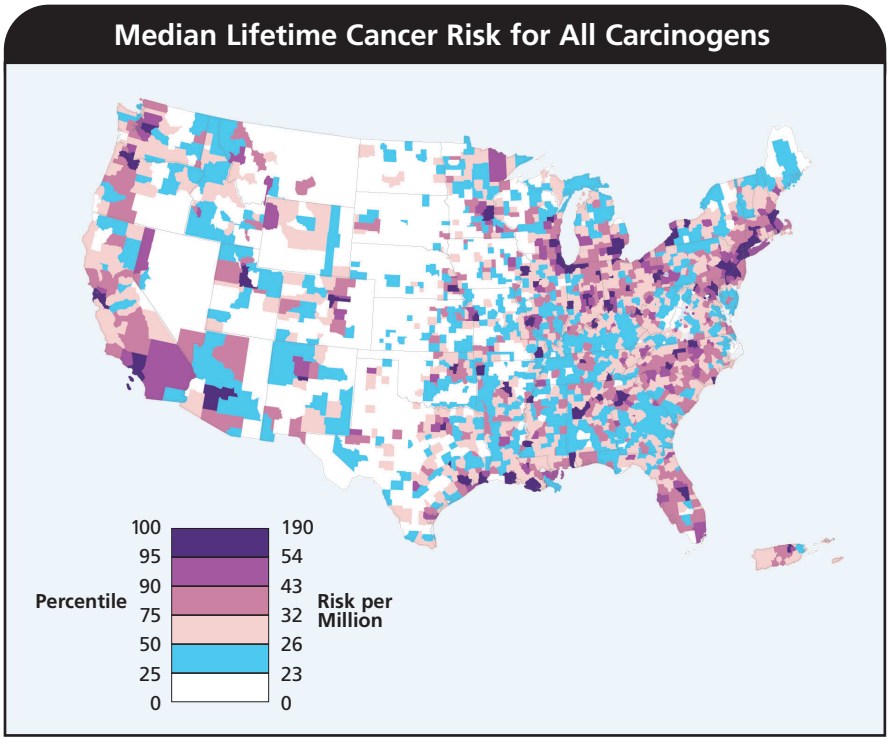
This first generation of NATA was not able to fully answer the question of how much risk air toxics pose. For instance, when diesel risks are eventually included, the cumulative risk ratings could rise substantially [see "Fuel for the Long Haul? Diesel in America," p. A458 this issue]. And when the EPA compared modeled emissions to seven that it had actually monitored, it found that the modeled emissions were sometimes as low as 15% of the monitored emissions. In addition, risks posed by noninhalation pathways, such as ingestion or dermal absorption, are not included in the risk assessment, nor are many risks from indoor exposures or from sources such as agriculture operations. The 155 other air toxics not studied but considered high priority by the EPA also contribute some risk, as do tens of thousands of other chemicals in regular use.

On the other hand, actual risks from the substances assessed may be lower, because there are built-in margins of safety in the risk assessment for each substance. And risks borne by any one individual may be lower (or higher) than those assumed for a "typical" person in this study.

EPA officials plan to use NATA information to help identify the air toxics of greatest concern, improve understanding about sources and exposures, and set priorities for future work. However, the results are not intended for direct use in regulatory actions.

One potentially affected industry, represented by the American Chemistry Council of Arlington, Virginia, says it sanctions the EPA's fledgling efforts. "We support the EPA release of NATA as a first step in making broad assessments about where there are remaining risks and the relative contributions from cars, small business, and larger industry," council spokesman Chris VandenHeuvel says.

EPA and ACC officials say that emissions of the 33 air toxics are lower now, or should be soon, following implementation of numerous pollution control actions since 1996. Some of those reductions may be reflected in the 1999 data to be used for the next iteration of NATA, scheduled for release at the end of 2003. The current results are available on the Internet at **http://www.epa.gov/ttn/atw/nata/index.html**.
–Bob Weinhold



Source: Office of Air Quality Planning and Standards, U.S. EPA. National-Scale Air Toxics Assessment [http://www.epa.gov/ttn/atw/nata/maprisk.html].

CHILDREN'S HEALTH

Bad Grades for School Buses

When parents put their children on a school bus, their chief concerns may be the safety of the driving or the traffic on the streets. A recent study suggests, however, that another real threat to children's health may come from the air inside the bus.

The study, conducted by researchers from the Natural Resources Defense Council (NRDC), the University of California at Berkeley School of Public Health, and the California-based advocacy group Coalition for Clean Air, suggests that riding diesel-fueled school buses may increase children's risk for cancer and aggravate respiratory problems. Most of the 442,000 school buses carrying some 23 million children today use diesel fuel.

The researchers rode four empty school buses for a total of 20 hours along actual elementary school bus routes in Los Angeles. Using equipment that continuously sampled the air in the buses, they found interior exhaust concentrations that were more than eight times the average concentrations found in the ambient air in California. The average concentrations inside the buses also were as much as four times higher than those inside cars driven by other team members traveling in front of each bus. "In many of these buses, the engine is in front, and the tail pipe is in the back, and the exhaust runs underneath the entire inside of the bus," says Gina Solomon, a senior scientist at the NRDC. "If there are small cracks or holes in the exhaust system, diesel exhaust may come right in from underneath the bus."

The researchers estimate that for a child riding a school bus one hour each day, the cancer risk would be roughly 23–46 cases per million children, says Solomon. The U.S. Environmental Protection Agency considers a risk of 1 per million to be significant.

"We wanted to give a sense of what the risk may be compared to other risks," Solomon says. "These numbers are close to the magnitude of risk associated with secondhand cigarette smoke. We think that in some cases school buses may be a significant risk to kids. And it's an avoidable risk because there are ways to clean buses up."

Stephen Rappaport, a professor of environmental sciences and engineering at the University of North Carolina at Chapel Hill, says the study is worth attention but should not cause undue alarm. "It's a preliminary study based on a small number of observations," he says. "But there's enough concern there to motivate a larger study to find out what the exposures really are."

Solomon also points out limitations of the small pilot study. "We expect that there are a lot of buses out there that are probably cleaner than the ones we looked at, and I'll bet there are a lot of buses out there that are dirtier too," she says. The buses used in the study were manufactured in the 1980s. Buses made before 1993 are fairly common across the country and cannot be retrofitted with optional particle traps that help them run more cleanly.

Though the researchers do not suggest that parents pull their children off buses, they do recommend that children ride as close to the front of the bus as they can, with the windows open when possible. In the long term, the NRDC recommends that parents urge schools to switch as soon as possible to buses that use alternative fuels such as natural gas so that children are not exposed to excessive diesel exhaust for years. School buses are good candidates for using natural gas because, unlike heavy-duty trucks, they are usually fueled each day at a central location. Schools can also reduce emissions greatly by regularly inspecting and repairing buses. **–Angela Spivey**

Worse than bullies. A new report shows that children may face an unexpected threat on school buses—unhealthy air.

Clockwise from left: PhotoDisc; PhotoDisc; European Union

Biodiesel Bulldozes Ahead

Use of biodiesel in the United States grew from 500,000 gallons in 1999 to 20 million gallons in 2001 due partly to better supply, changes in farm equipment manufacturer warranties, and a growing desire to reduce U.S. dependence on foreign petroleum. Vehicles that use biodiesel—made using vegetable oils, fats, and greases—have fewer emissions of heavy hydrocarbons, particulate matter, CO, and CO_2, making this trend not only politically correct but also healthier for people and the environment. Biodiesel producers will benefit from a U.S. EPA move last year to cut the amount of sulfur allowed in diesel fuel from 500 ppm to 15 ppm by 2006. Biodiesel is the only fuel that already meets this standard.

EPA Money Hits the Beach

As part of the 2000 Beaches Environmental Assessment and Coastal Health Act, which aims to standardize monitoring and notification procedures across the country, U.S. EPA administrator Christie Whitman announced $10 million in grant funding for fiscal year 2002 for coastal and Great Lakes states, territories, and local health agencies. The funds are to be used to upgrade monitoring systems for beach water quality and improve how the public is notified of beach warnings and closures. At the 18 March 2002 press conference announcing the grants, Whitman said, "With this money we hope to reduce the risk of exposure to disease-causing microorganisms in the water while people enjoy our incredible water resources."

Poised for Less Noise

In May 2002 the European Parliament approved new measures on noise pollution. Dutch Green Party spokesman Alexander de Roo said the new measures lay the foundation for a consistent EU-wide noise policy that will firmly tackle a problem that affects one-third of the EU population. A review of all existing noise regulations is to be published within 18 months, and a new draft directive sets forth an aggressive timetable for measuring and mapping noise from transportation sources and large urban centers. Plans for developing multilevel government strategies to "avoid, prevent, and reduce" noise from such sources—and not just fight it—were also laid out.

INDOOR AIR QUALITY

What's That Smell?

When ozone comes in contact with carpets, unpleasant odors arise that differ from "new carpet smell." The malodorous fumes arise from the oxidation of vegetable-based machining oils found in carpets into compounds called aldehydes and ketones. Although the odors do not cause acute health effects, "they may influence well-being, mood, and productivity," says environmental engineer Glenn Morrison of the University of Missouri at Rolla.

While at the University of California at Berkeley, Morrison and civil engineering professor William Nazaroff exposed samples of commonly sold carpets to 100 parts per billion (ppb) ozone for 10 days and continuously measured gas emissions. As reported in the 15 May 2002 issue of *Environmental Science & Technology*, a variety of aldehydes and ketones were detected. Particularly noted was a form of the aldehyde 2-nonenal that the human nose detects at just 100 parts per trillion (compared to 500 ppb, or 5,000-fold higher concentrations, for pine and lemon scents). Morrison describes the smell of 2-nonenal as "pungent cucumbers." Other aldehydes and ketones smell like cut grass or nail polish remover. "The whole suite of odors could make a person ask 'what's that smell?' when they walk into a room," he says.

Indoor ozone concentrations rarely reach 100 ppb—a Los Angeles home with open windows on a summer afternoon contains about 40 ppb—but the researchers used high concentrations to speed reactions and generate detectable levels of smelly chemicals. At lower ozone concentrations, reactions proceed more slowly.

About 80% of reactions occur in the carpet's fibers, and the rest occur in the backing. Carpets become a reservoir for aldehydes and ketones, and odors may linger for years. In contrast, "new carpet smell" stems from carpet glues, and odors dramatically drop a few weeks after installation.

Raising a stink. "Pungent cucumber" is just one of the smells that results when ozone interacts with the oils in carpets.

The strong, irritating smell of ozone pales beside the unpleasant odors that result when ozone reacts with common everyday substances. According to a review in the December 2000 issue of *Indoor Air* by Charles Weschler, a chemist at the University of Medicine and Dentistry of New Jersey/Robert Wood Johnson Medical School in Piscataway, many common indoor substances, including pine- and lemon-scented cleaners, react with ozone to generate indoor pollutants such as formaldehyde. Weschler says ozone also reacts with indoor surface materials such as rubber, neoprene, and paint, releasing compounds that can damage both building materials—for example by causing rubber to crack—and human health.

Ozone-linked indoor pollutants may contribute to "sick building syndrome"; studies have found that chemicals present at odorous but nontoxic concentrations cause headaches, mucous membrane irritation, dizziness, and irritability, and reduce productivity and raise stress. "The evidence for adverse health effects from [ozone-related] carpet emissions is indicated, yet still circumstantial," says Morrison. Weschler adds that the human health effects of odors from carpets "need a great deal more attention."

Opening windows to air out smelly carpets may actually make the problem worse by adding more ozone. To limit indoor ozone, Weschler recommends opening windows at night when outdoor ozone levels are lowest. Air conditioners can help—they largely recirculate inside air, rather than drawing in outside air. However, limiting ventilation concentrates pollutants that originate indoors. **–Carol Potera**

ENVIRONMENTAL MEDICINE

Lung Disease a Drain on Coffers

Medical care for people with chronic respiratory diseases cost Americans $45.3 billion in 1996, according to a University of California at San Francisco study published in the 1 March 2002 issue of the *European Respiratory Journal*. The study extrapolated these results and more from data gathered under the Medical Expenditure Panel Survey (MEPS), an ongoing survey of how Americans—as represented by a sample of 21,571 individuals—use and pay for health services.

The study focused on the cost of medical care given to individuals who have asthma, chronic bronchitis, chronic airway obstruction, and other major respiratory diseases, compared with costs for people who do not have serious lung problems. More than 4.5% of the survey respondents—1,027 people—reported one or more serious respiratory conditions, allowing researchers to make a weighted estimate that 12.1 million people in the United States have similar conditions. More than 80% of the MEPS respondents who had respiratory disease also had other chronic illnesses such as heart disease and diabetes that added significantly to the cost of personal medical care.

The costs associated with respiratory diseases were teased out by tabulating all health care costs, then eliminating those that could be attributed to other diseases present at the same time in the same patients. Total annual medical care costs averaged $3,753 for people with respiratory conditions, with 45% of those dollars going to hospital stays and another 17% to prescription drugs. "In some sense, the expenditure data we've talked about in the paper give you the benefits to be gained by intervention," says lead author Edward Yelin. "They make an important contribution to health policy debate."

Expenses directly connected to respiratory diseases accounted for only $1,003–2,588 of the costs for each respiratory disease patient, allowing the researchers to attribute $12.1–31.2 billion of respiratory patient expenses directly to respiratory diseases themselves. According to Yelin, the study looked at costs as a whole, not necessarily broken down by who pays what. But costs could also be considered from the perspective of insurance companies or individuals' out-of-pocket

PhotoDisc, Matt Ray/EHP

The Beat

DieselNet

As public transportation providers and corporate fleet managers search for the most fuel-efficient heavy trucks and buses, and as policy makers work to regulate such vehicles' emissions in an effort to reduce air pollution, all are confronted by the pros and cons of using diesel engines. Diesel engines are powerful, durable, and efficient—more efficient in using fuel than the natural gas engines being proposed as alternatives—and they emit less carbon dioxide, a greenhouse gas. On the other hand, diesel engines emit particulate matter and other pollutants that can trigger asthma attacks and worsen respiratory diseases such as emphysema. These pollutants have also been linked to increased rates of lung and bladder cancer, strokes, heart disease, and certain kinds of birth defects.

To keep those involved in diesel engine regulation, production, and consumption up to date on the latest trends, Ecopoint, a Canadian consulting firm specializing in mitigating internal combustion engine emissions, has developed the DieselNet website, located at **http://www.dieselnet.com/**. The site is a resource for practical knowledge for resolving diesel emission–related problems and developing cleaner diesel technologies.

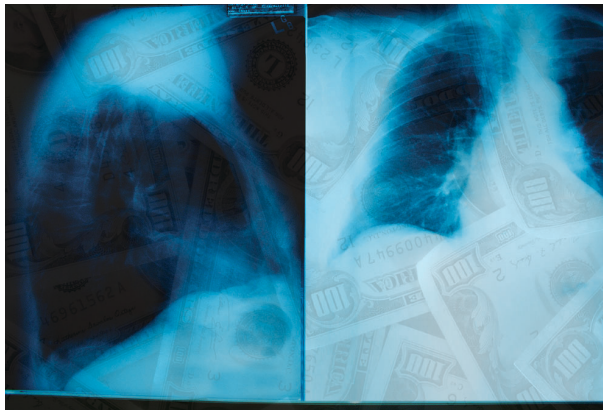
The homepage features a list of the most current news items in the field, including regulatory updates, newly published scientific papers, and information on upcoming conferences. Forums—one for discussing general diesel topics and one devoted to issues of occupational exposures and sampling methods—are also accessible through this page.

For the lay reader, a glossary of over 150 need-to-know diesel terms and acronyms is provided, ranging from air toxics to zero emission vehicle. For the industry expert, links to a number of online technical reports and to academic, industry, and government research programs are available. Experts may also consult the DieselNet Technology Guide, which contains information accessible through headings such as Diesel Emissions (including documents on characterization and measurement of emissions as well as health and environmental effects), Particulate Filters, and Clean Diesel Engine.

The Emissions Standards page lists links to diesel emission standards for a number of governing bodies in Asia, Europe, North America, South America, and Australia. While only regulations for on-road vehicles and emissions are available for some of the countries, other additional categories are provided for others. From this page, visitors can also access an elementary overview of certain classes of regulated standards. **–Erin E. Dooley**

expenses, Yelin says. Policies that lead to improvement in respiratory health—for example, by directing more resources toward intervention strategies that help patients avoid hospitalization—might save some of those dollars.

The current iteration of the MEPS, which began in 1996 and continues to gather data in two-year chunks, is the third and most recent U.S. national survey of health costs conducted by the federal Agency for Healthcare Research and Quality in collaboration with the National Center for Health Statistics and the survey research firm Westat. National data are available on the agency website at **http://www.meps.ahrq.gov/**. **–Victoria McGovern**



Lungs & bucks. Up to $31.2 billion in annual respiratory patient expenses may be attributable to respiratory diseases themselves.

Intervening for Inner-City Kids

At the 2002 annual meeting of the American Academy of Allergy, Asthma, and Immunology, researchers from the ongoing Inner-City Asthma Study, funded by the NIAID and the NIEHS, reported on the efficacy of two simple methods for reducing emergency room visits and symptoms in inner-city children with asthma. In physician feedback intervention, social workers act as a liaison between the children's doctors and parents, regularly updating the doctors on the children's symptoms so treatment strategies can be adjusted as needed. Three weeks of symptom-free days a year were gained using this method. In environmental intervention, eliminating asthma triggers such as environmental tobacco smoke, cockroaches, dust mites, mold, and cooking fumes from the homes of children with asthma also lessened symptoms and ER visits.

Driving Force against Driving

Drivers worldwide are preparing for the next annual In Town Without My Car! Day on 22 September 2002. Since its 1995 inception in Bath, England, the event has grown to having more than 1,000 cities and towns in 33 countries participating in 2001. Developed to increase public awareness of quality-of-life issues including air and noise pollution and car-thronged streets, it is a day when downtown areas are closed to cars and trucks, and social and cultural activities are staged to promote walking, cycling, and the use of streets as social spaces. Supported by the European Commission for the Environment, the day is also a time when comparative studies of the effect of vehicular traffic on air quality and noise levels can be conducted.

Better Buses for D.C.

The rate of asthma in Washington, D.C., is twice the national average, a statistic that may be about to change, thanks to new local Metropolitan Transit Authority initiatives. In February 2002, Metro rolled out a fleet of 164 new buses fueled by compressed natural gas, along with a new fueling and repair facility for them. It has since voted to add 250 more buses and another fueling station over the next two years. The new buses emit about 40% less NO and 90% less particulate matter than comparable diesel buses. Metro has also approved retrofitting its remaining diesel buses with particulate traps and using low-sulfur products to fuel them.

Clockwise from bottom left: PhotoDisc, Matt Ray/EHP; DieselNet; PhotoDisc; Agence de l'Environnement et de la Maitrise de l'Energie, Energie-Cités